Installation Manual
Evacuated Tube Solar Water Heaters

Sunshine Solar water heaters are AS/NZ 2712:2007 certified. Please read the following instructions carefully to ensure their correct installation for optimum results.

If you have any questions please call us on 0800 sunshine (0800 786 744)
These instructions are current as at August 2013
Evacuated tube solar system – installation manual

This assembly manual covers assembly of the frame (if needed), roof mounting of the 20 and 30 tube evacuated solar tube collectors and installation to the cylinder.

Contents

Page  
3  Section 1  
Specifications and cautions

6  Section 2  
General guidelines for roof-mounting of the solar collectors

7  Section 3  
Collector assembly

9  Section 4  
Frame assembly when collector angle needs to be greater than the roof pitch

10  Section 5  
Roof fixings

11  Section 6  
Plumbing

12  Section 7  
Electrical

12  Section 8  
Finishing off

14  Section 9  
Setting up the controller

15  Section 10  
Limitations and Clauses

16  Section 11  
Installer checklist
Section 1: Specifications and cautions

Dimensions of the solar collectors: ET20 (20 tube) and ET30 (30 tube).
Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>ET20</th>
<th>ET30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Tubes</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Dimensions (L×W×H)</td>
<td>2050×1400×153</td>
<td>2050×2100×153</td>
</tr>
<tr>
<td>Effectual Absorb Area</td>
<td>1.62m$^2$</td>
<td>2.42m$^2$</td>
</tr>
<tr>
<td>Weight (Empty)</td>
<td>63kgs</td>
<td>94kgs</td>
</tr>
<tr>
<td>Manifold’s Capacity</td>
<td>1.15L</td>
<td>1.7L</td>
</tr>
<tr>
<td>Connections</td>
<td>G3/4&quot; male thread</td>
<td>G3/4&quot; male thread</td>
</tr>
</tbody>
</table>

Components

1. **Heat Pipe**
   Transfers the thermal energy from within the vacuum tube to the condenser efficiently and rapidly.

2. **Glass tube top holder**
   The Part to hold the glass tubes to the manifold box.

3. **Cover**
   Stabilises the heat pipe and minimises the thermal energy loss from the glass tube.

4. **Conductive Aluminium fins**
   Transfer the thermal energy from the glass inner wall to the heat pipe more efficiently.

5. **Vacuum layer between the glass skins**

6. **Solar glass tube**
   High efficiency solar glass tube with maximum radiation absorption, minimum thermal radiation losses and high insulation performance.

7. **Base / tube seal**
   This section has a mirror finish to minimise heat loss in the vacuum layer seal zone.

Parameters

<table>
<thead>
<tr>
<th>Solar collector tube parameters</th>
<th>Absorptivity</th>
<th>Emissivity</th>
<th>Glass transmission</th>
<th>Vacuum</th>
<th>Tiptop temp.</th>
<th>Low temp. durability</th>
<th>Wind durability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≥92%</td>
<td>≤10%</td>
<td>≥92%</td>
<td>≤5×10$^{-2}$Pa</td>
<td>250℃</td>
<td>——35℃</td>
<td>30m/s</td>
</tr>
</tbody>
</table>
Cautions

1.1 Gloves and Eye protection must be used when handling glass tubes. Avoid scratching or any sudden blow to tubes;

1.2 Under no circumstances are the tubes to be left exposed to the sun over a long period without heat extraction from the system;

1.3 Unpack and install tubes after the manifold unit has been installed and all pipe work has been completed and the system is filled. (Avoid high temperature of empty manifold to affect system efficiency);

1.4 During installation of the tubes, the pump should be switched on;

1.5 If the system is out of use for a long time, the solar collector must be covered over / shaded with a suitable screen;

1.6 Apply locally applicable Health and Safety guidelines at all time;

1.7 The solar collector should be installed within $22^\circ\sim50^\circ$ angle.

1.8 The weight bearing capacity of the roof MUST be calculated for the maximum collector weight, the load-bearing points and the rafter size / strength;

1.9 When heating a swimming pool or spa, a heat exchanger should be used between the pool and the collector.

1.10 Sunshine Solar manifolds are designed to operate at a maximum pressure of 6 Bar (90psi). It’s strongly recommended to use a suitable pressure relief valve.

1.11 To extend the service life of your system, the vacuum tubes should not be installed until the system is fully connected and ready for use.

System diagrams

For variations to this schematic (e.g. solar ready or wetback) please visit the installers section on our website http://www.sunshinesolar.co.nz/installers.html or call us on 0800 786 744.

Mains pressure, open loop solar system with electricity – Retrofit by 4-way port
Section 2: General guidelines for roof-mounting of the solar collectors.

- The ideal location for the Solar Collectors is on a roof facing the mid-day / early afternoon sun. (North / NNW in New Zealand).
- The panel angle to the sun should be approximately the same as the geographical latitude (e.g. 36° for Auckland, 45° for Dunedin).
- If the roof pitch is significantly less than this value, we recommend that the panel is elevated on a frame to maximise the collector efficiency.
- Clients will have a view on the use of a frame; it is important to explain to them (in writing) that Sunshine Solar does recommend a frame in these circumstances to maximise efficiency, especially in higher value latitudes (eg Dunedin).
- It is important also that the panels will not be shaded for any of the day in summer or winter by trees or buildings etc.

- Stainless steel fittings of an appropriate grade must be used, including roof mounting screws.
- Roof cladding penetrations must be appropriately sealed according to local building code standards and must follow good practice at all times.
Section 3: Collector assembly

Before beginning, make sure you have all the pieces required;

- 2-3 boxes of 10 evacuated tubes (depending if it is an ET20 or 30).
- 1 box containing the manifold, bottom track, end cups, stainless steel clips and a small brass fitting.
- 1 box containing the vertical tracks.
- Flat roof stand if required – refer to page 9 for diagram.

Assembling the frame

Put frame together as per diagram.

1. Take apart the stainless steel fixing brackets and thread them through the holes in the frame pieces as shown in the picture.
   
   The brackets sit with the projecting edges ‘facing each other’.

   **ET30 only** – For the central vertical frame piece, ONLY place the top clip at this stage.

1a. Vertical tracks—the manifold end has the holes for the brackets further apart—picture showing manifold end with brackets.

1b. Vertical tracks—Lower end, picture showing topside of brackets.

2. To fit the manifold onto the frame, lift the manifold and position it between the outer pairs of stainless steel fixing clips. Then slide the clips inwards to clamp the manifold.

2b. At this stage ONLY do up the nuts finger tight - you may need to adjust the position later.

   **ET30 only** - See that the lower central manifold clip is NOT yet fitted in the frame.

3. Repeat the fixing process for the bottom rail. All the pairs of brackets can be located as the bottom track is not adjustable.

   **Note** – make sure it is the right way round!
Finalising position

1. To finalise the position of the Manifold, and tighten the fixings, the two end evacuated tubes must be fitted. An incorrect spacing between the manifold and the bottom rail will mean that the tube end caps will not click securely into place.

2. To fit the first tube, the heat pipe must be pulled out from the tube as shown. (Do not use the thermal conduction glue as the tube is only being temporarily installed).

3. Then insert the end firmly and completely into the manifold.

4. Next slide the loose copper collar up, followed by the black plastic tube mount which screws onto the manifold.

5. Then, ease the evacuated tube gently but firmly into the black plastic tube mount until you feel it come to a stop.

6. Clip the plastic end-cap into place on the bottom rail.

7. NOTE if the end-cap has NOT clipped in securely (as in the photo), the manifold will have to be adjusted up to allow the end cap to click into place.

8. Now the manifold clips can be tightened ON THIS SIDE ONLY because the tube end cap has clipped securely over the evacuated tube; in other words the manifold is correctly positioned on the frame.

   **ET30 only** – At this stage, the last central manifold clip can be added, and the pair tightened up. Make sure the central frame piece is still in the middle of the manifold!

9. Now the two evacuated tubes can be removed and re-packed.

Fitting the feet to the Collector unit;

10. If the unit is to be fitted flat to a roof, the feet will all be bolted to the frame that has just been completed.

11. If the unit is to be elevated, then the front feet will be fitted to the collector frame as above but the rear feet will be fitted to the elevation frame.

12. The feet are bolted to the frame sections as shown. Note the rubber spacer / grip that is glued to each foot.

13. Stainless steel fixing screws of the appropriate grade must be used to fix the units to the roof.
Section 4: Pitched frame assembly

The ET20 and ET30 collectors can be elevated to the required angle on both flat and pitched roofs using the specialised frame pieces supplied.

Adjustable angle range: 22°-50°

Making up the frame

The cross braces (6) and angled bracing section (3) should be cut to the desired length.

Both sections must be fitted to the collector frame using the stainless steel M8 bolts provided. The bolt holes should be drilled carefully to avoid scarring the powder-coated surface of the section.

The vertical parts (5) can be pulled out to the right angle of choice and bolted up with the bolts provided in the kit. The feet should be fitted as shown in Section 3.

Notes:

- The above diagram shows an ET30 frame, the ET20 is similar, without the middle bars.
- Ensure there is a butanol layer between the feet and roof.
Section 5: Roof fixings

1a. Fixing detail to corrugate—Polypropylene block

- Proprietary "hanger bolt" (or 14g Tec screw) fixed through purlin 45mm penetration.
- Proprietary aluminium frame "roof track"
- Polypropylene block
- Roofing Silicone
- Existing timber purlins
- 2wire dogs to existing purlin
- Rafter/truss

1b. Additional purlin support

- Proprietary "hanger bolt" (or 14g Tec screw) fixed through purlin 45mm penetration.
- Proprietary aluminium frame "roof track"
- Polypropylene block
- Roofing Silicone
- Existing timber purlins
- 1wire dogs to existing purlin
- Existing rafter/truss
- New 90x45 SG8 purlin strengthening between existing rafters, skew nailed to existing purlin. Fix with 4/90x3.15 nails to each end of purlin support

2. Fixing detail to metal/concrete tiles

NOTE:
Vary position of bottom track to ensure Front Track sitting of roof profile peak.

- Proprietary "hanger bolt" (or 14g Tec screw) fixed through purlin 45mm penetration.
- Hole to be predrilled and filled with silicon.
- Proprietary aluminium frame "roof track"
- Polypropylene block (optional with hanger bolt)
- Roofing Silicone
- Rafter/truss
- "Z" nail purlin to rafter

NOTE:
ALL ROOF SEALING DETAILS ARE TO BE IN ACCORDANCE WITH G12/AS2
Section 6: Plumbing

1. For a new install—please follow 1. NZS3606 installation guide, ensure there is room for the thermostat and that relief valves have sufficient room for maintenance and potential removal.

2. For a retrofit—turn off and unplug / disconnect cylinder.

3. Drain cylinder.

4. Add riser to return end of 4-way valve (retrofit).

5. Connect 4 way valve (retrofit).

6. Connect and close ball valve, non-return valve and pump to the cold side of the cylinder, see diagram.

7. Ensure the pump has enough support and is installed in a vertical position accessible for replacement and adjustment of settings.

8. Connect Tempering valve if required to hot and cold sources on cylinder hot supply as per standard.

9. Connect and close ball valves.

10. Fill cylinder and turn on.

11. Connect pipes from roof.

12. Open ball valves and check for leaks.

13. System to be installed to the following plumbing standards; ASNZS3500.4, G12 of building code; copper to NZS3501.

14. Ensure all pipes out of cylinder are lagged.

Note: All fittings shown above (excluding tile roof flashing), plus 20m 3/8” pipe and relay, are available in our solar kits (pump not included in solar kits). See pricelist or call us on 0800 786 744.
Section 7: Electrical

Use controller manual supplied for detailed instructions; also refer to plumbing & electrical schematic on page 5 of this guide.

1. Mount controller (and relay for retrofits).
2. Attach probes T3 at middle and T2 at bottom of cylinder(s) (top connect behind insulation ½ way from top of cylinder, bottom thermocouple often is best behind insulation touching copper by thermostat / element) – New systems will have specific probe pockets.
3. Ensure probe pockets are free of moisture. Use probe grommet to stop water getting into pocket.
4. Ensure good connection between probe and inside of cylinder.
5. Connect thermocouples to controller.
6. Connect pump.
7. Connect controller to element via single pole relay if not a solar cylinder – supply must not be subject to ripple control.
8. Connect power to controller – relay is a switch, do NOT connect an outside live to relay.
10. For overheat dump option connect pipe thermostat, (live comes from P1 connection) and 3-way valve.
11. For a solar cylinder use only the top element and connect direct to the mains (not through the controller) on all day rate.

Section 8: Finishing Off

13. Purge pipe and pump of air.
14. Set the pump speed – I for <30 tubes, II <50 tubes.
15. Pressure test for leaks by opening to operating pressure and running the pump.
16. Install tubes into manifold – see page 13 for directions.
17. Fit exterior insulation – so that no bare copper or brass is showing.
18. UV protect the insulation if not already protected by using PVC tape, cover red dektite.
19. Program the controller. Full description for setup options and maintenance given in the controller manual supplied. Also see page 14.
20. Debrief and review settings with customer.
21. Fill out CoC’s and PS3’s for council.
22. Clean up the site from boxes, wires, etc.
Installation of the tubes and end-caps

1. To fit the tubes, the heat pipe must be pulled out from the tube as shown. Coat the end of the heat pipe with the thermal conduction glue.

2. Then insert the end of the heat pipe firmly and completely into the manifold.

3. Next slide the loose copper collar up.

4. Slide up the black plastic tube mount which then screws firmly onto the manifold.

5. Then, ease the evacuated tube gently but firmly into the black plastic tube mount until you feel it come to a stop.

**NOTE** - When the collector is on a roof, the tube can slide out again. Keep up gentle pressure until the end cap is in place.

6. Clip the plastic end-cap into place on the bottom rail, pushing steadily until it clicks into place.
Section 8: Setting up the controller – SR868C8Q Controller

Use page 10 and 11 in controller manual as a guide.

Controller may already be programmed, if pre-programmed always check settings to ensure all correct.

Pressing set will allow you to change a setting, use + and - to change the setting, pressing esc will take you back one setting and will not lose the stored data.

- Set time using the time and date button, + and - to change.
- Press the SET button and a Password will come up, set this to 0000 by pressing the SET button four times.
- This will take you into a menu screen DTO, press SET and then + to make this read 12C
- Press esc

Heating using the controller through a relay

Note: if you are using a solar cylinder then normally do not use this function but connect top element directly to the mains supply.

- From DTO above.
- Press + and it will say DTF – press SET and then + to make this 8C.
- Press esc.
- Press + and it will say THET.
- Press SET and it will say TH1O (Timing Heating 1 On), press SET and then – to make this 0100, press set twice until it has a temperature ‘40’. Press plus to increase this to 50.
- Press ESC then + display should say TH1F – change this to 0700 and 60C in the same way.
- TH2O and TH2F should both be 10:00, TH3O should be 17:00 and 50C,
- Change TH3F to 23:00 and 60C.
- Press + to TEMP menu, press set.
- EMOF 130C press esc, press +.
- EMON 120C press esc, press +.
- CMX ‘–’ press esc, press +.
- CMN ‘–’ press esc, press +.
- SMX – SET to 80°C for retrofit cylinders or “__” for solar or wetback cylinders.
- All other functions should normally be off “__”.
- FUN menu press set, press + until nMin press set – change to 50%.
- Press ESC 3 times to escape out of setup.

Warning:

When using the controller to control the element this is activated by the top sensor being under the set point. Most solar cylinders have the sensor pocket too high, this should be at the halfway point. If using a high sensor pocket (T3) to control the element you will not guarantee the client more than 30L of hot water.

Ensure good contact between probe and what you are measuring.
Section 9: Potential Problems

1. No hot water:
   a. Check element is switched on at the wall.
   b. Check that the fuse in the thermostat has not popped – may need to replace with auto-reset thermostat, reduce SMX by 5°C.
   c. Check the timing for the element is on for long enough – most cylinders require 6 hours of heating.
   d. Check shower flow rate is not too high – may require flow meter.

2. System not performing as well as expected
   a. Check non-return valve is installed and working, check not thermos phoning at night. (Temp at night should be similar to ambient) – may require a second NRV.

3. Boiling on the roof but not heating cylinder
   a. Check Non-return valve and pump are round the right way.
   b. Bleed pump if making loud noise, is pump connected vertically?
   c. Check pipe length is not more than 15m each way with small bore pipe (too greater frictional losses for the pump to handle) – quick fix is a second pump in series.
   d. Check there is no high spots above the solar (will create a steam block) – use steam vent. (AAV).
   e. Ensure NRV is after the pump.
   f. Check steam vent (AAV) is working.
   g. Check pump is on fast enough speed.

4. System flooding through house (very rare)
   a. This has mostly happened where heat has got through to Polypropylene pipe and melted it. Ensure that copper is used where this can occur. (NB heat can travel up the cold supply pipe when the whole cylinder is HOT.) May require thermal trap on the cold supply (bare copper pipe in a loop).
   b. Check that the heat dump at the TPR valve can drain away without backing up and flooding – may require flow restrictor in heat dump loop.

5. Cylinder making banging noise
   a. Due to cylinder expansion through heat. Ensure that a cold water expansion valve and a hot water TPR valve are fitted and working.

   a. Check that the plastic surrounding the roof sensor has not melted to cause a short. NB Only the metal sensor should be inserted into the probe pocket.
   b. Check that the screw into the wire at the control box is screwed into the wire and not the plastic.
   c. To check if a wire fault, switch with a dummy sensor.

7. Funny temperature readings
   a. Check the right sensor is used in the right position. PT1000 for roof and NTC for the cylinder.

8. Element not coming up to 60°C
   a. Check probe contact with cylinder and allow 8°C for losses.
   b. Check timing and temp of heating program.
   c. Check clock time, check night rate and ripple control potential conflicts with timers.

9. Night circulation from cylinder to panel—due to controller not reaching pump off Temp differential (DTF)
   a. Improve connection with T2 Probe.
   b. Increase DTO and DTF by 5 degrees each.

10. Too much hot water—system is always boiling
    a. Remove tubes.
    b. Install heat dump loop.
    c. Set controller to holiday mode.
    d. Look at heating timing.
Section 10: Limitations and clauses—required for AS2712:2007 2.9.1

A. The solar water heater, parts and fittings are usable up to 10 bar pressure / 1000kPA.
   The system is made of copper so pool levels of chlorine are not acceptable for use.
   For levels of high lime content please check the element in cylinder is incalloy otherwise Sunshine solar
   panels are capable of handling poor water quality.

B. I  The water heater will be installed in accordance with AS/NZS3500.4 including insulation and piping.
   Copper piping should be used only, throughout install as per attached instructions.
   II Cylinders to be installed so to allow for draining of system, water expansion and relief of vacuum
      as per AS/NZS3500.4.
   III Drain trays to be installed as per AS/NZS3500.4, where required.
   IV N/a.
   V In case of hard water buildup of lime may occur on hot areas, ensure element type is suitable for
      the water type otherwise softening of water may be required.

C. The system is designed for level 1 and 2 frost protection, if in areas of long term below zero temperatures
   a closed loop system is advised.

D. Guards to the collectors may be required in areas of vandalism or large hail zones (Sydney).

E. In areas of cyclonic conditions specific engineering design is required; refer to Installation Handbook rev B
   for limitations. Panels weigh 18.8kg/m2 when fill of water.

F. For full installation including roof structure spacing please refer to Engineering Installation manual, purlin
   tables etc. Solar to be installed as to not compromise the structural integrity of the building.

G. Ensure appropriate fixings per roof type as contained in this manual, for roof types outside of these then
   refer to engineering manual otherwise specific engineer design required.

H. Controller manual to be supplied to customer (which has a boost instruction highlighted).

I. Controller manual to be supplied with the default (printed settings of the thermostats).

J. Follow the finishing off instructions contained for commissioning of the system.

K. Ensure that all systems have an appropriately solar capable tempering valve and this is set to 55C or 45C
   for elderly, schools and preschools applications. We recommend a 20mm + tempering valve for all low
   pressure applications.
Section 11: Important Checklist for Installer

(To complete and tick before leaving site)

Please ask customer to be available at the end of the day/estimated completion time for commissioning and to go through the paperwork.

Otherwise this can be discussed by phone or if another appointment is necessary a call out fee may be applied.

Important Checks

☐ Check for leaks
☐ Ensure probes have good contact
☐ Ensure pump works
☐ Check heating element switches on and off
☐ Controller programmed
☐ System debrief with customer and review controller settings
☐ Clean up the site from boxes, wires, etc.

Important Paperwork

☐ Complete Code of Compliance for council
☐ Complete Council specific PS3 documentation
☐ Complete warranty details in Owner’s Manual
☐ Leave system manuals for customer
☐ Electrical CoC form left with customer documents

If commissioning is not possible because the customer is absent please leave your contact details to make another time or discuss via a phone call.

Dear Customer

Unfortunately in your absence we were unable to go over some of the paperwork and commission your system with you. If you would like to discuss anything further please call me to make a time or go over these on the phone. Please note if another appointment is necessary a call out fee may be applied.

Installer:                        Date:                        
Notes:                           Phone: