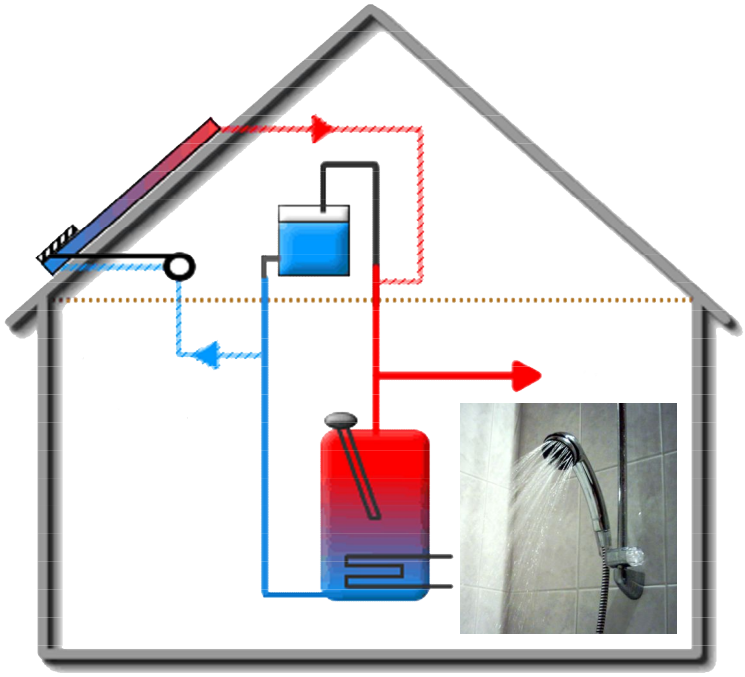


Solartwin.com

Zero carbon solar hot water systems simply for washing & bathing

Installation Method Statement



- Can heat tap water directly
- Freeze-tolerant panel
- No anti-freeze
- Safe low voltage
- PV drives variable speed pump
- Only 2 extra pipes
- Stratified storage of hot water maximises efficiency
- Simple to install

Zero Carbon, Solar Pumped Solar Hot Water

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1. Introducing Solartwin

Solartwin is a reliable, quickly fitted and affordable solar water heating system. It is based on a Scottish engineer's sudden insight on how to avoid the problem of frozen pipes bursting in winter - by just letting them freeze - flexibly!

Invented and patented by Kerr MacGregor at Napier University, Edinburgh, and developed in conjunction with Solar Twin Ltd, his innovation exploits recent advances in materials science.

Kerr identified highly flexible, thermally conductive pipes to accommodate the problem that water expands when it freezes. This 'freeze-tolerance' eliminates, at a stroke, any need for inefficient heat exchangers and antifreezes, and the numerous costly and power-draining control peripherals normally associated with conventional solar water heating.

Solartwin's unique pumping system uses a low-speed, single pass, water flow through the panel, rather than less efficient fast multiple passes. With not one, but two surface coatings on different parts of the absorber, selective and matt, total system efficiency and, crucially, cost-effectiveness are boosted still further.

In addition, all of the parasitic mains electricity consumption normally associated with pumps, 24 hour solar controller circuitry and various other peripherals is completely eliminated by using a dedicated low power, variable speed, *solar* powered pump. Based on new high torque, rare-earth magnet technology, it is powered totally from a small, off-grid photovoltaic module.

Solartwin usually takes less than a day to install! Typical total job duration is 5 - 10 person hours, eg 2 people for up to 5 hours each. Its name comes from combining both solar *thermal* and solar *electricity* into one system. Made in the UK, most of the aluminium it contains is bought from Norway because there it can be made with hydro-electricity, rather than conventional fossil fuel power.

2. Before You Start

Please read the whole of this document before you start.

This is an example of a typical method statement for installing a Solartwin solar hot water panel on a one or two storey domestic home, where there is already a low pressure vented hot water cylinder in place which does not need to be replaced. Your installation may differ.

WARNING. Only install your panel if you and all the people working with you are competent to do so, and only after you have assessed all risks, and either eliminated them or reduced them to safe levels.

CAUTION 1 There is a boiling risk, which is fully avoidable. Simply shade the main panel until after connecting all plumbing and wiring. A useful shade is the box in which it was packed. Use strong ropes to secure it against wind.

CAUTION 2. There is a slight risk of burst, which, again, is fully avoidable. Never close off both pipes of the panel either by folding them or by using bungs, valves, etc. At least one (preferably both) of its inlet and outlet pipes must be open to the air at all times, or it may burst due to boiling if placed in strong sunlight.

NOTE 1: If the panel is to be left empty, or without the pump running, in full sun for more than 5 sunny days in total, please drain and shade it, to limit internal temperatures.

NOTE 2: To allow Solartwin's peak temperature control function to operate correctly, the Solartwin panel is never to be installed on a solar tracker. Install it instead in a fixed plane such as on a roof, wall or fixed position A-frame.

NOTE 3: Please carry out all commissioning checks and signing off procedures that are given towards the end.

NOTE 4: Please ring your local Water Authority **before you start** to ask for a hardness figure for Calcium Carbonate in ppm (parts per million). If you get two figures, use the higher one. If you get one figure, add 20%. With this maximum figure, refer to Appendix 3 to see what, hardness control, if any, is required. Controlling scale build-up will maximise overall (solar and backup) system efficiency.

NOTE 5: Check that the header/expansion tank is in good working condition and has adequate volume and expansion capacity. In particular, it must conform to water bylaw regulations, be fully insulated and have a cover. If any of these conditions are not satisfied, decommission the system if it is unsafe. Any non-conformances must be advised to the client, in writing, detailing which elements must be upgraded.

NOTE 6: Check the mechanical integrity of the hot water cylinder so that it is fit for purpose. Check for damage and deterioration caused by scale or corrosion in the context of any additional stress placed upon the cylinder through the connection of the solar thermal system (e.g. thermal stress or additional system pressure).

NOTE 7: All installations require a detailed photo diary in order to obtain a full 5 year warranty. These should be taken as the installation progresses, not at the end. details of photos required are given in Section 11.

NOTE 8: the collector is normally delivered direct to site by Solar Twin. It is 2.465m x 1.264m x 75 mm and weighs 30.5 kg when empty. the panel should be manoeuvred by 2 people into a safe place where it will not be damaged, and checked for damage before storage. 2 people are required to move the panel at all times

3. Site Requirements

3.1. General

Carry out all duties in a professional, conscientious, responsible, healthy and safe manner. All operatives shall be experienced and trained in their respective trades and will be fully familiar with the correct method of installation of the Solartwin System so that both short-term as well as long-term installation work and product warranties are in no way compromised.

3.2. Responsibilities

3.2.1. Site supervision - MAIN contractor.
3.2.2. First Aid responsibility to be provided on site.
3.2.3. Reporting of accidents and responsibilities supplied on site with own company logging.
3.2.4. Technical guidance if required from the Solartwin office.

3.3. Materials, tools and equipment including selected PPE equipment

Item	Where used
Overalls	Generally
Safety Boots	Generally
Gloves	Handling scaffold and materials
Hard hat	Generally
Dust mask	Loft areas
Disposable overalls	Loft areas
Hand wipes	Before breaks, with glues and generally
Waterproof clothing	Outdoor rain protection

Tools and equipment lists vary from job to job.

3.3.1. General Personal Protective Equipment to be supplied and used is shown above. You may want to list further relevant items.
3.3.2. General Tools and equipment – equipment is normally all provided by the subcontractor.
3.3.2.1. All tools and equipment shall be fit for purpose and regularly checked and maintained in accordance with Health & Safety Guidelines.
3.3.2.2. All on-site electrical equipment shall be low voltage battery operated under 36 Volts DC or 110 Volts AC provided by an approved mains transformer or generator supply. Electrical equipment must not be used in damp or wet conditions. All non-cordless electrical equipment must be PAT tested.
3.3.2.3. All access equipment including ladders and scaffold must be correctly erected, well maintained and regularly inspected. Ladders will only be used as a means of access and not as a working platform for the purposes of installing a Solartwin system. Where appropriate, a safe working platform such as an SGB Youngman system approved to HD1004 Class 3 shall be hired from a reputable hire company. At all times, installers must comply with legal requirements for working at heights.

3.4. General Materials

3.4.1. All materials used shall be specified by the system manufacturer and used / installed with manufacturer's instructions.(See Appendix 2 for guidance on tools required)
3.4.2. Where necessary a COSHH assessment will be undertaken and all operatives instructed in and supplied with relevant information on safe methods of use and storage.
3.4.3. In transit, all components and materials will be carefully stored in company vehicles in order to minimise the possibility of damage in transit.

4. Preliminaries Before the Job Starts (0.5-1 person hour)

4.1. Arrive on site and introduce yourselves.
4.2. Note down the 4 serial numbers on the warranty - panel, pump, PV and controller
4.3. Pre-survey issues:
  4.3.1. Carry out a weather-risk assessment. Postpone the roof work if unsafe.
  4.3.2. Examine the site conditions fully for all other aspects of health and safety.
  4.3.3. Examine the condition of the roof and photograph. Make the customer aware of any damage such as broken tiles - before any work has started.
  4.3.4. Check installation feasibility and the accuracy of any earlier surveys including checking proposed panel elevation, pitches and also orientations using a compass with corrections for magnetic deviation. Also check inside the property to determine if the loft is free from obstruction. Check pipe routes and any obstacles or difficulties that may arise.
  4.3.5. Check that the header/expansion tank is in good working condition and has adequate volume and expansion capacity. If not, decommission the system and advise the client , give a written warning statement that the tank requires replacement.
4.4. Carry out and record a Legionella Risk Assessment and implement any required outcomes.
4.5. Check that if an ion exchange softener is being installed, that there will be no lead pipes downstream of the softener since there is a toxicity risk from these.
4.6. Critically inspect scaffolding if supplied to eaves level / access equipment / harnessed running roof line if all to be supplied by main contractor.
4.7. Fully brief occupants (if any) of work to be carried out detailing, when, where, including access and all health and safety implications of the installation relevant to them.

5. Prepare to Start the Job, if Appropriate (0.5-1 person hour)

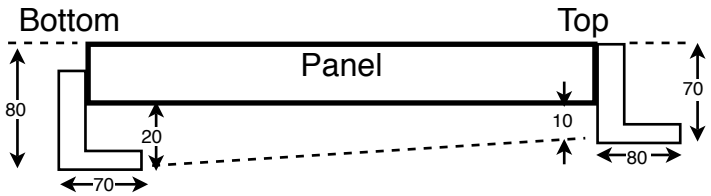
5.1. Carry out all appropriate onsite health and safety site measures including cordoning off the working area.
5.2. Unload panels, equipment and tools.
5.3. Check every single thing that you will need. Preparation now will save time later.
  5.3.1. Assemble and check the conditions, and presence of the required tools and parts before you start.
  5.3.2. Make sure that all tools and parts are appropriate and all are available before starting.
  5.3.3. Tick all Solartwin components off on the parts list one by one and identify each carefully.
  5.3.4. If items are missing or damaged report this immediately.
5.4. Lay dust sheets on all internal surfaces requiring protection including carpets and vulnerable hard floors.
5.5. Gain access to loft via suitable ladder, temporary ladder or working platforms, and check positions of cylinders and header / expansion tanks against survey data. Remove and lay ladders flat in a place where they will not obstruct access if unattended.
5.6. Measure the exact size of your panel from top to bottom where the support rails attach, and record this measurement.
5.7. If necessary, strengthen rafters (or timbers or other structures) used for securing the panel, for example by adding noggins between rafters or adding thicker timbers alongside them.

6. Roof Working (1-3 person hours)

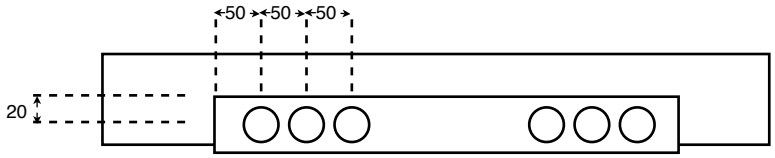
Required competence MUST include safe working at heights and on roof. Two people are required, but only one needs be on the roof.

6.1. Panel location while on the ground
- 6.1.1. Reassess if necessary / decide exactly where on the roof your panel is to go.
- 6.1.2. Reconfirm this position with customer if appropriate.
- 6.1.3. Make sure that the lowest part of the thermal panel will be no more than 5m below the highest point of vent pipe of the header / expansion tank to which the panel is attached.
- 6.1.4. Make sure that the highest part of the thermal panel will be no more than 5m above the water level of the header / expansion tank to which the panel is attached.

6.2. Pre-drill the roof brackets.
- 6.2.1. Whilst on the ground, both top and bottom roof brackets should be pre-drilled so that work to fix the panel to the brackets on the roof is minimised. Do not pre-drill holes for fixing the brackets to the rafters.
- 6.2.2. Each bracket should be placed on the frame, in turn, as shown, and six holes of 3.5 mm diameter should be drilled through bracket and panel. These holes should go right through the panel frame. Do not drill more than 20 mm into the panel, as the frame insulation is 25 mm thick. If the drill bit penetrates right through the insulation, you will deliver dust inside the panel.



The gaps of 20 mm and 10 mm to the roof are necessary so that dirt particles can roll out below the panel, and not get caught. Strips of timber or roof batten make good spacers.



View of Top Long Edge of Panel

- 6.2.3. Once the six holes through the bracket and panel have been drilled for each bracket, a 4 mm drill should be used through the brackets only, to provide clearance holes for the screws. Do not assemble brackets to the panel before the panel is raised on to the roof.

6.3. Fit panel temperature sensor to the back of the thermal panel as per controller manual, drape lead over the top of the panel and jam under the glazing bar. This should help protect it during the lifting of the panel. Install a second yellow lead adjacent to the first, if the property has been fully scaffolded due to difficult access.

6.4. Roof access
- 6.4.1. Carefully erect the roof access equipment according to its instructions, having first provided a level base from which to set this up.
- 6.4.2. Use undamaged and robust timbers and levellers where needed.
- 6.4.3. Include erection of guardrails and toe boards and stabilisers as appropriate.
- 6.4.4. Where installations exceed one day and where appropriate, remove all access equipment at the end of the day and store it in a secure place and re-erect it the next day.

6.5. Lifting and storage at height
- 6.5.1. Safely raise tools, brackets and fixings required for the roof work.
- 6.5.2. Store them in tied-on or otherwise well secured roof buckets, or toolbags or tool belts as appropriate.

6.6. Check that the rafters are strong enough. If you are not sure, ask a structural engineer to attend / calculate for you. In general a rafter or trimmer in good condition should have a minimum cross-sectional area of 7500 sq mm if it is to support the panel. If any rafter does not satisfy this requirement, then either securely fix/add a perpendicular trimmer between two rafters or thicken the rafter with timber which meets this requirement.

6.7. Find the rafters or noggins you intend to fix the brackets onto. This detective work can involve a variety of tricks including:

6.7.1. Feeling for rafters under slates using a long thin metal trowel

6.7.2. Remove a tile in the area of the rafter nearest both ends of the bracket and locate the exact fixing position by feeling through the roofing felt.

6.7.3. Looking under the eaves to see where the lower ends of the rafters are, if they are visible.

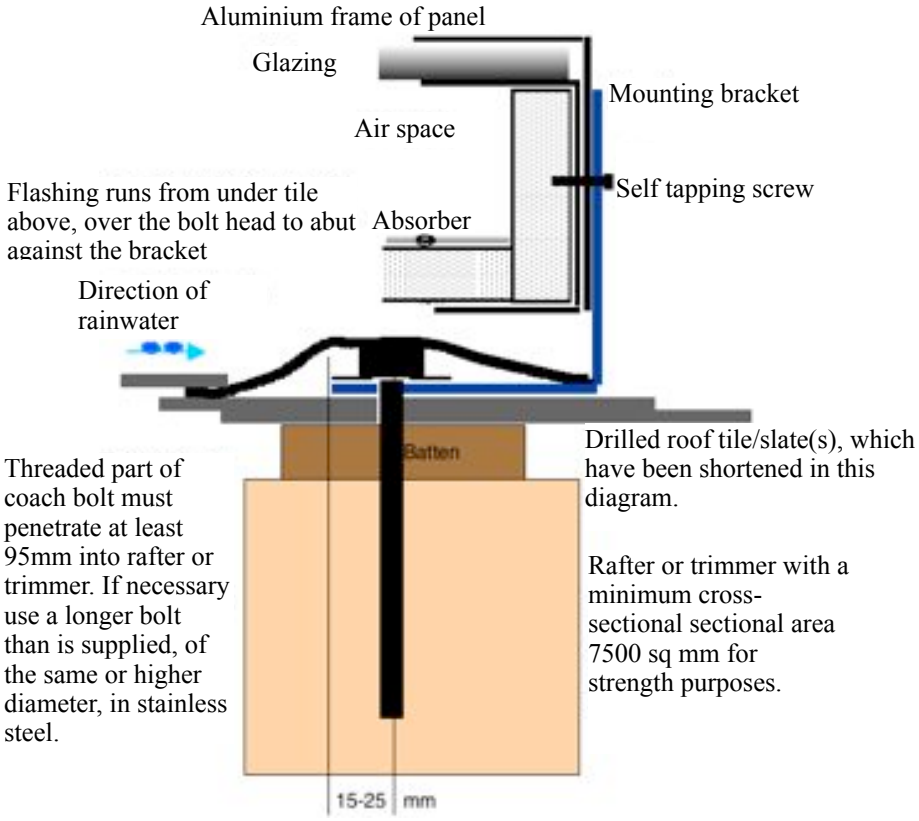
6.7.4. Measuring the positions of rafters in the attic from a reference point such as a chimney breast inside the attic and then transferring the measurements onto the roof.

6.8. Mark both edges of all possibly relevant rafters on the roof using chalk.

6.9. Decide which rafters you will fix to. Use the widest spacing possible allowing for 20mm no-drill area at the edge of the roof brackets. For example it is better to span four rafters than three.

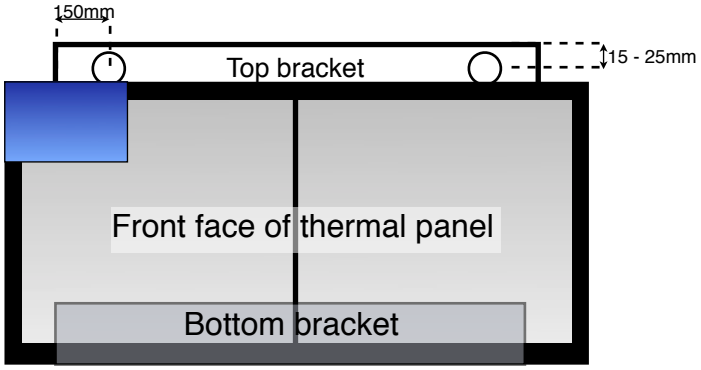
6.10. Secure the lower bracket to roof using drills and coach bolts as follows:

6.10.1. In summary, mount the lower bracket, and position the panel over it before marking and drilling the position of the upper bracket which also faces upwards. (Using a hole cutter is usually easier than using a drill to make holes.). You will use two coach bolts and washers to secure each mounting bracket to a rafter or trimmer. Space the coach screws as wide apart as possible, by spanning as many rafters as possible. The lower leg of each bracket must point up the roof. The coach bolts must be 15-25mm down from the upper edge of the bracket. Seal thoroughly by flashing over the bolt head and using silicone sealant at each drilled layer. The following diagram is not to scale.



NB Seal liberally with Dow Corning 791 sealant in the hole, and under and over the bolt head. Always dry tiles, if wet, before applying the silicone.

6.10.2. Hold the lower support bracket on the roof in the required position.
6.10.3. Use a spirit level to level the top edge of the bracket to within 1 degree of horizontal. This is because the pipe runs in the panel must run within 2 degrees of horizontal in order to prevent air bubbles from collecting.
6.10.4. Face the 80 mm (not the 70 mm) leg of the lower bracket perpendicular to the roof, ie towards the panel to minimise any leaf trap effect. This way any objects getting in at the top of the panels can fall out the wider gap at the bottom instead of lodging between the panel and the roof.
6.10.5. The panel may be mounted from 10 deg off horizontal to 90 deg (ie vertical). Different angles offer different performance over the year. Note that at panel tilt angles shallower than 15 deg off horizontal, the cleaning action of rain diminishes significantly.
6.10.6. Drill guide holes through the tiles into the rafters for the coach bolts.
6.10.7. Measure the distance between the holes and drill the support bracket accordingly (on the shorter side of the angle for the lower bracket). Make sure that the leg of the bracket points up the roof and that each of the two holes is drilled within 150mm of the end of the bracket and 15-25mm from the ridge-pointing edge of the bracket.



6.10.8. Apply silicone sealant in and around the hole on each of tiles that have been drilled.
6.10.9. Apply a smaller dab to the washers and slide them onto the coach bolts.
6.10.10. Now screw in the coach bolts into the rafters using a socket or ratchet spanner.
6.10.11. Apply silicone sealant around all bolt heads.

6.11. Secure the upper bracket to the roof.
6.11.1. Measure centres for coach bolt penetration (as measured before) 1265 mm upwards from the lower bracket to obtain the correct bolt centre position for the upper bracket.
6.11.2. Now attach the upper bracket using the coach bolts. This time, face the 70 mm (not the 80 mm) leg of the upper bracket perpendicular to the roof, ie towards the panel to minimise leaf trap effect.

6.12. Apply secure flashings over all coach bolts. The flash bands can be of lead type, but we recommend aluminium based flashing which has extremely similar performance. The flashing is placed over the bolt head (from the valley in the aluminium angle) and tucked under the tile above. It is additionally retained by 791 smeared liberally under the flashing.

6.13. Check that all coach bolts are secure and weather-tight before the next step.

6.14. Raise the panel safely to the roof (30-40 kg typical panel weight depending on its exact specification such as the number of glazing bars) - responsibility of principal contractor.

6.15. Position the panel securely abutting the brackets, top and bottom. At this stage, before you put the 12 securing screws in, it can still slide from side to side. Note that the lower edge of the panel has drillings, which act as drain holes. Always fit this lower edge facing downwards, never facing upwards.

6.16. Work out and drill your pipe and cable entries ***before*** securing the panel to the brackets!
6.16.1. Remember there are six or eight holes in the roof to consider.
4 for roof bolts
2 for pipes
2 for PV and temperature cables, of a route cannot be found without making an extra hole.

6.16.2. Decide where your pipe entry holes will be BEFORE attaching the panel to the brackets, otherwise they may foul a rafter on the way through if you don't plan ahead. You may need to slide the panel left and right a bit order to facilitate easy pipe exits before adding the 12 screws to attach it to the roof brackets.

6.16.3. Decide where you will drill for the pipes and cables.

6.16.4. Drill 2 holes opposite the pipe exits of the panel which will be able to accommodate the black corrugated pipe sheathing. Make a neat hole in the felt below the hole.

6.16.5. Finish off this job when you have secured the panel to the roof brackets.

6.17. Secure the panel to the roof brackets.

6.17.1. Fix the panel securely to the rails using the self tapping screws provided.

6.18. Waterproof the pipe and cable entries ***after*** securing the panel to the brackets.

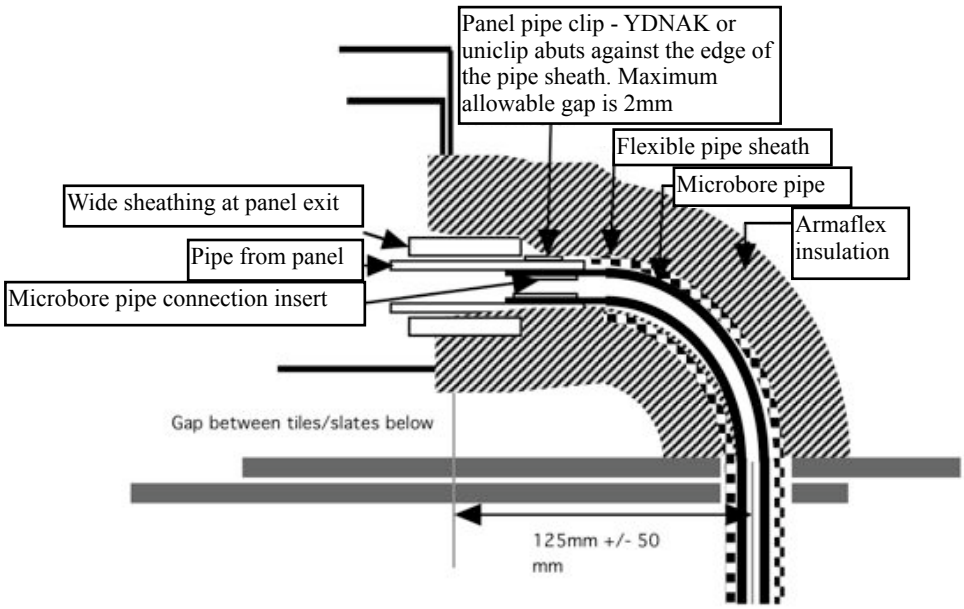
6.19. Use the two screws provided to attach the PV to an appropriate corner of the main panel

Photovoltaic (PV) Panel

6.19.1. Where is most appropriate? Typically the ***least*** and ***last*** shaded corners of the main panel. It is important to minimise shading from trees, chimneys etc, particularly between 1000 H-1800 H (sun time). If the PV panel has to be shaded for a time, the pump will pump more slowly or it may even stop. So position it to be shaded out late rather than early in the day.

6.19.2. Bear in mind that bird droppings could foul the PV panel - so positioning it under an aerial where birds may rest is not recommended!

6.20. Now complete the pipe entries through the roof. The following diagram is not to scale:



6.20.1. Cut the two narrower pipes exiting from the panel so that each protrudes 20-30mm longer than the wide pipe sheath.

6.20.2. Cut most of the black corrugated protective sleeving into two equal lengths(one for each silicone microbore tube) trimming any rough edges. the balance will be required to sheath the cables as they pass through the tiles/slates. NOTE: Sometimes cables (not pipes) can be tucked under tiles and through the felt (without cable damage), without the need to drill the tile again.

6.21.Start fitting the upper (hot) microbore pipe (from the 30m roll of silicone tube).

6.21.1. Insert one of the brass inserts into the end of the flexible silicone hose.

6.21.2. Put one of the black flexible corrugated sleeving pieces inside the shaped insulation piece (the Armaflex HT).

6.21.3. Find the hot (upper) length of silicone microbore hose and put it inside the above assembly.

6.21.4. Insert the end of the hose, complete with brass insert, into the panel hose and secure using one of the supplied YDNAK clips around the panel hose.

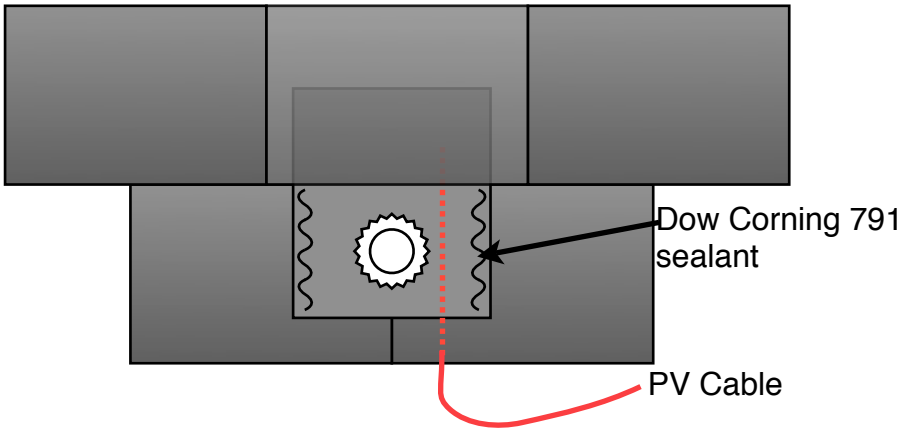
Pliers holding YDNAK.

6.21.5. If the roof has flat tiles, Solar twin supplies a flat silicone rubber slate to provide water-tightness for the pipe penetrations. if the tiles are not flat (e.g. double Roman) then a lead slate will be required, which will mould to the tile profile. the following notes refer to the use of the silicone slate.

6.21.6. First, check that the other end of the hose will thread through the hole in the tile and that it can fit through the felt. Insert the black corrugated tube through the roof penetration until about 50mm short of being in place. Fill around the black corrugated sheath liberally with silicone sealant. When sealing holes, the silicone sealant used around the pipe entry hole should fill all available space, make good contact with all the surfaces and its top surfaces should be raised slightly above the tile/slate surface in order to adhere to the silicone tile

6.21.7. Next, push the cable from the PV panel through the adjacent hole in the roof, above it, using a short length of black corrugated sheathing to protect the cable through the tile/slate. Lay the cable down the roof from the hole so that it goes straight down the roof, past and around the hot pipe (but not directly adjacent to it) Make sure the PV cable on the roof is very secure so that it will not be loosened or damaged by wind over many years. Seal up around this penetration too.

6.21.8. Place the silicone tile over the drilled hole so that the upper edge can be tucked under the tile above to flash the hole. trim to fit if necessary. The PV cable should be tucked under the bottom edge of the tile, (see below) Apply silicone sealant as shown below.



6.21.9. Thread the silicone microbore tube fully through the black corrugated sheath.

6.21.10. Provide any final shaping to the Armaflex (HT, UV resistant) foam pipe insulation angling the cuts so that there is a good fit, both to the roof and to the panel edge. It is important to get a clean straight cut against the tile/slate. Seal Armaflex securely all round onto the panel using Dow Corning 791 sealant.

An additional bead of silicone sealant should be added around at least the top half of the cut face of the Armaflex HT, where it seals onto the silicone slate. This will also deflect the rainwater and give adhesion.

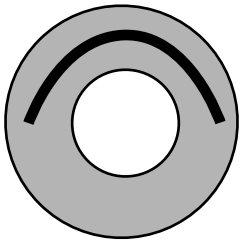
PICTURE HERE!

6.21.11. Repeat this procedure for the lower (cold) silicone tube, with the sensor cable inserted under this silicone tile as for the PV cable previously. You should now have two pipes going through the roof. Each will be sheathed in corrugated sheathing. Over that will be Armaflex foam insulation. The silicone pipe will be shielded from light and it will be securely connected to the panel inlet or outlet pipe

6.22. If pipes are to be led across the roof rather than going through it near the panel, it is important not to allow any pipe leverage at the point where it enters the the panel since this flexing may damage the pipe from the panel. Any unsupported length of pipe between where it exits the panel and its first point of fixing must not exceed 200mm.

6.23. Next, push the cable from the PV panel through the roof, using the last section of protective sleeving, and then through the roof. Again, seal up appropriately and with silicone sealant. Make sure the PV cable on the roof is very secure so that it will not be loosened or damaged by wind - over many years.

6.24. Watertightness: Apply roofing grade silicone sealant around all holes in the roof and seal the insulation to the side of the panel with silicone. The silicone sealant used around the pipe entry holes should fill all available space, make good contact with all surfaces and its top surface should be raised above the tile/slate surface to deflect the water flow around the black corrugated sleeve, as it goes through the tile/slate. An additional bead of silicone sealant should also be added around the top half of the cut face of the Armaflex HT



Cross-section of Armaflex

This will also deflect the rainwater. Alternatively use lead slates if appropriate to the design of the roof for watertightness at roof penetrations. Appropriate proprietary or flashed pipe entry methods may also be used, if watertight.

6.25. Connect any appropriate lightning protection if required by local weather conditions and regulations.

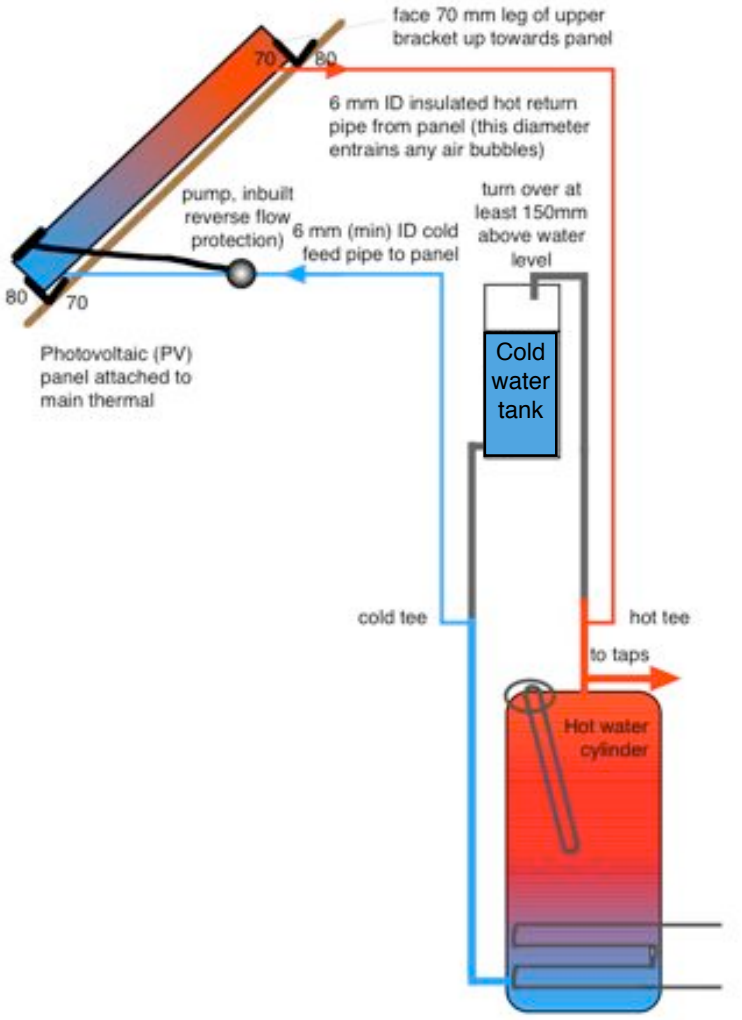
Inspect all work closely and descend.

7. Internal Plumbing and Wiring (1-3 person hours)

Operative must be competent in plumbing and hot water safety but CORGI is not normally required.
Hint: label all pipe ends blue for cold side.

A Typical Vented Cylinder System

(Thermostatic mixer valve plumbing has been omitted for clarity. Details are explained and shown diagrammatically in 7.13)



7.1. Do not paint the silicone pipes. Do not apply any adhesives to them apart from silicones. Builders roofing sealant or mastic must not contact the pipes unless it is silicone based.

7.2. Lengths. Total microbore pipe run length in both directions must not exceed 30 m. If total runs are to be longer, up to 50m maximum, use 15 mm copper pipe for the cold feed to the panel where it runs in freeze protected areas. Use our microbore pipe, where possible, since its lower area and volume reduces “dead leg” heat losses. Note: When copper pipe has to be used, it should gently rise in the direction of the water flow to avoid air-locks/bubbles becoming entrained.

7.3. It is essential to sheathe all silicone pipes against physical damage and light. Water regulations require this as well as it being important to do. The silicone pipes must be routed through Hep2O or similar robust external sheathing pipe in order to protect silicone pipe against physical damage from rodents or abrasion due to movement over time. Ensure that entry points of the silicone pipe into the Hep2O pipe are smooth and cannot cause abrasion damage. Apply a blob of silicone rubber to cover every place where the silicone pipe enters any sheathing. This will protect it from possible abrasion. This also applies to any point where silicone pipe may be prone to abrasion where it enters a hole. If there is any chance that the silicone may work loose or move before it sets, such as due to vibration because the system is already in operation, tape over it with insulation tape or similar tape to hold it in place until it sets.

7.4. HINT! Occasionally the water hammer from the pump may cause the silicone pipe to "slap" against the inside of the Hep2O. This noise can be solved by tensioning it slightly as it travels through the pipe by pumping the pipe by up to 1% longer than its resting length and securing at both ends of the Hep2O with silicone sealant (and tape until it sets).

7.5. Secure pipes correctly. Where silicone pipes are sheathed, use the spacing required according to the stiffer material - for example Hep2O. Should, for an exceptional reason the silicone pipes have to run unsheathed, and only where there is no risk of physical damage whatever, we recommend *maximum* clipping intervals of 0.5m on vertical runs and 0.3m on horizontal runs.

7.6. Seal all holes inside the loft at pipe and cable entry points. If there is a significant void between the tiles and the felt/inside of loft, the silicone should be sheathed in Hep2O and insulated as far as possible. Rodent attack may occur otherwise

Photo of rigid sheathing over silicone microbore pipe before insulation is added. Afterwards the sheathing was slid closer to the tee, the entry point to the sheathing was "blobbed" with silicone. Then the pipes were insulated and secured.

7.7. Insulation. The only insulation we provide is a small length of high performance UV-resistant Armaflex insulation, for use on the roof.

7.7.1. Externally, both pipes must have insulation which doubles as UV sheathing on the outside, such as Armaflex HT. Minimise freeze-exposed external lengths where possible.

7.7.2. For internal work, insulate the Hep2O and other pipe sheathing. All internal pipework should be insulated wherever possible.

7.7.3. Tape the butted joints of the insulation over the hot pipe together with heat resistant tape. Attach the insulation to rafters using the nail hole zip ties. Do not use normal pipe clips within 2m of the pump.

7.7.4. All 10mm silicone rubber pipes should be insulated with a material of thermal conductivity of not more than 0.045W/m.K and thickness at least that of the pipe diameter. (Scotland) or Max 7.23 W/m (Rest of UK).

7.7.5. Never put pipes of two different temperatures inside the same piece of insulation!

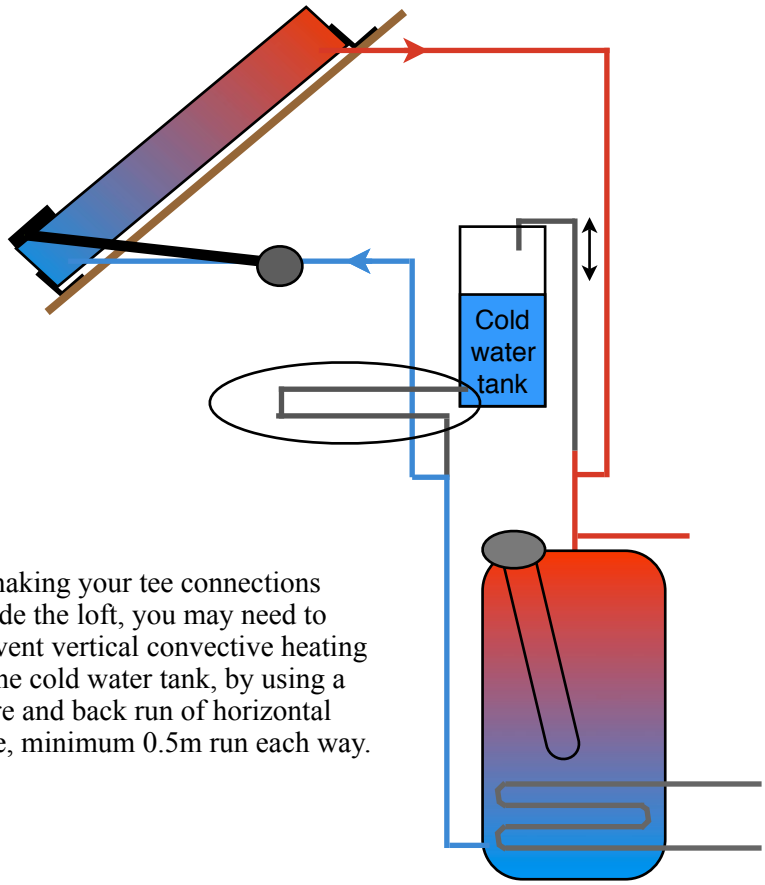
7.8. Before you start working with the existing plumbing.
- 7.8.1. Switch off the boiler and its controls.
- 7.8.2. Drain down the whole header / expansion tank. Drain down its connected cold and hot water system to an appropriate level. This is usually at least 100mm below any lowest intended teeing in point. You may not need to drain down the whole cylinder.

7.9. Teeing in.
- 7.9.1. The two compression tees will draw water out of the bottom of the cylinder and replace it, heated, at the top.
- 7.9.2. Tee in to a low pressure vented cylinder only.
- 7.9.3. Minimise heat loss by minimising the length of copper pipe runs. You can normally do this fitting both pipe tees fairly close to the hot water cylinder, for example 50-500mm above it.
- 7.9.4. Use 22 mm compression tee fittings with 22 mm or 3/4 inch olives. Our supplied reducers will fit our 6 mm (internal diameter) silicone rubber hoses using the supplied YDNAK clips to hold the rubber tube onto the fitting. Support pipes at least every 30cm if running horizontal and every 50cm if vertical.
- 7.9.5. **No plastic pipes whatever!** If any pipes or fittings connecting the cylinder to the header / expansion tank, including the vent pipe are made of plastics they must be replaced by copper pipes. Tee only into copper pipes.
- 7.9.6. In social housing applications we usually recommend teeing-in in the loft if this is possible, since this will eliminate all extra piping from the airing cupboard.

7.10. Cold tee from bottom of cylinder to pump.
- 7.10.1. Fit the cold pipe tee on the cooler side onto a copper pipe and be sure that there are no cold water distribution tees in between it and the cylinder. There must be no tees or valves between the solartwin cold tee and the cylinder. In particular, make sure that the cold tee is not drawing hot water past any tees that feed any other part of the house or those cold taps may experience a warm pulse.
- 7.10.2. The tee must be on the cold feed from the header / expansion tank to the cylinder to allow pipe flushing into the cylinder to take place when taps are opened.
- 7.10.3. When fitting this cold tee, if possible point the small diameter exit upwards (ideally) or sideways, but never downwards. Upwards positioning reduces the possibility of particulates entering the Solartwin system.
- 7.10.4. In addition, for the same reason, make sure that if possible, the tee is positioned at or above shoulder level of the cylinder. If you need to tee in lower, do not tee in lower than 0.3 m above the base of the cylinder or the wider pipe's gravitational water particle filter will not function. Teeing in too low could result in the pump and panel accumulating debris which could otherwise be filtered out.
- 7.10.5. Make sure that the hose connecting the cold water tee to the pump is at least 2 m long and has at least a 90 degree turn in it, since its elasticity stops waterborne transmitted vibration from the valves in the pump from reaching the main pipework of the house (see section 7.12 for more details).
- 7.10.6. Also, position the cold tee so that it will not allow vertical convective heating to the header tank to occur. In other words, tee in not too close to the header tank.

Loft Tee Connection

(Thermostatic mixer valve plumbing has been omitted for clarity. Details are explained and shown diagrammatically in 7.13)



If making your tee connections inside the loft, you may need to prevent vertical convective heating to the cold water tank, by using a there and back run of horizontal pipe, minimum 0.5m run each way.

7.10.7. The hot microbore pipe leaving the panel must tee in to a copper (not plastic) vent pipe which is:
- At least 120mm below the water level of the header / expansion tank
- No more than 5m below the highest point of the vent pipe of the header / expansion tank.
- No more than 9 m below the top of the main panel.

7.10.8. The vent pipe must have at least 150 mm turn-over height above cold water level, to prevent possible pump-over.

7.10.9. When installing a Thermostatic Mixer Valve, you must tee off the vent before installing. Installing in-line with the vent is dangerous as the valve could block the vent.

7.11. Pump Mounting

7.11.1. Inspect that the pump is in good condition before installation

7.11.2. The pump is not user-serviceable. It should not be opened, in any circumstances as this would invalidate the warranty and could compromise water tightness.

7.11.3. Mount the pump in a freeze protected area (wherever possible) on the cold feed side to the panel as shown:

7.11.4. Allow 30-60mm cable slack between where the electrical wires leave the pump and their first attachment point. Since the pump is mounted flexibly, the wires must not be under tension or they may pull out. The photo above shows a correct example.

7.11.5. Wires and spigots must point downwards.

7.11.6. The level of the pump should be 0-120 mm above the usual water level of the water level of header / expansion tank, not below it. The lower limit must always be no lower than the water level of the tank. If necessary this upper limit can be raised to 1m, however this may cause difficulties in priming the system.

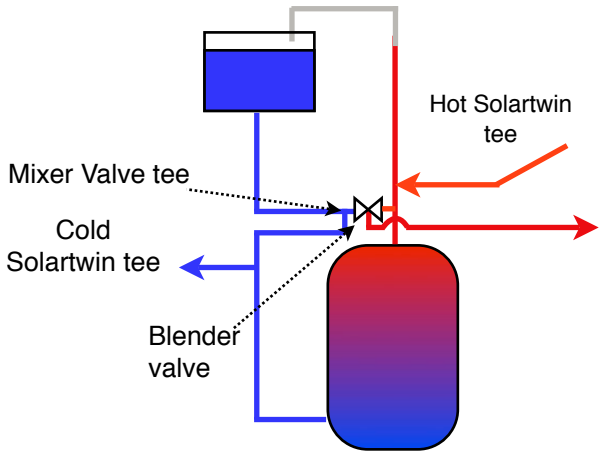
7.11.7. Mount the pump with a strong nylon zip tie around its rectangular crank case attached to the middle (+/-50mm) of a 300-400 mm piece of Armaflex insulation, the two ends of which are then attached to a firm support.
7.11.8. Neither this zip tie nor the pump should touch anything else other than the Armaflex.
7.11.9. Attach the Armaflex to a solid and non-resonating support. Plasterboard is not suitable as an attachment point, while rafters usually are. The zip ties should be 70-100mm from the end of the Armaflex. This mount offers the best protection against vibration.
7.11.10. Connect the pipes, the ends of which must be cut square and cleanly. Do not attempt to adjust the tensions of YDNAK pipe connectors. They have been factory-pre-tensioned and must not be altered. YDNAKS can only be used once.
7.11.11. Do not apply thermal insulation to the motor of the pump: it needs circulating air and an operating temperature below 40C. Pipes up to 5m from the pump may vibrate in normal operation, so ensure that they do not abrade against nearby surfaces. Insulating as close as possible to the pipes on each side of the pump is recommended.
7.11.12. Be sure not to allow any possible abrasion where pipes may vibrate against surfaces near the pump.
7.11.13. Do not allow unclipped lengths of cable to hang off the pump. Attach them securely. The insulated silicone tubes coming from the pump should point vertically downwards and hang in a gentle loop, which is important to minimise vibration and strain on the pipe.
7.11.14. Route and clip all cables securely throughout the property. Cables must run separately from pipes and must not be clipped together with them.
7.11.15. Initially, connect one, but not both of the PV wires to the pump. You will connect the second when you commission the system.
7.11.16. Make sure that the Solartwin pipes within 2-5 m of the pump are not attached directly to surfaces, but that the insulation around them is attached to surfaces instead. This is in order to reduce vibration transmission from the pipes to the surface.

7.12. Thermostatic mixer valve installation (compulsory for all installations within the scope of the Microgeneration Certification Scheme – i.e. all domestic installations and installations up to 45 kW)
7.12.1. Install the new cold tee that feeds the mixer valve between the cold Solartwin tee and the header tank. Do not fit it between the cold Solartwin tee and the cylinder, since this water may be warm on occasions.
7.12.2. Make sure that the pipe from the cold mixer valve tee to the mixer valve never flows upwards. Only sideways and downwards is allowed. Keep it as short as possible, ideally no longer than 1.5 times pipe diameter. These constraints are for Legionella safety reasons, as the cold pipe feeding the valve may not be used for several months at a time, becoming a dead leg, especially in winter. Water regulations require that dead legs should be eliminated if possible, but if not possible, they should be kept as short as possible.
7.12.3. In addition you should allow a minimum distance of 150 mm (preferably at least 500 mm) between the cold Solartwin tee and the mixer valve tee. This will reduce unwanted heat reaching the mixer valve. Make sure that no pipes run upwards to or from the mixer valve since this loses heat. Only horizontal or downwards is viable.
7.12.4. Insulate any feed pipe to the mixer valve if it goes through the loft.
7.12.5. Never obstruct the vent pipe. This is dangerous, could cause a blockage and contrary to Building Regulations. In particular, never install the mixer valve inline with the vent pipe. Tee off the vent pipe instead.
7.12.6. Set the mixer valve to 60C and lock it. Mixer Valves should be at 60C on all cylinders, including thermal stores.

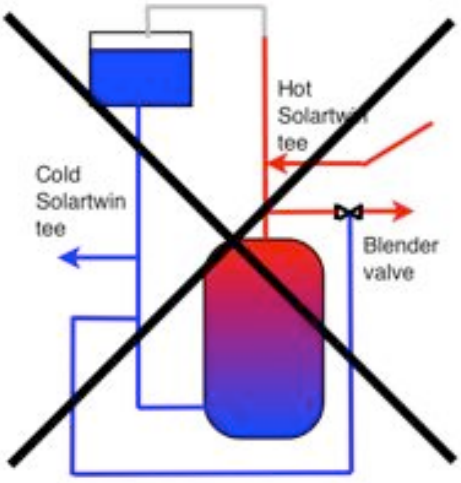
7.13. Make sure that there are no potential air locks in the vent pipe. Occasionally due to incorrect plumbing work there may be a downward instead of upward run on a horizontal part of the vent pipe. This must be corrected to an upward run or the hot return from the panel may pump over the vent pipe.

7.14. Insulate all copper pipes around cylinder as this is a requirement to comply with Part L of Building Regulations on new cylinders, where installed.
7.14.1. Insulate all copper pipes around cylinder as this is a requirement to comply with Part L of Building Regulations on new cylinders, where installed.

7.15. Install the solar controller as per separate method statement.



Correct Mixer Valve Installation



Incorrect Mixer Valve Installation

These diagrams show the correct and incorrect cold tee positions for the thermostatic mixer valve. On the left, the mixer valve tee is correctly positioned above the cold Solartwin tee; on the right, the tee is positioned below the cold Solartwin tee. Under no circumstances should this set-up be used as it is a Legionella risk.

7.16. Attach the users guide (including advice on effective use of the system) securely to the timer of the backup heater.

7.17. Switch on water supply. Refill header / expansion tank and hot water cylinder.

- 7.17.1. Once at pressure, check for leaks.
- 7.17.2. Correct if necessary.
- 7.17.3. Add Fernox Limescale Preventer, only if appropriate, to the cold water header tank. (see users guide) **Do not add it to the expansion tank on an indirect system.**
- 7.17.4. Never use antifreeze, or similar, in the solar circuit through the panel. This is because it is not needed, and it is too viscous, especially when cold. In indirect systems, use only a corrosion inhibitor (again no antifreeze) such as Fernox MB1 or Fernox F1, in the solar circuit.
- 7.17.5. Open every single hot and cold tap in the property, one by one, to check for airlocks. All must flow satisfactorily.

7.18. Switch on electrics and boiler controls when safe to do so.

8. Commissioning (0.5 - 1 person hour)

8.1. There is usually no need to bleed or vent the system. Just connect the pump to the photovoltaic panel. On a sunny day, the controller charges in 5-10 minutes. Once this becomes operational the system primes and fills in 5-10 mins! If there is no direct sun on the PV, run a 9V battery pack such as from a rechargeable drill across pump for 10 + mins to prime the system as follows...

8.2. Before or after commissioning, as appropriate, connect the power from the controller to the pump, using correct connectors and check that there is no risk of short circuit or accidental disconnection.

8.3. In either case, check the vent pipe for escaping bubbles, which will escape at a rate of about 0.4 to 1 litre a minute. This check may be visual or auditory or both. (For example, listen for the bubbling noises at the pipe, or watch for escaping air by carefully placing a soap bubble/film over the end of it and watching it blow, provided that contamination of the cold water tank is prevented.) If, on rare occasions, water pumps out of the vent pipe, this may be because the vent pipe has a place in it where it does not run continually upwards. This may need to be corrected.

8.4. When air stops escaping from the vent, the system is primed.

8.5. There is no need to calibrate the dose-response of the flow against sunlight levels. This has been pre-specified for the panel supplied.

8.6. Optimise system performance by taking reasonable steps to minimise the use of backup (non-solar) sources of domestic hot water heating or, where applicable, by controlling any reduction in solar fraction. These measures include

8.6.1. Adjust the time settings of backup heating controls so that timed backup energy input only takes place between 1600 and 2200hrs. Consider a later on-time (than 1600hrs) for westerly facing systems. Most timers default to turning the water heating on 3 times a day: in the morning, at lunch and in the evening. Reset this to evening only.

8.6.2. Time the evening backup water heating to heat the water to 60/65C and then to hold it there **for 1 hour,** *after* the sun has done its job, and to go off *before* the adults in the house take their baths: so the cylinder's base is cool overnight. You will rarely need to have it turned on for all 8 hours. Domestic immersion heaters typically need 3-5 hours starting from cold. Gas or oil boilers usually only need about 2 hours of "on time" (After a good solar day, the backup heating may not come on at all - when the thermostat sees that the water is already solar heated beyond 60/65C.)

8.6.3. Do not programme in ***daytime*** backup heating.

9. Post-Commissioning Checks (0.5 - 1 person hour)

This is aimed to aim you produce the perfect installation! Please go through these one by one, tick each as it is confirmed (or write a deviation explanation) and then send a copy to Solartwin unless it is a DIY installation.

You, the installer should complete this section on site.

Customer no. and name _____

Date post_commissioning checks completed _____

by_____ **(installer)**

Property address and postcode

9.1. General

9.1.1. Confirm that both Solartwin tees/connections are fitted to a low pressure vented domestic hot water system.

9.2. Thermal Panel

9.2.1. Confirm that the panel serial number is logged on the warranty.
9.2.2. Confirm that the lowest part of the thermal panel will be no more than 5m below the highest point of vent pipe of the header / expansion tank to which the panel is attached.
9.2.3. Confirm that the highest part of the thermal panel will be no more than 5m above the water level of the header / expansion tank to which the panel is attached.
9.2.4. Confirm that the panel is positioned with deliberately minimised shading, for maximised performance.

9.3. PV Panel

9.3.1. Confirm that the PV serial number is logged on the warranty.
9.3.2. Confirm that the PV is securely fitted.
9.3.3. Confirm that it is in the plane of the main panel, and located normally in the least and last shaded position so that boiling and overheat risks are minimised. Position away from TV aerials and overhead wires so that the risk of bird dropping contamination / cutout is very low. Such contamination will not normally cause failure and should self-clean in time.

9.4. Pump

9.4.1. Confirm that the pump serial number is logged on the warranty.
9.4.2. Confirm that the pump is fitted in a freeze protected area wherever possible.
9.4.3. Check that the pump mounting is secure and robust.
9.4.4. Check that pump wiring is with the correct polarity and that the wires to it have adequate slack in them.
9.4.5. Gently tug the wires to the pump's connector to check they are secure.
9.4.6. Check the pump is pumping in the right direction - from bottom of cylinder to bottom of panel.
9.4.7. Check the pump's operation at full power (may need battery pack) and listen to check there is no excessive noise / vibration.
9.4.8. Check that neither the pump nor pipes vibrate nor abrade against nearby surfaces during pump operation.
9.4.9. Perform the pipe squeeze test when the pump is running and the system is primed. Squeeze shut the inlet pipe - the pump note should change, usually the pump will race (as it cavitates). Squeeze shut outlet pipes - pump note should change again, usually a lower / slower note (this is bypass valve test).
9.4.10. Check that the pump height is 0-120 mm above the water level of the header / expansion tank.
9.4.11. Check that the pump has at least 2m length of pipe between it and the cylinder and that this pipe turns at least 90 degrees to minimise vibration transmission.

9.5. Cold tee to pump checks

9.5.1. Note the pipe size where cold tee fits (15/22/28 mm etc)

9.5.2. Check that the cold tee is not pointing downwards but that it is either horizontal or, preferably pointing upwards.

9.5.3. Check that the cold tee is not drawing hot water past any tees which feed any other part of the house or those cold taps may experience a warm pulse.

9.5.4. Check that the cold tee is at least 300mm above the base of the cylinder.

9.6. Hot tee from panel checks

9.6.1. Note the pipe size where hot tee fits (15/22/28 mm etc).

9.6.2. Check that the hot tee is at least 120mm below the water level of the header / expansion tank

9.6.3. Check that the hot tee is no more than 9m below the top of the panel.

9.6.4. Check that the hot tee and all parts of the hot silicone pipes are no more than 5m below the highest point of the vent pipe which overhangs the header / expansion tank to which the panel is connected.

9.6.5. Check that the hot tee normally connects to the vertical vent pipe itself, or that if attached to a horizontal run that bubbles will run up in the direction of the vent pipe and not back towards the cylinder. You may need to use a spirit level for this on any near-horizontal pipe runs. If the water filled pipes from the vent pipe of the cylinder to the vent are not continually running upwards the vent pipe will airlock and water is likely to pump over the vent pipe.

9.7. Cables

9.7.1. Check all cables are clipped or tied and secured correctly and that cables on the roof are particularly secure.

9.7.2. Confirm that they cannot be confused with mains cables.

9.8. Watertightness

9.8.1. Pressure test for leaks as Water Regulations require.

9.8.2. Inspect system for operation and drips and check no damp spots or condensation on roof and at other pipe routes including penetrations through roof or walls, joints, unions, glands and seals etc.

9.9. Cold water header or expansion tank

9.9.1. Check that the header / expansion tank is refilled and that the levels are correct and there is no overflow from overflow pipe.

9.9.2. Check that the header / expansion tank covers are in place and secure and are not liable to degrade, (for example, chipboard is an inappropriate material for a cold tank cover).

9.9.3. Check that the positions and heights and materials of venting arrangements are correct.

9.9.4. Check that there are no obstructions or risk of obstructions to the venting arrangements of the hot water cylinder and thereby the panel.

9.10.Roof work

9.10.1. Check that roof fixings are firm and undamaged or well repaired if damaged.

9.10.2. Check that pipe penetrations, external seals and weatherings are all sound.

9.10.3. Check for broken slates, tiles etc and replace them.

9.10.4. Check that gutters etc are not damaged or blocked with building debris and that any flashing into it has not been disturbed.

9.11.Pipe Runs

9.11.1. Check that all pipes are sheathed first by Hep2O or similar sleeving and then in insulation. Check that all places where the silicone pipe enters or exits sleeving that it is secured in place with a blob of silicone and cannot slip about or abrade.
If there is any chance that the silicone may work loose of move before it sets, such as due to vibration because the system is already in operation, the blob at the entry pint must be taped over with insulation tape or similar tape to hold it in place until it sets.

9.11.2. Check that pipes are adequately secured and are supported via their insulation and not directly onto surfaces to minimise vibration transmission.

9.11.3. Check that all silicone pipes are protected from physical damage, usually by routing through a rigid pipe as described earlier.

9.11.4. Check that pipe insulation is high temperature grade, in place and secured at junctions and corners and that the insulation coverage on the hot pipe run is continuous, wherever

practicable between the cylinder and panel. On the cold pipe run the insulation should also be continuous.

9.11.5. Whether or not the cylinder was replaced, check that pipes are insulated to Part L of Building regs.

9.11.6. Check that the vent pipe is insulated for the whole of its length where this is practicable.

9.12. Boiler function and control

9.12.1. Check that the boiler is functioning and can heat water to 60C for hot water cylinder and 65C for thermal stores unless suppliers require (rather than just recommend) higher temperatures.

9.12.2. Check that a boiler interlock exists and operates - using a cylinder stat which is fitted and set to an appropriate temperature. Not too hot - suggest 60C.

9.12.3. Check that the backup heating controls deliver timed backup energy only between 1600 and 2200hrs (maximum range given here).

9.12.4. Check that the users guide (including advice on effective use of the system) is attached securely to the timer of the backup heater.

9.13.Cylinder

9.13.1. Check that the cylinder label(s) is/are attached and visible in all installations. Include the decommissioning instructions here: please attach them securely to the cylinder, for example in a clear plastic pocket.

9.13.2. Check the insulation of the hot water cylinder (and all pipes connected to it) is at a level at least equivalent to that applicable to new installations. For cylinders with factory applied insulation this can be satisfied if the standing heat loss is certified to comply with section 12 of BS1566-1: 2002 or equivalent. Where this certification is not apparent or where the cylinder has no factory-applied insulation check that you will have installed additional insulation certified to comply with BS5615: 1985. Also that the insulation is fitted correctly, snugly, properly closed at the top of the cylinder and not covering mains power cables, particularly to the immersion heater.

9.13.3. Check again that the hot water cylinder's mechanical integrity is fit for purpose.

9.14.Thermostatic mixer valve, if fitted for water leaving cylinder (rather than valve located close to the taps).

9.14.1. Check that thermostatic mixer valve, if fitted, is set to customer's chosen temperature, which must be over 60C.

9.14.2. Check that the mixer valve control knob is locked correctly and that its cover is securely replaced.

9.14.3. Check that the cold feed to the valve will always contain cold water and not water which may be fully or partially heated by solar. Compared to the position of the cold Solartwin tee, this feed for the cold supply to the thermostatic mixer valve must be at least 1m towards to header tank. It must never be on the cylinder side of the tee.

9.15.Limescale control

9.15.1. Check the limescale control method, if needed, is in place and functioning.

9.15.2. If an ion exchange softener is used, check that there are no lead pipes downstream of it.

9.16.Legionella, summary of the most pertinent actions

9.16.1. Check there are no dead legs in the cold or hot water plumbing. If there are any, these must be closed off.

9.16.2. Check that the header tank contains clean water and that any significant sediment has been removed. If so flush the whole hot water system to completely cold with at least 4 changes of water.

9.16.3. Check that the header tank has a sound lid and that this is on the header tank with no gaps so that the header tank is fully covered. The tank must be fully insulated.

9.16.4. Reconfirm that the boiler stat and thermostatic mixer valve if any are set to 60C or higher.

9.16.5. Heat the cylinder to 60-65 C using the backup heating before allowing hot water to be used. Since plumbing of any kind can disturb legionella bacteria and move these bacteria into the cylinder high temperatures will be needed to kill these.

9.16.6. Make a written confirmation above that you did these checks which are required by law and which must, by law, be retained by us if you have installed for us.

10. **Final clearing up** (0.5 - 1 person hours)

10.1. Pack away all tools and equipment.
10.2. Tidy site and recycle all waste where possible.
10.3. Leave the site at least as clean as, and preferably cleaner than when you arrived.
10.4. Carefully remove dust sheets and clean all surfaces requiring cleaning.
10.5. Final re-inspect system for correct operation and watertightness.

11. **Installation Signing off and Documentation** (0.5 - 1 person hours)

Only do this when you have fully commissioned the system and have fulfilled all the above checks.

11.1. Show the customer all work carried out and remedy any outstanding installation issues.
11.2. Show and explain the users guide including any maintenance if required. Explain clearly how to use all relevant controls and in particular how changes (such as retiming backup heating by day) will probably reduce the effectiveness of the solar system.
11.3. Give the customer plenty of time to ask you questions and please answer them fully.
11.4. Collect balance payment if appropriate and check this is the correct sum.
11.5. Only if a new cylinder or hot water store was fitted,
  11.5.1. Complete and sign and date its commissioning certificate.
  11.5.2. Attach copy of cylinder label to certificate or transcribe label details if necessary.
11.6. For the solar installation,
  11.6.1. Complete and sign and date the commissioning certificate / warranty in triplicate for the solar installation.
  11.6.2. Make sure that the following are filled in please,
    11.6.2.1. Solartwin panel serial number.
    11.6.2.2. Pump serial number.
    11.6.2.3. PV panel serial number.
    11.6.2.4. Controller serial number.
  11.6.3. Ask customer to countersign all three commissioning certificate warranty sheets.
11.7. Sign and date the cylinder warranty if it is supplied and give to customer.
11.8. Deliver the following documents in a waterproof envelope near the hot water cylinder if the customer agrees to this.
  11.8.1. Copies of the signed commissioning certificate(s) / warranty- one for the grants refund and the other for the customer's own records. One of these certificates will have a grants claim envelope attached.
  11.8.2. User guide.
  11.8.3. Decommissioning instructions.
  11.8.4. Installations instructions and method statement and parts list.
  11.8.5. Fernox replacement cards and sticker to customer only if appropriate (this is found inside the Fernox box which comes in the kit).
  11.8.6. Make and deliver any additional recommendations in writing as appropriate.
11.9. Checklist that all photos are taken:

Installer name: _____

Customer no. and name: _____

Confirmation of all photos present, by Solartwin _____

On date: _____

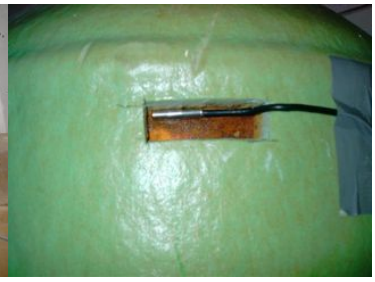
11.10. Take 10 - 20 digital photographs, clearly showing all visible parts of the installation within 7 days of the installation or commissioning. Each photo should be identifiable (eg. “Jones 1234 roof”) and include:

11.10.1. Before you go onto the roof, a long distance outside shot(s) of the roof(s) or other mounting surface with the panel mounted on it including the **ground** used to place scaffolding or access upon

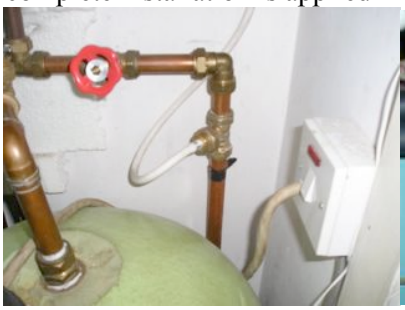
11.10.2. Close up shots of the **whole of the collector** showing the pipes going into and out of it, roof penetrations by pipes and the PV unit, also all flashings. This may require more than one photo.

11.10.3. The **hot water cylinder**, showing the pipes around it, plus how the temperature sensor is attached and secured with tape.





11.10.4. Close ups of the hot and cold Solartwin **tees** and any surrounding pipes before AND after complete installation is applied



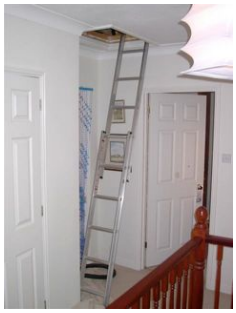

11.10.5. The **cold water / expansion tank**, showing insulated pipes going in and out of it

11.10.6. All visible **solar pipe runs**, showing, if appropriate, where they enter voids after complete insulation is applied.

11.10.7. The **pump and its mounting**, showing, if possible, its position in relation to the header / expansion tank before AND after complete insulation is applied.

11.10.8.A wide shot in the loft of **underneath where the panel fits** so we can see the rafters or any strengthening work.

11.10.9.A shot of the **loft hatch** and ladder, if any.



11.10.10. Views of all **additional plumbing or other work** if carried out such as softeners, thermostatic mixer valves, header / expansion tanks & associated work including pipe work.

11.10.11. Close up shot of cylinder label secured to cylinder and the user guide secured to the backup heating timer.

11.10.12. Picture of controller installed (working, displaying one temperature if possible)

11.10.13. ANY non-standard installation techniques (that have been impossible to avoid) should be photographed in full.

11.11. When fully completed, sign off when leaving the site, if site safety regulations require this.

12. After Leaving the Installation

12.1. Please confirm that you have completed the job successfully to Solartwin, with any relevant feedback.
12.2. Please email the photos to Solartwin.
12.3. Send to Solar Twin Ltd in a Solartwin freepost envelope.
12.3.1. The Solartwin copy of the warranty / commissioning certificate(s).
12.3.2. The signed and dated commissioning check list and any Legionella risk issues and solutions.
12.3.3. If appropriate, tear-off stub of the paying in slip - and please write on it the:
- Customer number
- Sum paid in

12.4. If appropriate, send to the Co-op bank in a Co-op freepost envelope:
Cheque for balance payment.
Paying in slip.

Solartwin to complete this commissioning counterchecks section with reference to the photos / other info

EITHER Reconfirming full compliance _____(sign)
On date _____
OR
List of deviations found and changes to be made and date for completion.

On date _____

_____(sign)

13. Revisits

In the unlikely event that either the photographs taken were not satisfactory, or there is a new customer service issue that requires a revisit, the following conditions apply:

All remedial work must be photographed in full to the satisfaction of Solar Twin.
Ay equipment modified or installed should be photographed.
If in doubt, photograph it.

All Photographs must be digital photographs taken on a good quality camera. It is highly unlikely that mobile phone cameras will give sufficient clarity to be acceptable so they should not be used.

14. Finally

Thank you for installing Solartwin. We are constantly trying to improve our methods, so any suggestions you may have are welcome. These can be sent to us by any of the means given below:

Post
Solar Twin Ltd
50 Watergate Street
Chester
CH1 2LA
UK

Phone
01244 403 407

Fax
01244 403 654

Email
info@solartwin.com

Appendix 1

Note: The Solartwin panel has passed the rigourous EN12975 test, and has qualified for the Solar Keymark. This requires us to state the collector passed a simulated wind/snow pressure load test of 1000 Pa.

Standards and Documents included

1.1 Standards include

1.1.1 BS 5918: 1989, Domestic hot water systems
1.1.2 BS 6785 : 1986, Domestic solar swimming pools systems
1.1.3 2000 ACOP&G L8 The control of Legionella bacteria in water systems
1.1.4 DD ENV 12977-1 (Drafts)
1.1.5 DD ENV 12977-2 (Drafts)
1.1.6 DD ENV 12977-3 (Drafts)
1.1.7 BS EN 12975-1(British Standards)
1.1.8 BS EN 12975-2 (British Standards)
1.1.9 BS 12976-2 (British Standards)
1.1.10 BS 12976-1 (British Standards)
1.1.11 BS1566-1: 2002 or equivalent (hot water cylinders)
1.1.12 BS5615: 1985 (hot water cylinder insulation))
1.1.13 MIS 3001 Microgeneration Installation Standard (Solar Thermal)
1.1.14 MCS 002 Microgeneration Installation Standard (Information)

1.2. Enforceable legislation includes:

1.2.1 Building Regulations and Planning Regulations England and Wales.
1.2.2 Building Regulations Scotland
1.2.3 Building Regulations Northern Ireland
1.2.4 Local water bylaws
1.2.5 The water supply (water fittings) Regulations 1999
1.2.6 Heath & safety at Work Act (HSW) 1974
1.2.7 Management Heath & safety at Work (MHSWR) 1999
1.2.8 Construction (Health, Safety & Welfare) 1996
1.2.9 Construction Regulations 1989
1.2.10 Construction Design and Management (CDM) 1994
1.2.11 Lifting operations and Equipment (LOLER) 1998
1.2.12 Manual handling operations 1992
1.2.13 Provision and Use of Work Equipment (PUWER) 1998
1.2.14 The Workplace (Health, Safety and Welfare) 1992
1.2.15 Working at Heights HSE Handbook
1.2.16 Health and Safety (First Aid) Regulations 1981
1.2.17 Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995
1.2.18 Noise at Work Regulations 1989 Electricity at Work
1.2.19 1989 Control of Substances Hazardous to Health Regulations (COSHH)
1.2.20 1994 Personal Protective equipment at work 1992
1.2.21 ROHS 2006 The Restriction of the Use of Certain Hazardous Substances in Electrical and
1.2.22 Electronic Equipment Regulations (RoHS) 2006 SI 1463.
1.2.23 Airborne Noise: 86/594/EEC
1.2.24 Construction Products Directive: 89/106/EEC
1.2.25 Electromagnetic Directive: 89/336/EEC
1.2.26 Energy labelling Directive: 92/75/EEC
1.2.27 Machinery Directive: 98/37/EEC
1.2.28 The Pressure Equipment Regulations (PED) 1999
1.2.29 Waste Electrical and Electronic Equipment Directive (WEEE): 2002/96/EC and 2003/108/EEC
1.2.30 Energy Using Products Directive (EuP): 2005/32/EEC

Appendix 2
Equipment and Materials

This is still an incomplete list, but we hope it will be of some help.

notes:
E = essential D=desired

Appropriate access equipment such as scaffolding
Please note that using ladders alone for roof access is unsafe and is illegal and can result in prosecution/enforcement by HSE.

E	Ladders suggested
E	3 way combination step ladder
E	3 x 3.5m ladder 7.2m extended
E	4.3m extending roof ladder 7.6m extended
E	2.9m extending roof ladder 4.6m extended
E	Harness + 1.5m lanyard
E	Hand jammer (ascension)
E	Rope - 10-12mm thick x 30m long (adequate for fall arrest)
E	Drill SDS with adapter chuck - 110v + 2-m ext or min 24v cordless
D	Combination spanners - 10, 13, 17, 19mm 12" adjustable up to 34mm
E	Sockets + wrench - 10, 13, 17, 19mm
E	Screwdrivers - flat, posidrive, Phillips (various sizes), terminal
E	Stanley knife + blades (retractable)
E	Wood saw - suitable for joists
E	Hacksaw - 300mm + 24t blades
E	Claw hammer
E	Drill bits
	wood flat up to 16mm
	metal various up to 13mm including 4mm (with at least one spare)
	masonry, SDS 5.5, 6, 8, 10, 16mm 160mm long
	6mm 210mm long
	10, 16mm 450mm long (walls)
E	Pliers - side-cutters, electrical, locking (mole grips)
E	Inspection lamp
E	Pipe cutters - 15mm, 22mm roll around ones with small clearance are best
E	Spirit level (pocket size)
	Dust sheets (from door to loft - approx 20m)
	Mastic gun for silicone sealant
E	Tape measure - 5m
E	4.5" Grinder, cutting discs (for roof tiles)
E	Tool belt
E	2 roof buckets of different colours if possible (with angled base approx 30 degree
E	Kneeling/walking boards (to span joists in loft - approx 1.2m x 0.5m)
E	Magnetic compass with flat edge or GPS
D	Detachable rope cover 1m for protection at ridge
D	Indelible marker / pencil
D	Wire brush
D	Deburring tool for pipe sheathing

Materials to be supplied by installer / DIYer

D	Chalk (for marking out)
E	Roll of lead flashing - 300mm wide
E	0.5 tube of silicone sealant - roof grade low modulus (eg. Dow Corning 791 black or clear)
D	Electrical PVC Insulation tape - black + blue for marking hot and old pipes

Materials - mainly for internal work (in addition to parts supplied in kit)

E	30m roll of Pexepipe or HEP20 for pipe sheathing
E	Electric cable roll of 2 core rated at 24v 0.5amp min. red+black, if PV cable is too short
	Electrical terminal connector 2 amp screw connections to enable 2 wires to be connected to wires
D	Screw to hold this to a joist
	Olives (4 off) 3/4 inch imperial (for older pipe/imperial)
E	Pipe insulation - internal (unless extra external is needed) 105ºC temperature grade, thickness must be 13mm minimum
	22mm int diameter for most water pipes (for internal)
	15mm int diameter for plastic sheathing

Appendix 3

Hardness Control

What you need to do will depend on whether your installation is direct (heating the contents of the cylinder directly in the panel) or indirect, through a heat exchanger coil. It is very important to do your hardness control correctly. It is usually also easy to do.

Solartwin performance and warranty requirements in relation to hardness. These apply to standard directly plumbed installations at different maximum water hardnesses as described below. Note: we refer to parts per million calcium carbonate below, however other units can also be used.	**Chemical item**	CaCO3	Ca or Ca2+	CaCO3 or Ca or Ca2+	-
	Also known as	Calcium carbonate (note: WITH the word carbonate!)	Calcium or calcium ion (note: WITHOUT the word carbonate!)	Calcium carbonate or calcium or calcium ion	-
	Units, summary	ppm (or mg/l)	ppm (or mg/l)	mmol/l	-
	Units, in full	Parts per million (or millgrammes per litre)	Parts per million (or millgrammes per litre)	Millimoles per litre	English (or clark) degrees of hardness
So what must be done..?	(description/ factor)	1	0.4	0.01	0.07
0-99 (max) ppm CaCO3 NO Water hardness treatment To be done Here	Very soft	0	0	0	0
	Very soft	25	10	0.25	1.8
	Soft	50	20	0.5	3.5
	Mod soft	75	30	0.75	5.3
	Mod soft	99	39.6	0.99	6.9
100-199 (max) ppm CaC03 either Fernox superconcentrate Limescale Preventer OR Ion exchange water softener required	Slightly hard	100	40	1	7
	Mod hard	150	60	1.5	10.5
	Hard	199	79.6	1.99	13.9
If EVER over 200ppm CaCO3 Ion exchange Water softener required	Hard	200	80	2	14
	Hard	240	96	2.4	16.8
	Very hard	300	120	3	21
	Very hard	400	160	4	28
	Extr'ly hard	500	200	5	35

Direct Systems hardness control

If you are installing a Solartwin which is directly plumbed, please read the next section carefully and comply with it fully. Otherwise please skip to the section called 'Hardness control in indirect Solartwin installations'.

What is a direct installation?

A direct installation is usually where water going through the panel is the same water which later comes out of the hot tap, or other hot water supply. It is where new water is regularly passed through a panel in a way which may lead to limescale deposition. About 80% of domestic Solartwin installations are direct installations. The rest will be indirect of some form or another.

Get and use accurate water hardness figure please.

Hardness information is usually obtainable free from the local water supplier. Just phone the number on your water supply bill, and have the address and postcode of the property concerned ready.

Water supply data is likely to be more accurate that one-off on-site testing. Do NOT rely on one-off site testing. This is almost always inaccurate.

If you are given a high-low range by the water company, always base your hardness control decision on the higher of the two figures. If you are given only one hardness figure add 20% to it to allow for variation.

Please do not confuse different but similar sounding terms, for example make sure that 'parts per million calcium' are not treated the same as 'parts per million calcium *carbonate*', since the first figure is only 40% of the second! If in doubt ask the water company to put their figures in writing with clear units given.

Only use the appropriate hardness control solutions from the above table.

Never user electromagnetic water conditioners such as magnets or any electronic water descaling/ conditioning systems or any physical water shocking systems such as ultrasonics on any water going into Solartwin. Their use will invalidate your warranty. Their use may lead to your panel bursting.

For intermittently used properties or fortic type cylinders reduce the 100/200 hardness thresholds by 20% to 80/160ppm.

Appendix 4 Cylinder Notice

THIS PAGE MUST BE AFFIXED TO THE HOT WATER CYLINDER WHICH THE SOLARTWIN IS HEATING

WARNING

This hot water cylinder is directly connected to a Solartwin solar water heating panel.

Please read on, about working on a water system connected to Solartwin...

The cold header tank is also connected to this hot water cylinder. If you drain this hot water cylinder down, or drain the header tank, or if you work near the Solartwin pipes and connected pipes while it is drained down, or if you refill it, please read right to the end of this document before you start:

Draining down the cylinder, for example if replacing a hot water cylinder.

You can simply drain the cylinder while letting the panel drain itself using the pump. But beware of hot water or steam. The Solartwin pump should normally not be disconnected during the drain down process itself. Instead it should be allowed to keep running so that it will pump some or all of the water out of the collector. If possible avoid disconnecting the pump unless the collector will be left drained for more than a week until it boils dry. The pump can run dry for up to a week. It is low voltage and runs on solar electricity with a maximum voltage of 21 Volts DC and a maximum power consumption of 5 Watts. The collector is not harmed by being left dry and hot in the sun.

Working with Solartwin drained down requires important thermal safety precautions

Even after the solar water collector has been drained, residual hot water or steam may still come out, sometimes in sudden bursts, for hours or days afterwards, particularly in bright or sunny weather. Pipes connected to the collector may get very hot, up to 100C. The solar collector always needs to be open vented from at least one side and preferably two. Never close off any of the pipes to or from the collector, even for a brief period. Doing so is dangerous and may cause high pressure steam to build up with the possibility of bursting and serious water or steam burns.

Recommissioning Solartwin is normally easy

Solartwin is a relatively robust technology, and the pump usually primes and recommissions itself immediately on filling the cylinder / header tank or expansion tank.

When refilling the cylinder, please take care that it is filled with clean water and ensure that particles are not carried into the solar water heating system's (narrower 6mm) pipework, because they might block it. After refilling the cylinder, always check, by listening to it, that the low voltage solar pump is working. If the sunlight levels are too low for it to operate attach a 9-15 volt DC battery or power pack if necessary, observing the correct polarity.

Once it has pumped for at least 20 minutes check that it is primed and really pumping water by pinching the pipes on either side, in turn, shutting off the flow for no more than ten seconds. If the note of the pump changes noticeably with one or both pinching actions, then it is correctly primed. Occasionally the note may not change. In this case the pump needs to be primed - lower it below the water level of the cold tank so that cold water enters it.

When working on the water system, and in particular when refilling the collector by day, please note that the panel's internal surfaces may well be over 100C and that the hottest part is the upper 40% which might occasionally be as hot as 190C. This means that steam may emerge from the vent pipe for a short period if it is refilled during sunlight, This is normal. However, do not touch the vent pipe and keep away from the end of the vent pipe until all risk of scald or burn has ceased.

THIS PAGE MUST BE AFFIXED TO THE HOT WATER CYLINDER WHICH THE SOLARTWIN IS HEATING

Decommissioning Solartwin - on its own

Normally, draining down the hot water cylinder first, and then decommissioning a pumped / boiled dry Solartwin system afterwards, is by far the best and safest method of decommissioning. If you want to disconnect or decommission Solartwin without doing draining down first, it is best to do so at night or when sunlight levels on the panel are below 20% of peak - in other words, when the sky in front of it is heavily overcast or it is raining and there are no gaps in the clouds.

(Very rarely, the system may need to be decommissioned at short notice during sunlight. This decommission should be chosen only when there is ***absolutely no alternative*** because there will inevitably be significant risk of burns from hot water or steam. We stress that the following method is ***not recommended*** because it involves these risks. We are including it only because it is likely to be safer than having no instructions whatsoever)

For an emergency daytime decommission which is normally not advisable, you will need 2 buckets, preferably with handles, 5-15 metres of strong string, 2 pencils or similar bung devices, and a pair of scissors. Plus you will need to protect yourself well, particularly your hands, eyes and face against possible steam burns or soaking from very hot water. Identify the solartwin silicone rubber pipes to and from the panel correctly. Plan what you will do. Take the top off the cold water tank (if it is nearby) in case you need a cold water plunge for a burn.

1/ When you are fully prepared, disconnect the low voltage power to the pump. For example cut one single wire of the pump. Cut it so there will be an end left to reconnect.

2/ Within 1 minute of this, at arms length, cut the inlet (usually colder) pipe to the panel. Bung the end which goes to the cylinder (unless it is above the level of the header / expansion tank, in which it will not flow) and leave the panel end open. Secure this end with string so that any hot water coming from it is caught by one of the buckets.

3/ Immediately afterwards, and within 3 minutes, again at arms length, cut the other pipe, which carries the hot water from the top of the panel to the top of the cylinder. It is likely to be hotter than the other pipe. Once again, bung the end which goes to the cylinder (unless it is above the water level of the header / expansion tank, in which it will not flow) and leave the panel end open. Again secure this end with string so that any hot water coming from it is caught in a bucket. The panel and piping typically contain approx 3-10 litres of water.

Technical support is available - **phone 01244 403404** Monday to Friday from 10am to 6pm

If you observe the above points, you should have a problem-free recommissioning of the Solartwin solar water heating system. However, if you are unsure, or need additional information, please call. Solartwin is relatively new and easy technology and we are here to help to explain it. Technical support is normal available from Monday to Friday from 10 am to 6 pm. We supply technical information for installers at: www.solartwin.com

End of product / component life issues.

This section is a summary. We have not addressed every issue in full here. Please avoid landfilling or incinerating this product as one unit at the end of its life. Recycle or reuse its component materials if possible. The main component of Solartwin by weight is recyclable aluminium. The foam insulation is CFC free and is also HCFC free and does not need to be degassed (unlike some older refrigerator insulation). The silicone rubber pipes and hoses are currently not recyclable at the date of printing. The polycarbonate glazing can usually be recycled. Please recycle electrical and electronic components appropriately. If disassembling the panel, take due care. For example, wear a fine particle dust mask if the insulation is damaged or has become abraded. Avoid injury from sharp edges and do not disassemble it in direct sunlight (this casts a hazy or sharp edged shadow) because of risk of high temperature burns.

Appendix 5

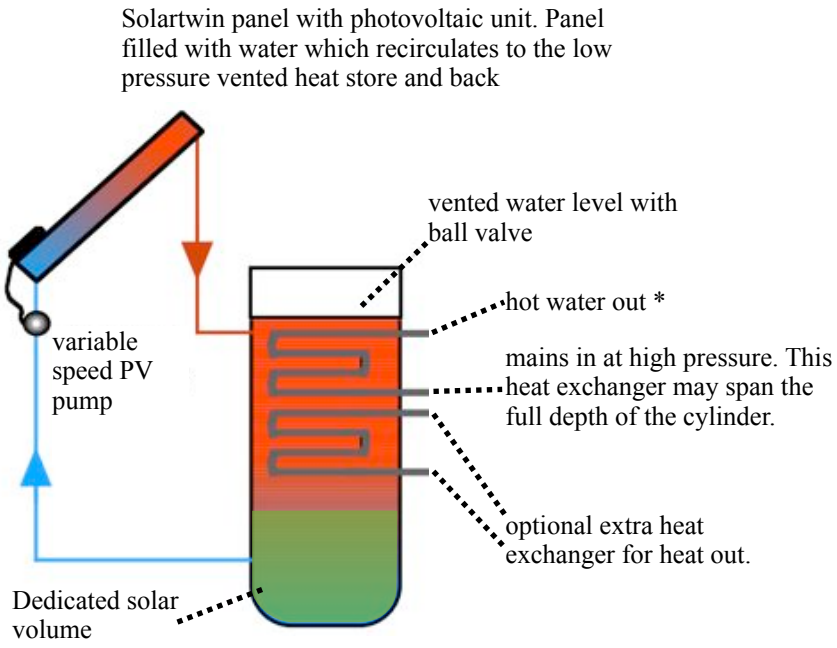
Two Variations on Standard Solartwin Plumbing

Solartwin heat store plumbing
(Thermal Store)

showing solar heat store application

This may be free standing as a hot water supply. Alternatively, its output may be top-up heated, so that it pre-feeds another water heating system such as a combi boiler or high pressure cylinder. A thermostatic mixer valve is required at * to prevent high temperature spikes, for example, if this pre-feeds a solar-ready combi boiler. (Thermostatic mixer valve plumbing has been omitted for clarity. Details are explained and shown diagrammatically in 7.13)

Note 1: When a thermal store is fitted, Solar Twin recommends setting the thermostat on the store at 65C (5 degrees hotter than for a cylinder). The solar controller will also need to have its export temperature raised from 65C to 70C to avoid occasional export of back-up heat.
Note 2: When specifying a thermal store, we recommend a dedicated solar volume of at least 70.5 litres per solar collector. This gives compliance with the Building Services Compliance Guide. See drawing below.
Note 3: A pressure reducing valve will be required if the incoming mains water pressure exceeds 3.5 bar within any 24 hour cycle. Hot and cold pressures must also be balanced where there are thermostatic mixer valves downstream, including thermostatic showers.



Various additional heat sources may sometimes be applied to the heat store, including electric immersion or low pressure hot water (direct or indirect such as from a conventional boiler or wood stove etc.) Use Fernox MB1 Protector (NOT superconcentrate limescale preventer!) or similar at 4% in the Solartwin circuit.

Appendix 5 cont.

Solartwin heat store plumbing
(Combi boiler)

Combi boilers generally fall into two categories; "Solar ready" which can accept preheated water up to 60ºC or non-solar ready which can typically accept preheated water no more than 25-30ºC. Solar ready combis just require one thermostatic mixing valve to reduce the temperature to around 5ºC below the maximum combi inlet temperature.

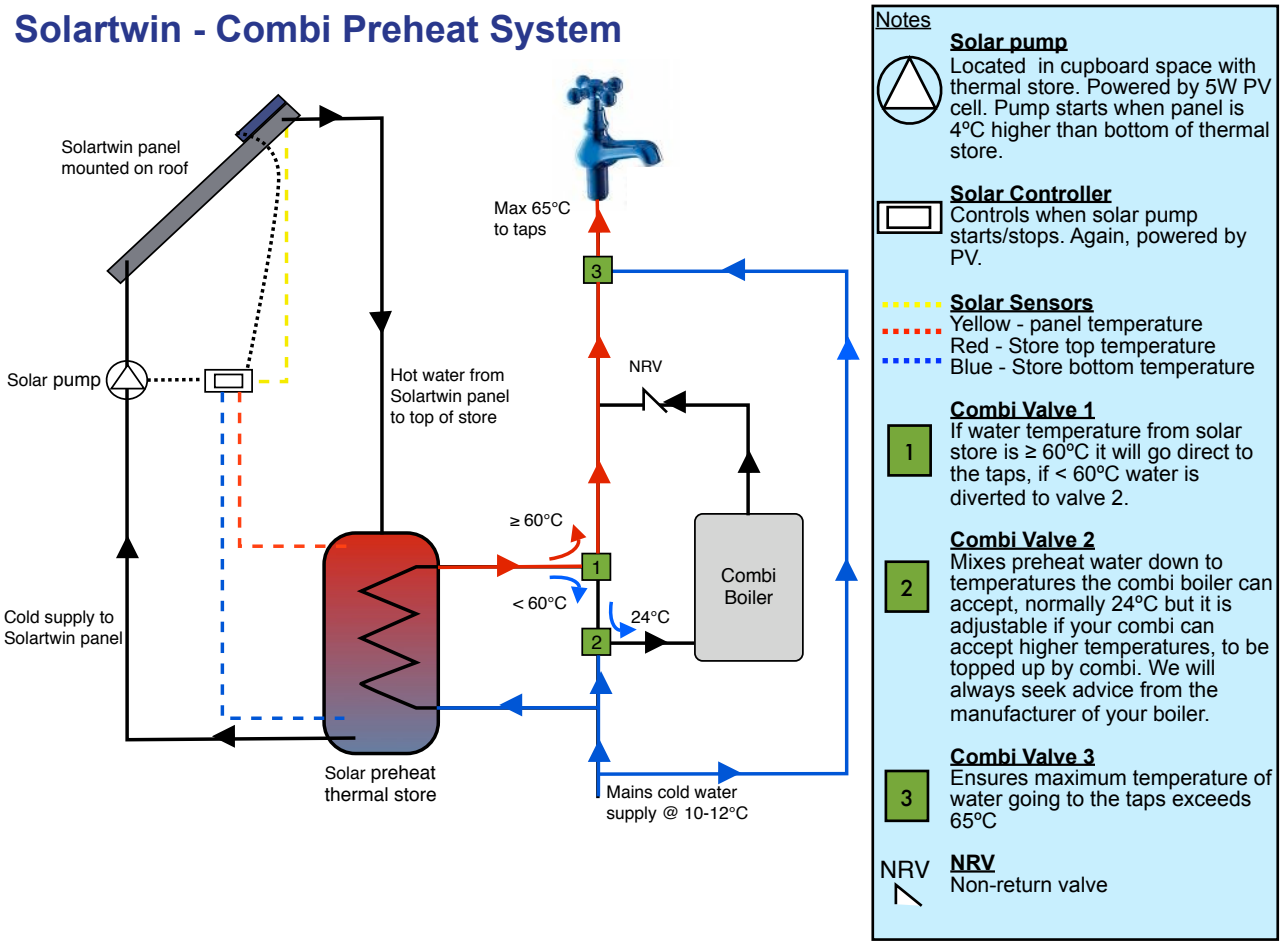
The Solartwin combi preheat system offers a non-intrusive solution by use of a low maintenance vented thermal store, dimensions typically 571x571x750mm., that will often fit in a kitchen unit, below or to the side of the combi boiler. In some cases the bottom of the kitchen unit may need to be cut out so the thermal store will fit (floor standing). If space is not an issue we can also offer a slightly larger thermal store, dimensions 450x900mm which also requires a 300mm in height feed and expansion tank sat on top of it.

The solar panel pipes will feed down from the roof to the location of the thermal store, where the heat is stored. The mains water supply to the combi extracts the heat from the store, pre-feeding hot water to the combi valve(s).

As Solartwin combi preheat systems are indirect, scale can be controlled with just a single dose of scale inhibitor rather than an ion-exchange water softener.

The solar pump will be mounted at the water level in the thermal store/feed and expansion tank fixed onto an anti-vibration mount. Due to the mechanics of the pump you may hear a gentle whirring of the pump when operating in peak sun conditions

Where possible, position the solar controller outside of the cupboard/unit so that you can see how your system is performing.



Appendix 6 Pressure Drops and Multiple panels

Maximum pressure drop.

Although this is not relevant to most installations, because we have pre-specified most or all of the associated components, for the purposes of European certification we are required to state a maximum allowable pressure drop across the panel in normal operation. It is 0.2 Bar. This equates to a water flow of approx 200 litres per hour at 20C. In fact a domestic Solartwin collector normally runs at a maximum flow rate of 0.7 litres per minute. This is approximately 40 litres per hour: it creates a pressure drop across the panel itself of only around 0.02 bar.

Power.

No more than two systems can be run from one controller. If two PVs are to be run to one controller they must not be joined externally, the joint can be made inside the building or alternatively at the controller. If two PVs are to be used with one cable, the cable should be rated at at least 1.5mm^2.

Parallel not series!

Always plumb multiple Solartwin panels in parallel, never in series. The apertures in the system, including pipe diameters, have been carefully selected to potentially accommodate steam from *one* panel boiling, should it do so, but not for *more* than one in series.

Use the correct flow and return pipes.

Even in multiple panel installations you must use the normal 6mm (internal diameter) silicone microbore pipe for all connections to the panels and pumps provided that the total pipe run, to panel and back is no longer than 30m.

If the total return distance is over 30m total you can replace the cold (Inlet) pipe with copper of 10-12 mm internal diameter, but only in freeze protected areas. Any copper on the solar circuit must travel upwards as it will not be able to entrain air bubbles. Never increase the diameter of the hot (outlet) pipe with any other pipe since it *must* be 6mm internal diameter in order to entrain air bubbles out of the system. Never substitute another pipe on the hot side: always use the microbore silicone pipe for the hot side, until it reaches a vertical run of vent pipe of the appropriate diameter.

What internal pipe diameter should the vent pipe be?

Large enough to accommodate steam if all the panels boiled at once. Rather than give a formula, we have calculated this to make life easy for installers, so please follow the table overleaf. It shows pipe sizing for arrays of up to 80 panels (224 sqm) Please note that the figures are for the *internal* diameter. Remember to allow for this when choosing the external diameter of a pipe, which may be larger. If you are fitting bigger arrays than 80 panels, please call us for vent pipe dimensioning.

Selection table: vent pipe diameter.		vent internal diameter, mm	
Area, sqm of panels, nominal	no of panels used	minimum mm	preferred mm
2.8	1	12	19
5.6	2	13	19
8.4	3	14	19
11.2	4	15	19
14	5	17	21
16.8	6	18	23
19.6	7	20	25
22.4	8	21	27
25.2	9	23	29
28	10	24	30
33.6	12	26	33
42	15	29	37
56	20	34	42
70	25	38	48
84	30	41	52
112	40	47	60
140	50	53	67
168	60	58	74
196	70	63	79
224	80	67	85

Appendix 7 Amendments

Version	Date	Amendments
2009a	14 Jan 2009	Thermostatic mixing valve details added
2009b	4 Feb 2009	Removed two Solartwin plumbing variations Clarifications on thermostatic mixing valves added
2009c	21 Oct 2009	Clarifications to Roof Working made Solar Volume clarification, diagram and Combi options added to Appendix 5 Power information added to Appendix 6
2009d	28 Oct 2009	New references to hot water cylinder / insulation standards and MCS documents including MIS 3001 clause 4.4.3 on dedicated solar volume in time, backup heating, customer explanations on performance optimisation, labelling (inc new label position), cylinder condition and insulation. Requirement for pipes on TMV's not to run upwards. Number of required photos increased to 10-20.
2010a	22 Feb 2010	Thermal Store advice updated
2010a	22 Feb 2010	Pipe insulation minimum diameter specified
2010a	22 Feb 2010	Advisory on handling the panel
2010a	22 Feb 2010	Silicone Tile instructions