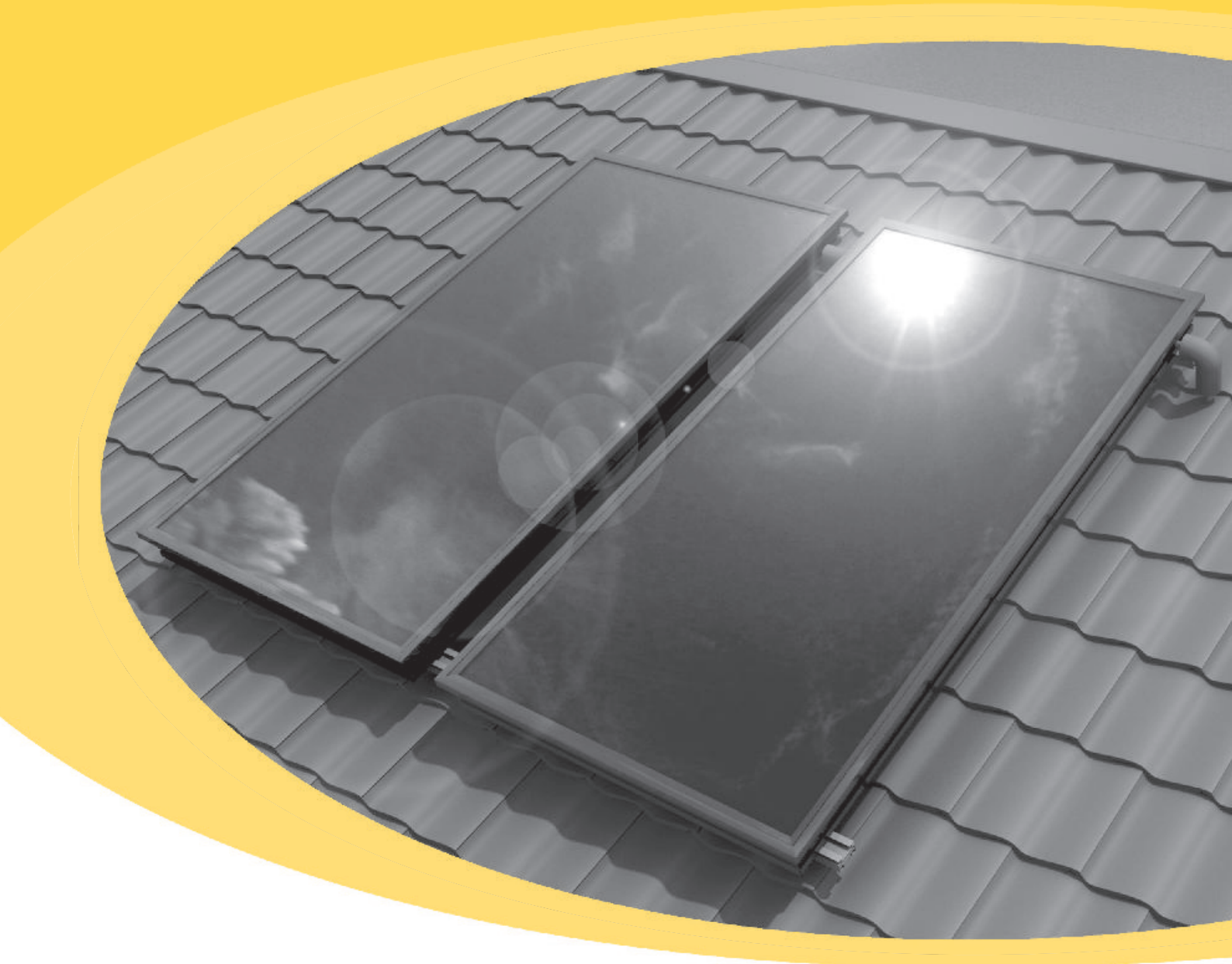
Solar Thermal

Solar Thermal Systems

On-Roof, Flat Roof and In-Roof Systems

Installation & User Guide



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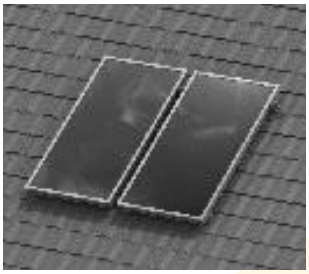
Part No. DOC 73. Rev. 01 August 2008

GRANT

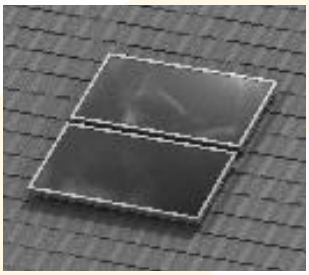
EFFICIENT HEATING SOLUTIONS

System Options

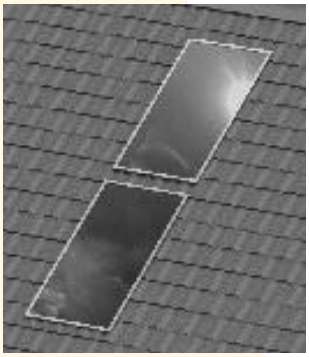
On-Roof



Portrait (side by side)



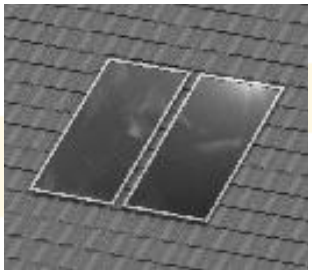
Landscape (one above other)



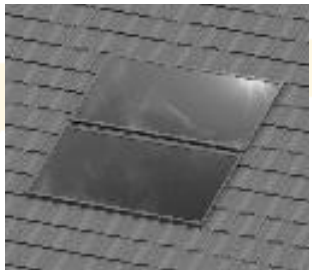
Portrait (one above other)

Flat Roof

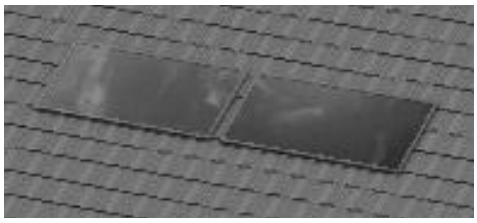
In-Roof



Portrait (side by side)

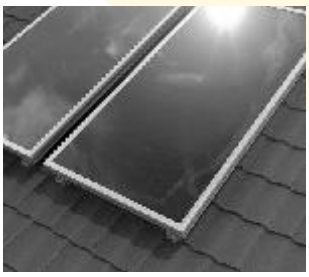


Landscape (one above other)



Landscape (side by side)

Grant solar collectors are slender in appearance and are extremely durable with an extruded Aluminium frame and 4mm thick low iron glass.



Grant Aurora
with high quality Silver finish anodized frame, this contemporary look is a stylish feature to accentuate the property and looks great on dark roof coverings such as slate.

Grant Sahara
with a Bronze anodized frame, this blends with most domestic roof types, providing an aesthetically pleasing appearance.

Contents

Installation Guide

1 General

The following information is a step-by-step guide to the installation and operation of the Grant Solar Thermal system.

1.1 Product Description

The Grant Solar Thermal system uses flat plate solar collectors that can be fitted in either a 'portrait' or 'landscape' configuration and offers three different mounting methods – 'On-roof', 'In-roof' and 'Flat-roof'.

The 'On-roof' and 'In-roof' mounting kits are designed for use on roof slopes of between 20° and 65° and must be installed in accordance with these instructions.

The 'Flat-roof' mounting kit can be used on any flat surface capable of carrying the weight of the collectors and any dead weighting used.

In-Roof Systems only:
A waterproof membrane must be used on all roofs. On older roofs the sarking felt is acceptable but if this is not present, then a breathable waterproof membrane must be fitted and it should end at the eaves (roof guttering).

Short term damp can occur beneath the roof covering (tiles or slates) on roof slopes of less than 20° or greater than 65°, or where there are long rafters or joined roofs, as a result of extreme weather conditions (e.g. driving rain, snow covering or ice formation). This can be avoided by using additional wedge section sealing strips. However, adequate ventilation of the roof must still be provided.

Installation kits for 'On-roof' installations are supplied with roof anchors to suit the type of roof covering concerned – i.e. profile tiles, flat tiles or slates. This must be specified when the kit is ordered. Before commencing installation check that the roof anchors supplied are correct for the roof type. If the height of profile tiles is particularly high a special adjustable height roof anchor is available. Contact Grant for details.

If necessary, the installation can be modified to suit the site conditions. However, any changes must be approved by Grant and must meet Building Regulations, codes of practice, and any relevant local bylaws and regulations in force at the time. Failure to comply with this will invalidate the product warranty.

1.2 Package Contents

Solar collectors, fixing components and other system accessories must be handled with care during storage and transport. If the packaging is damaged during transit this must be immediately reported to the supplier/delivery driver.

Before starting installation check the kit supplied contains all the required components. Refer to Section 2.1.

All packing materials must be disposed of appropriately after installation.

1.3 Format of installation instructions

These instructions describe the installation of collectors in both the 'portrait' and 'landscape' format using all three mounting types – 'On-roof', 'Flat roof' and 'In-roof'. This is covered in Sections 4, 5 and 6 respectively.

The actual fitting of the collectors and the connection to the hydraulic solar circuit is identical for all the above mentioned mounting options, and is covered in Sections 7 and 8 respectively.

1.4 Safety Instructions and Symbols

When installing the system, take note of the safety instructions in this document. The symbols used in the text are explained below:

Caution:
This symbol draws attention to a potential hazard!

Note:
This symbol indicates useful information or a general note.

1.5 Safekeeping of the Installation Instructions

These Installation & User Instructions must be handed over to the householder on completion of the installation. They should be kept for future reference as necessary.

1.6 Installation

Installation must be carried out by a competent installer in compliance with all current local planning requirements, Building Regulations, codes of practice, Health and safety legislation, and any relevant local bylaws and regulations in force at the time.

All electrical installation work must be carried out by a qualified electrician. All wiring and earth bonding must comply with current IEE wiring regulations.

In-roof and On-roof installations only:
When installed, both the In-roof and On-roof systems can experience uplift due to the wind. When installing either system ensure that the collectors are installed no less that THREE tiles from any roof edge.

Important:
All system pipe connections must use compression fittings with brass olives. Soft soldered joints must NOT be used on the solar primary circuit.

Plastic pipe must NOT be used for any part of the solar primary circuit.

All internal solar primary system pipework should be insulated using suitable high temperature resistant pipe insulation.

1.7 Equipment and Materials to be provided

General:

- Heat conducting paste - for temperature sensors (optional)

On-roof Installation:

- 2 'Grant' lead flashings or 2 'Solardek' flashings or 2 vent tiles (see Section 9)
- Fixing screws for fixing battens/roof anchors

Flat roof installation:

If the supporting frame is secured by weights rather than being screwed down, the weights must conform to the following specifications for a wind pressure zone up to 8 m building height and a snow load zone up to 0.75 kN/m^2 (*Table 1*).

Table 1: Dead Weight Requirements

Flat Roof installation	Up to 8m
1 solar collector	290 kg
2 solar collectors	580 kg
3 solar collectors	870 kg
4 solar collectors	1160 kg
5 solar collectors	1450 kg

As weights, lawn edge stones can be used, for example.

Permissible roof load must not be exceeded under any circumstances, and if necessary a structural engineer must be consulted beforehand. If the substructure has been penetrated, it must be carefully re-sealed in accordance with technical standards.

In-roof Installation:

- Fixing screws for mounting battens

1.8 Tools Required

On-roof and Flat roof installations:

- Screwdriver (6mm hexagon socket)
- Pencil
- Tape measure or folding rule
- 17/19mm open-jaw spanners (x2)
- 13mm open-jaw spanner
- Screwdrivers (standard and cross-head)
- Electric screwdriver/drill

In-roof installation:

- Pencil
- Tape measure or folding rule
- 2 open-jaw spanners 17/19mm
- 1 open-jaw spanner 13/14mm
- Screwdrivers (standard and cross-head, sizes 2 and 3)
- Socket wrench with T-handle, size 6
- Electric screwdriver with socket bit for sealing screw (8mm hexagon)
- Hammer
- Solar collector carrying handles
- Torx T25 screwdriver

Commissioning:

- Filling station
- Pressure gauge
- Screwdriver (flat bladed)

1 General

1.9 Standards and Approvals

Grant flat plate solar collectors conform to the requirements of BS EN 12975 Thermal solar systems and components – Solar collectors, and have the 'Solar Keymark' approval.

2 Package Contents

2.1 Standard Installation Kits

For 'On-roof and 'Flat roof' Installations (in portrait format)

Table 2: Installation Kit Contents

Article	Standard 1 Collector Kit	Standard 2 Collector Kit	Standard 3 Collector Kit	Standard 4 Collector Kit	Standard 5 Collector Kit
Mounting rail	extension kit only	2	2 (plus extension kit)	4	4 (plus extension kit)
Mounting hook	2	4	6	8	10
Cylinder bolt	4	8	12	16	20
Fixing bracket	4	8	12	16	20
Anchor block	4	8	12	16	20
Installation and operating instructions	1	1	1	1	1
On-Roof installation					
Roof anchor*	4	6	8	10	12
Flat Roof installation					
Flat roof angle frame	2	3	3	4	5
Securing cruciform kit	1	1	1	1	1

* Roof anchor - to suit type of roof covering (see pages 14 to 17)
- Slate
- Flat tile
- Profile tile

3 Dimensions & Fixing Intervals

3.1 On-roof Installation

Position of Roof Anchors and Mounting Rails

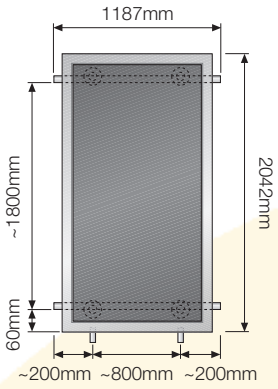


Figure 1: 1 collector (portrait)

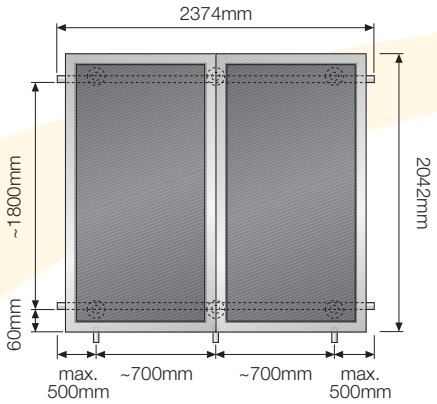


Figure 2: 2 collectors (portrait)

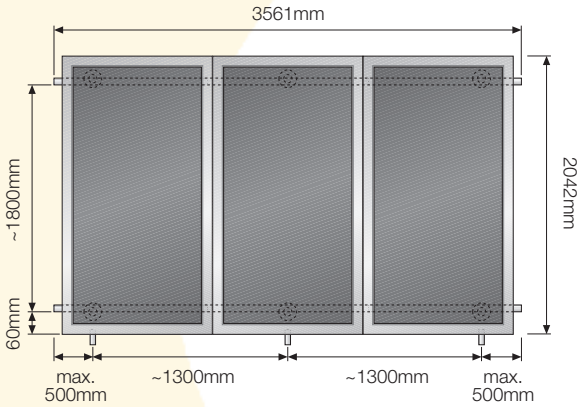


Figure 3: 3 collectors (portrait)

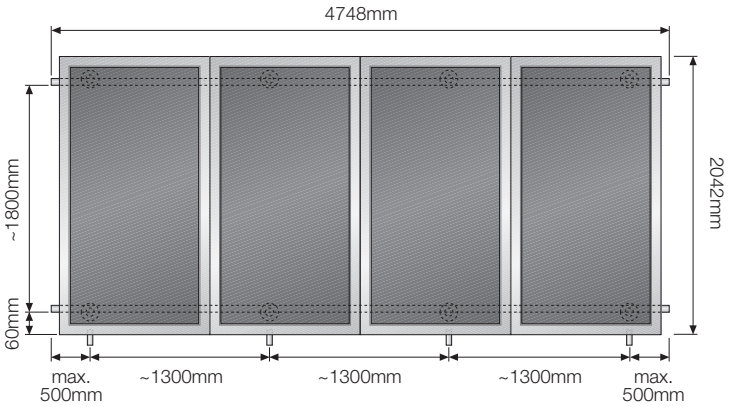


Figure 4: 4 collectors (portrait)

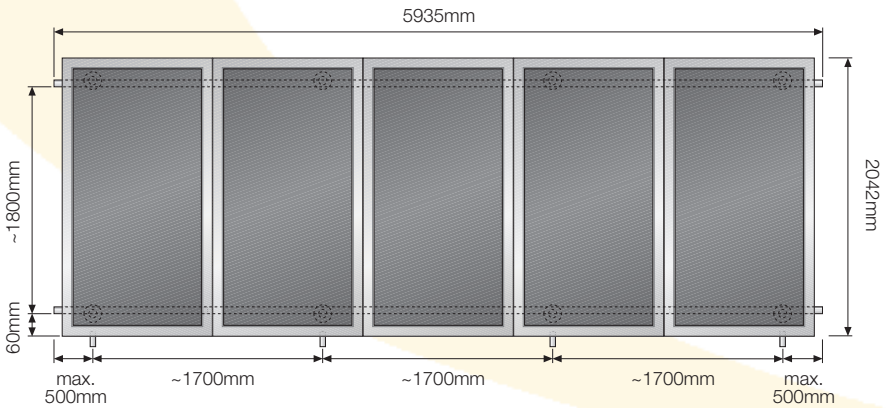


Figure 5: 5 collectors (portrait)

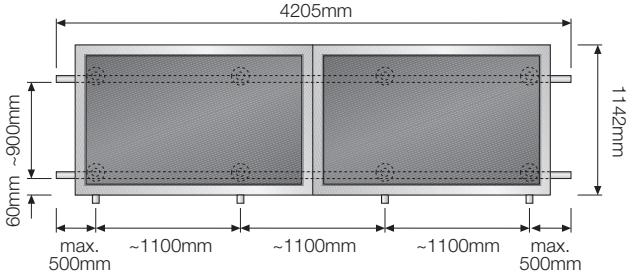


Figure 6: 2 collectors (landscape)

3.2 Flat-roof Installation

Position of Roof Anchors and Mounting Rails

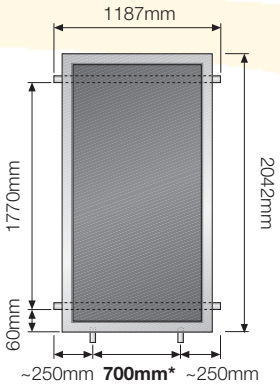


Figure 7: 1 collector (portrait)

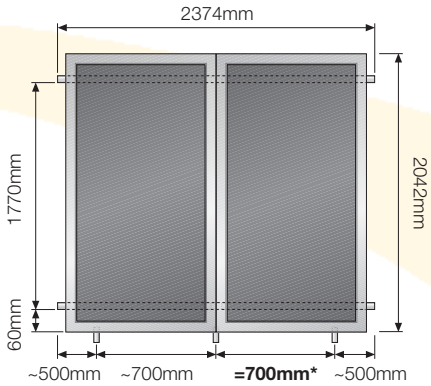


Figure 8: 2 collectors (portrait)

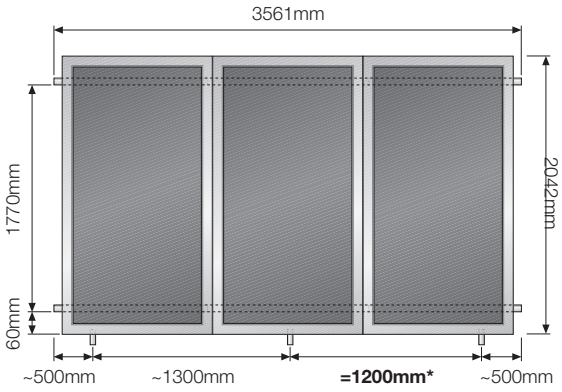


Figure 9: 3 collectors (portrait)

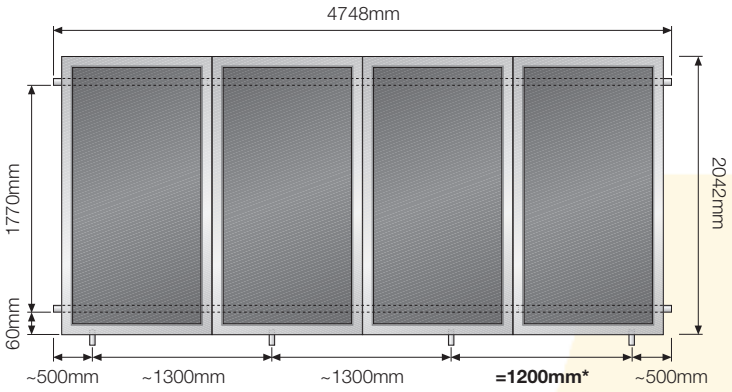


Figure 10: 4 collectors (portrait)

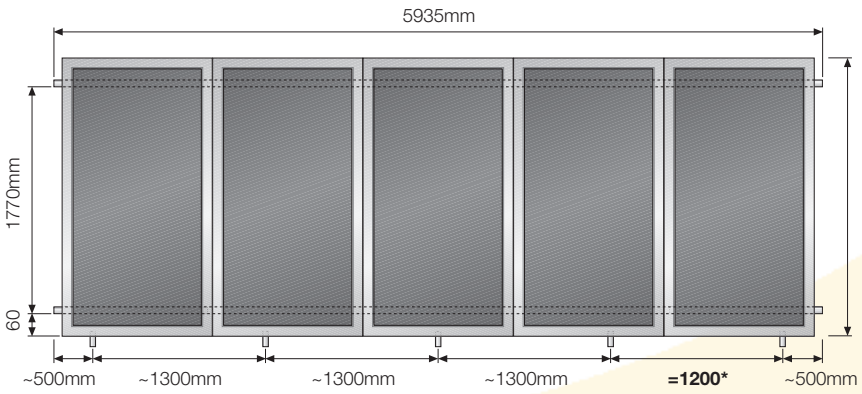
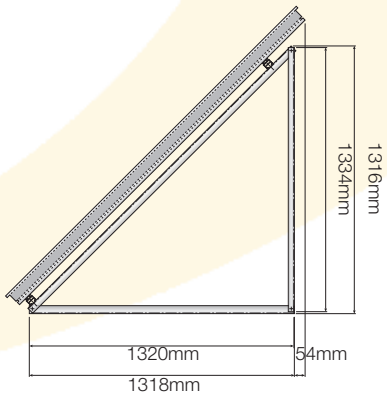


Figure 11: 5 collectors (portrait)



* This is a fixed dimension and must be as shown above

3 Dimensions & Fixing Intervals

3.3 In-Roof System Installation

Position of Mounting Rails

1-5 Solar Collectors, Vertical, Side by Side

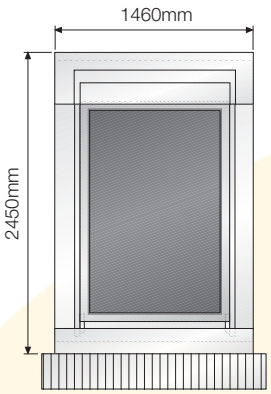


Figure 12: 1 collector (portrait)

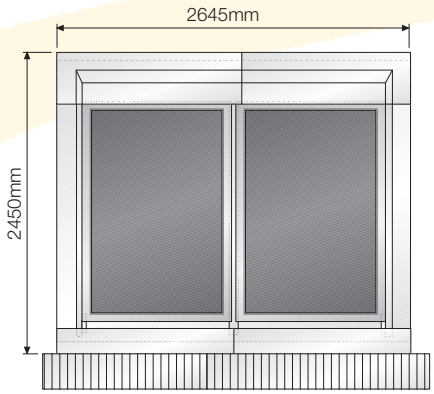


Figure 13: 2 collectors (portrait)

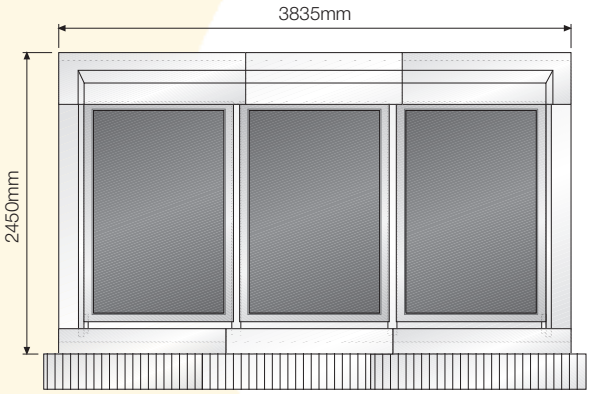


Figure 14: 3 collectors (portrait)

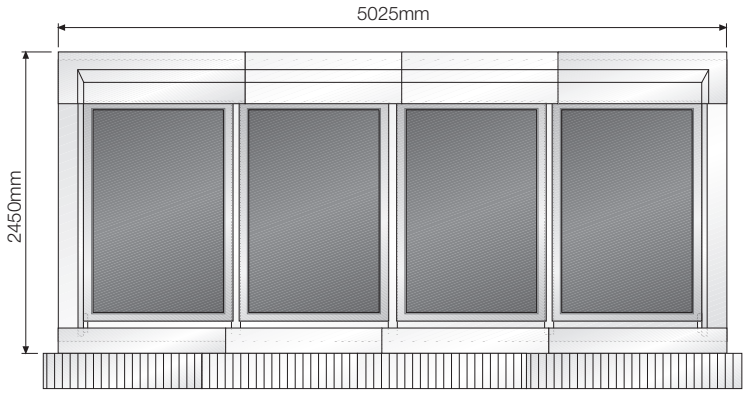


Figure 15: 4 collectors (portrait)

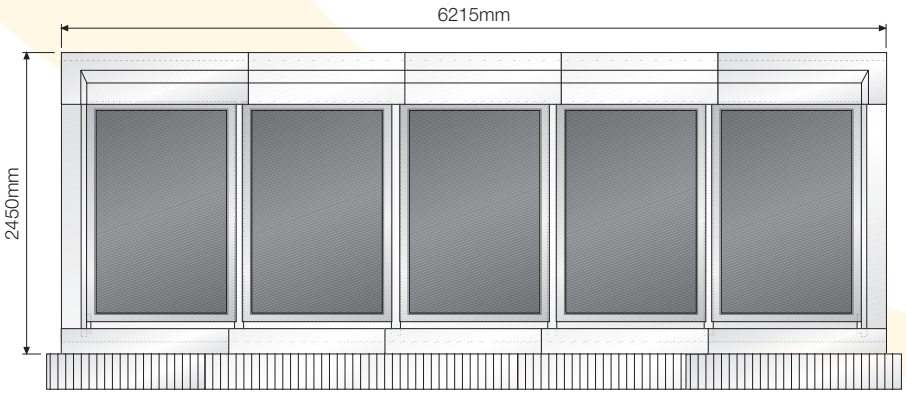


Figure 16: 5 collectors (portrait)

Note: Dimensions include cover frame

3.3 In-Roof System Installation

Position of Mounting Rails

1-5 Solar Collectors, Horizontal, Side by Side

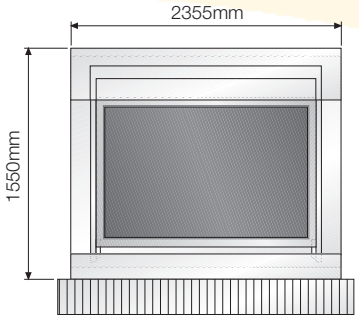


Figure 17: 1 collector (landscape)

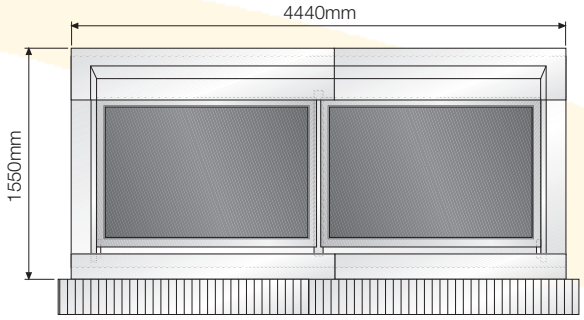


Figure 18: 2 collectors (landscape)

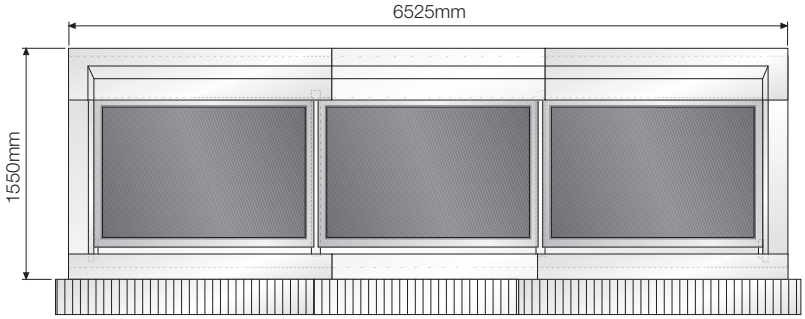


Figure 19: 3 collectors (landscape)

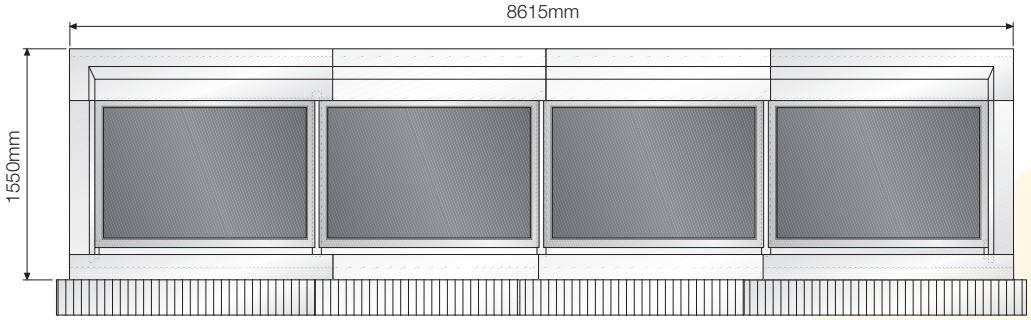


Figure 20: 4 collectors (landscape)

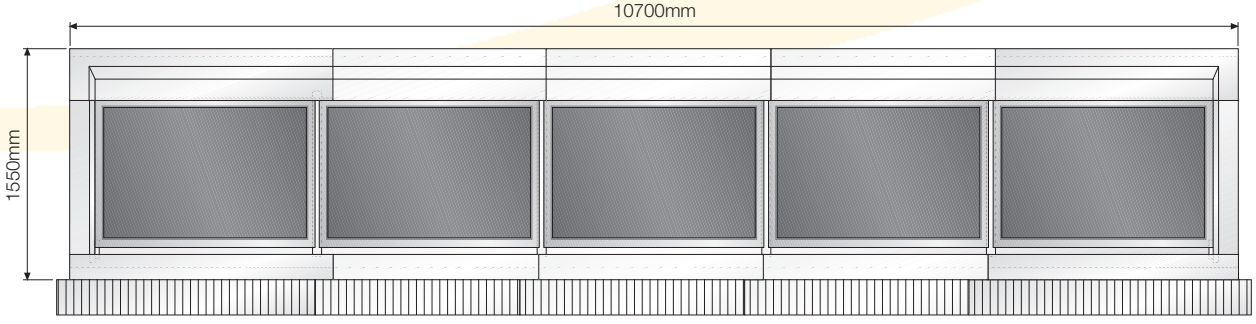
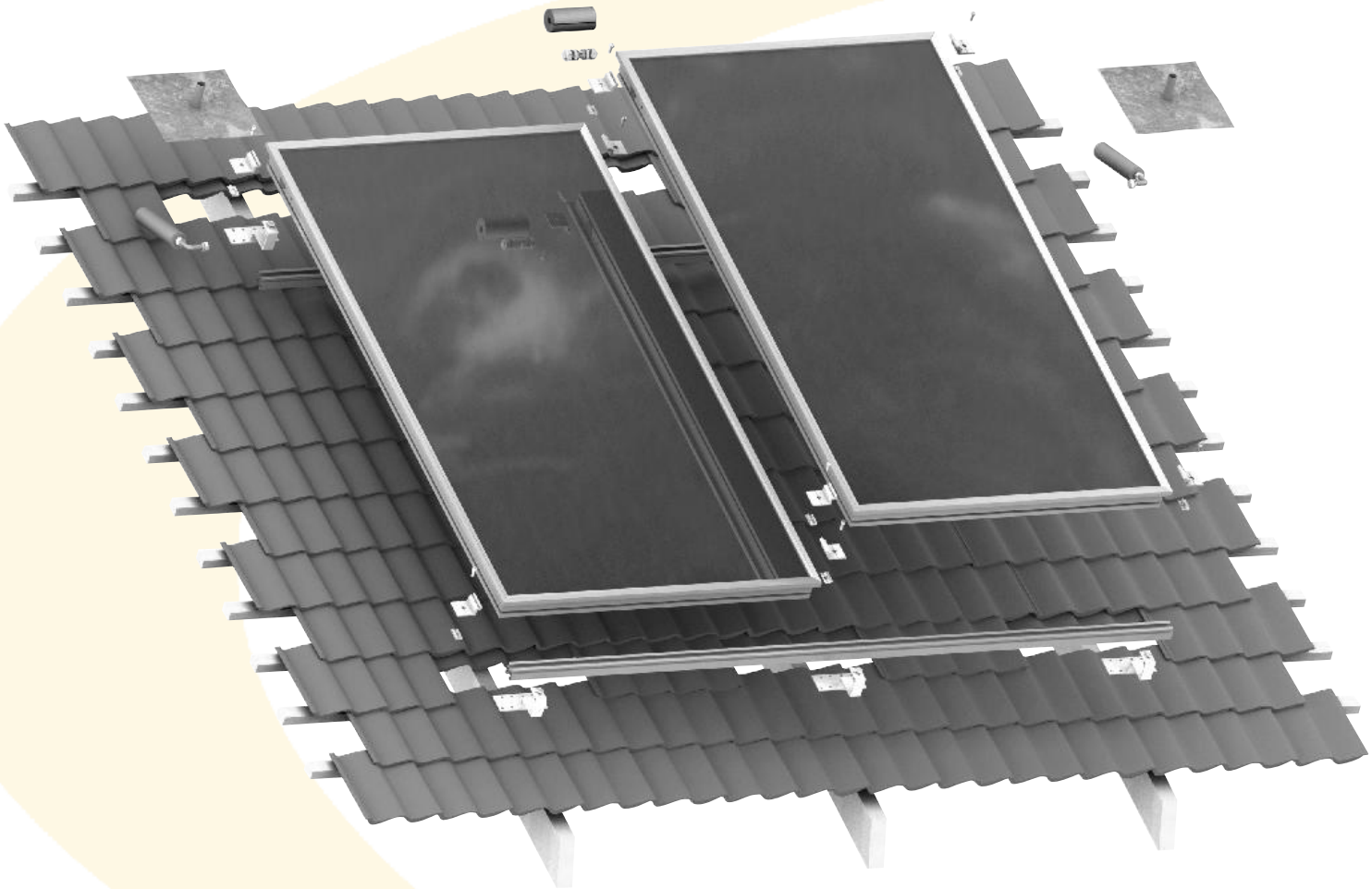


Figure 21: 5 collectors (landscape)

Note: Dimensions include cover frame

4 On-Roof System Installation

See Section 9 for details of roof penetrations.



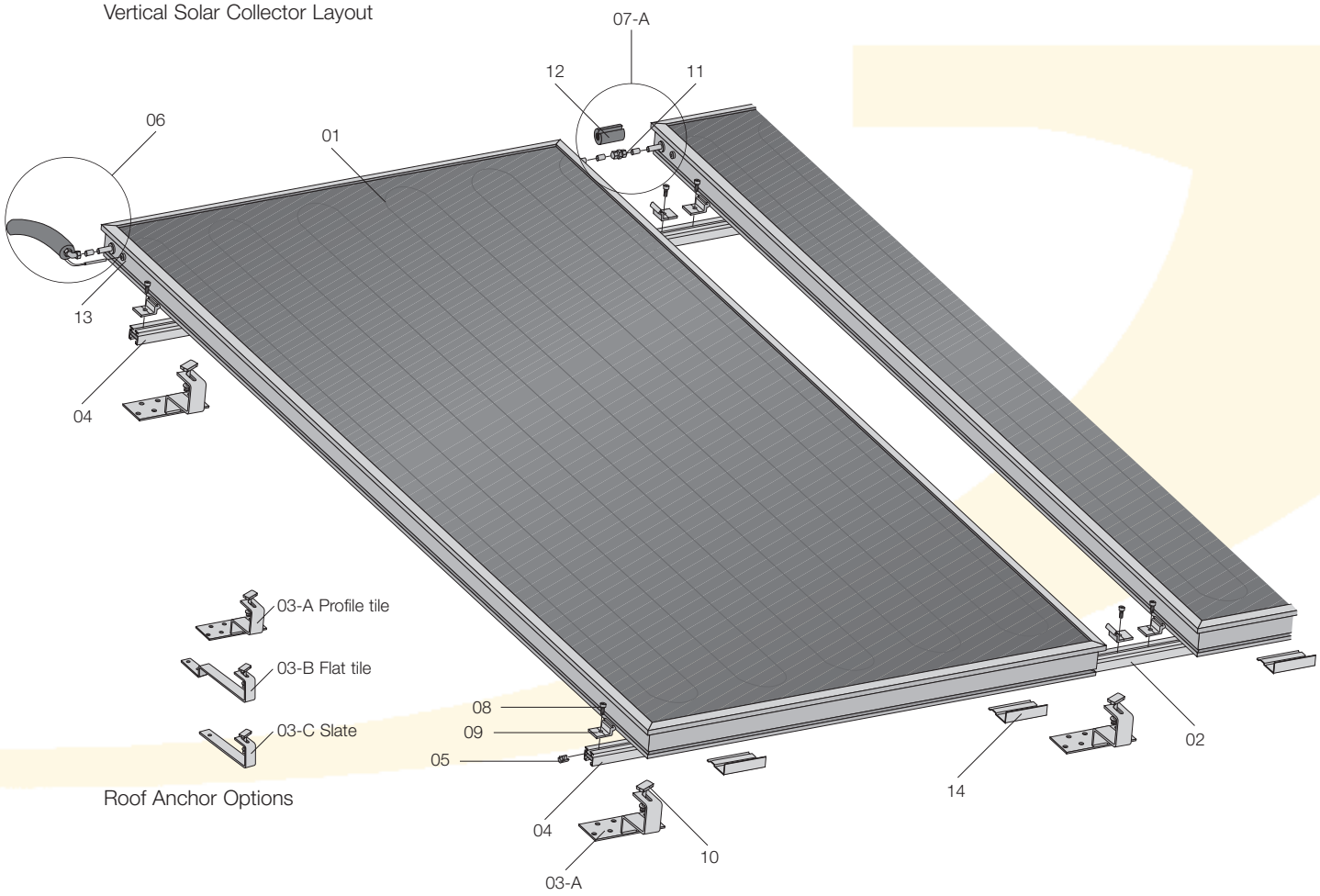
4.1 Installation Summary

The standard installation kit allows solar collectors to be fitted vertically onto horizontal mounting rails.

Mounting rails are fixed to the roof structure using the appropriate type of roof anchors for the roof covering - e.g. slates, flat tiles or profile tiles.

Item	Description
01	Collector
02	Mounting rail set
03	Roof Anchors -A profile tile B flat tile C slate roof
04	Rail profile
05	Anchor block
06	Collector connection kit
07	Collector to Collector connection kit
08	Cylinder anchor bolt
09	Fixing Bracket
10	Interlocking bolt
11	Hydraulic connection
12	Insulation
13	Temperature sensor
14	Mounting hooks

Figure 22: Installation Summary, Vertical Solar Collector Layout



Roof Anchor Options

4 On-Roof System Installation

4.2 Profile Tile

Roof Anchors fixed to Rafters

1. For profile concrete tiles, these roof anchors are attached directly to the roof rafters (rafter-mounted installation).

   Caution:
   Never attach safety harness to the installation system!

2. Expose the installation area above the rafters. For roof anchor intervals, see Page 8, 3.1 On-Roof System installation.

   Note:
   As a rule, pushing up the roof tiles is sufficient. Horizontal positioning of roof anchors is dependent on the rafters and the tile valleys.

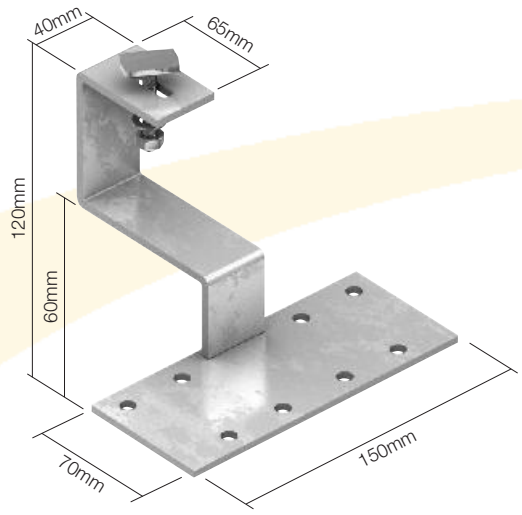


Figure 23: Dimensions of Roof Anchor A

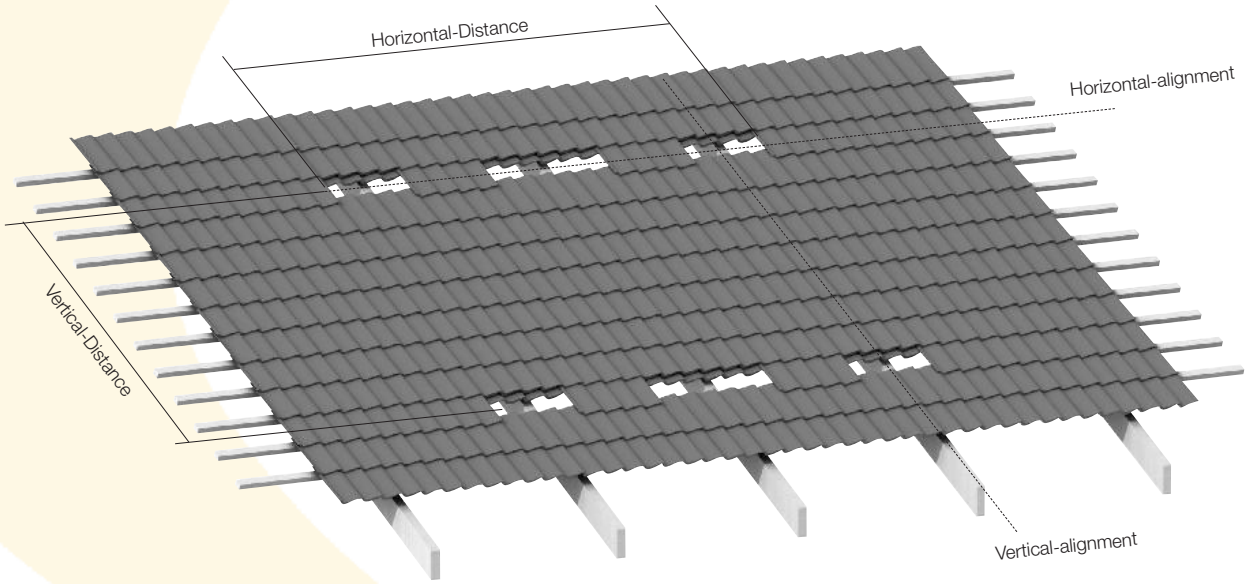


Figure 24: Horizontal and Vertical Alignment

3. Place roof anchor (03-A) in line with the top edge of the roof tile in the tile valley. Fix the base plate of the roof anchor to the rafter with screws (16).

4. Fix all further roof anchors in the same way. For roof anchor intervals, see Page 8, 3.1 On-Roof System installation.

   Note:
   Roof anchors must be horizontally and vertically aligned (follow roof tile valleys).

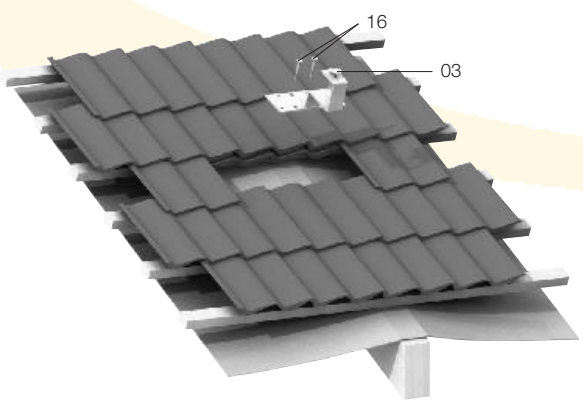


Figure 25: Installation of Roof Anchors A

4.3 Flat Tile

Roof Anchors fixed to Rafters

1. For flat concrete tiles, these roof anchors are attached directly to the roof rafters (rafter-mounted installation).

   Caution:
   Never attach safety harness to the installation system!

2. Expose the area above the rafters. For roof anchor intervals, see page 8, 3.1 On-Roof System.

   Note:
   As a rule, pushing up the roof tiles is sufficient. Horizontal positioning of roof anchors is dependent on the rafters and the tile valleys.

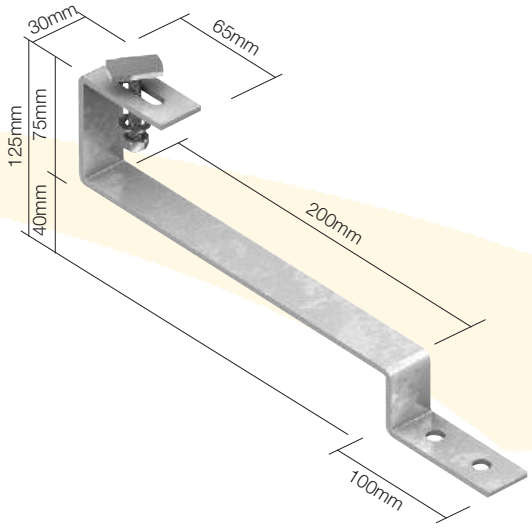


Figure 26: Dimensions of Roof Anchor B

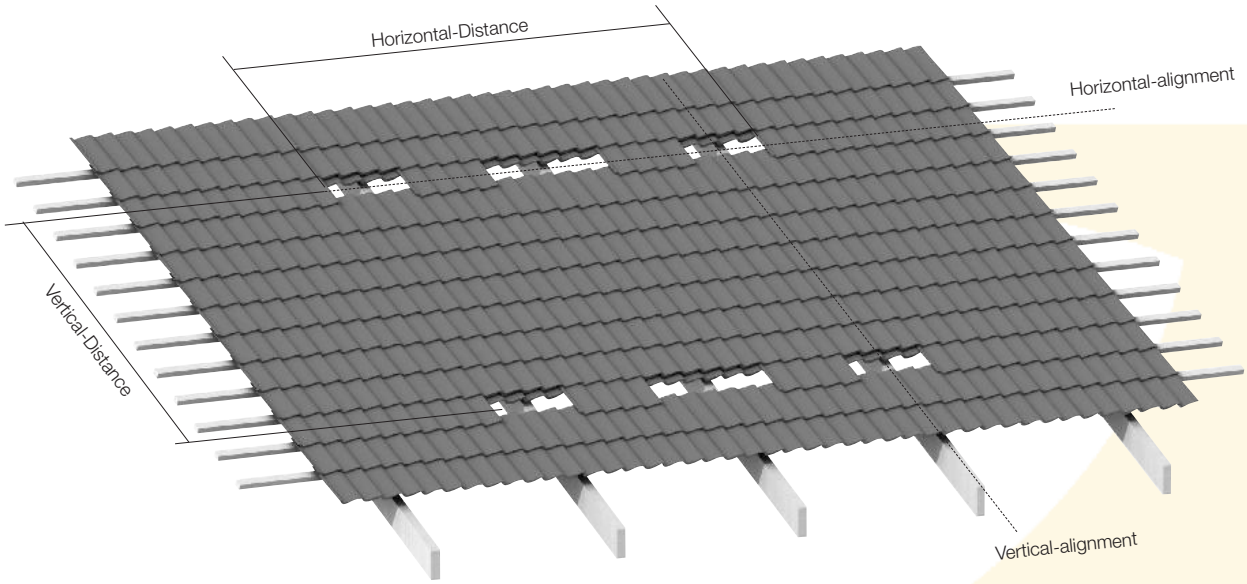


Figure 27: Horizontal and Vertical Alignment

3. Place roof anchor (03-B) in line with the top edge of the roof tile. Fix the roof anchor to the rafter with screws (16).
4. Fix all further roof anchors in the same way. For roof anchor intervals, see Page 8, 3.1 On-Roof System installation.

   Note:
   Roof anchors must be horizontally and vertically aligned (follow roof tile valleys).

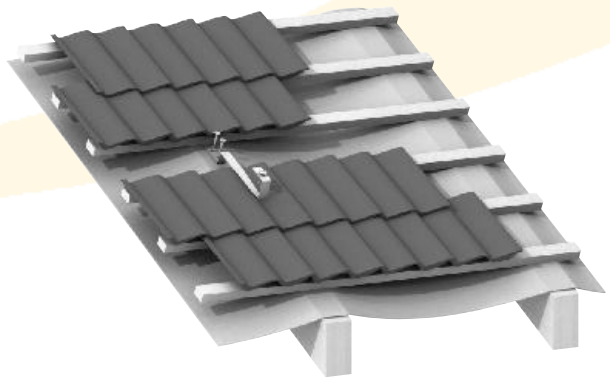


Figure 28: Fixing Mounting Battens and Roof Anchors

4 On-Roof System Installation

4.4 Slate Tile

Roof Anchors fixed to Rafters

1. On slate roofs, additional mounting battens are fixed to the roof substructure. Roof anchors 'C' are fixed through the slate tiles to the mounting batten (batten-mounted installation).

   Caution:
   Never attach safety harness to the installation system!

2. Expose the area required for installation (length of mounting batten). For roof anchor intervals, see Page 8, 3.1 On-Roof System installation.

   Note:
   As a rule, pushing up the roof slates is sufficient. Horizontal positioning of roof anchors is dependent on the rafters and the tile valleys.

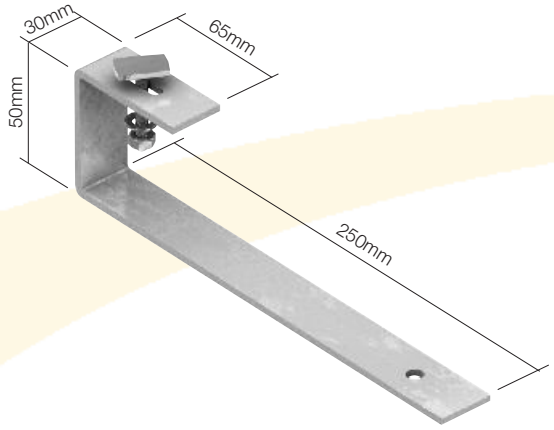


Figure 29: Horizontal and Vertical Alignment

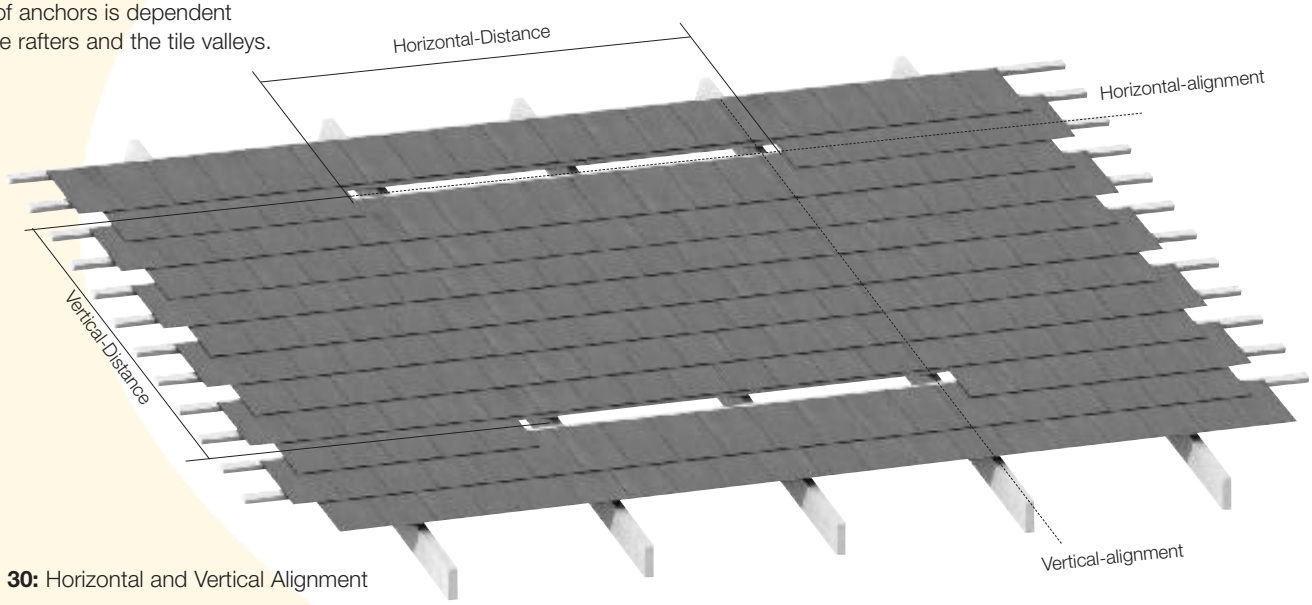


Figure 30: Horizontal and Vertical Alignment

3. Mounting battens (18) are fixed with screws to the rafters at a distance of 185mm from the roof batten below.

   Note:
   The distance of 185mm is dependent on the roof anchor and type of roofing and must be modified if necessary.

4. Place the roof anchor (17) on to the slate tile and mounting battens and fix with screws (16).

5. Fix all further roof anchors in the same way. For roof anchor intervals, see Page 8, 3.1 On-Roof System installation.

   Note:
   Roof anchors must be horizontally and vertically aligned.

Note:
If roof is fully sarked (timber boards) then mounting anchors should be screwed through sarking into the rafters below.

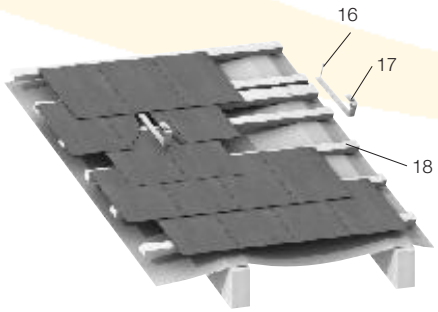


Figure 31: Fixing Mounting Battens and Roof Anchors

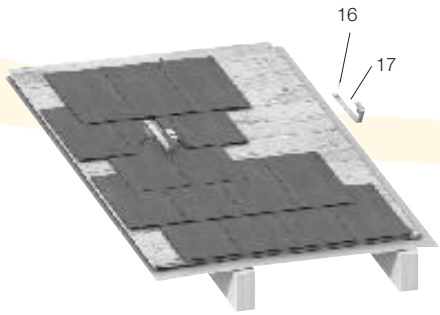


Figure 32: Fixing Mounting Battens and Roof Anchors through Sarking

4.5 Alignment and Fixing of Mounting Rails

1. Close the roof covering at the top and bottom.
2. Fix top mounting rail (04) to the roof anchor (03).

   Position the heads of interlocking bolts (10) parallel to the mounting rail (04) and place them on the mounting rail, push the interlocking bolts to the top in the roof anchor (03) and secure with a 90° turn. Tighten the nuts of the interlocking bolts (hand tight). Use serrated washers to secure the nuts.

   Install all further mounting rails in the same way.
3. Align the mounting rails horizontally and vertically so that the rails and the roof tiles are parallel. Diagonal dimensions between mounting rails must be equal:
   D1 = D2

   Tighten the nuts on the interlocking bolts.

   Installation of solar collectors:
   See pages 33 to 35.

4.6 Joining Mounting Rails

1. On some installations it may be necessary to join two or more sections of mounting rail to create a longer length of rail.
2. Join the sections of rail using the screws and fishplates (supplied in the fixing kit provided), as follows:

   Fit the fishplate into the rectangular opening at the end of the one section of mounting rail. Refer to Figure 36.

   Align the threaded hole in the fishplate with the hole in the rail (50mm from the rail end), fit the cylinder bolt provided and tighten to secure. Refer to Figure 37.

   Fit the exposed end of the fishplate into the rectangular opening of the second mounting rail. As before, align the threaded hole of the fish plate with the hole in the rail, fit the cylinder bolt and tighten to secure the second rail section to the first. Refer to Figure 38.

   Repeat this process for all other connections between mounting rail sections.

Now go to Section 7.

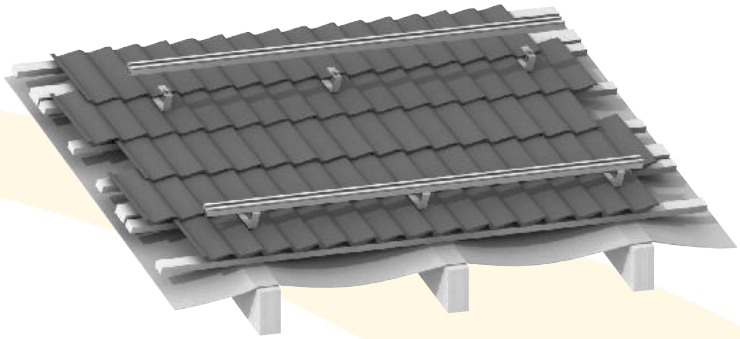


Figure 33: Roof Covering with Roof Anchors

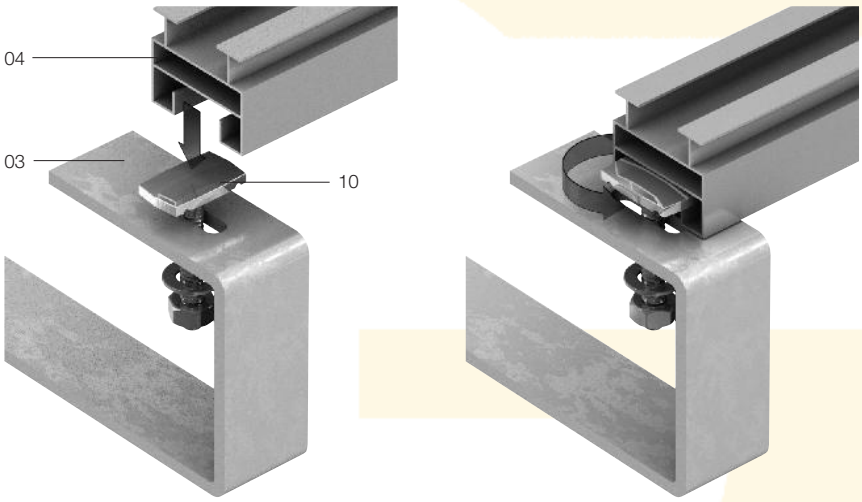


Figure 34: Fixing the Mounting Rail

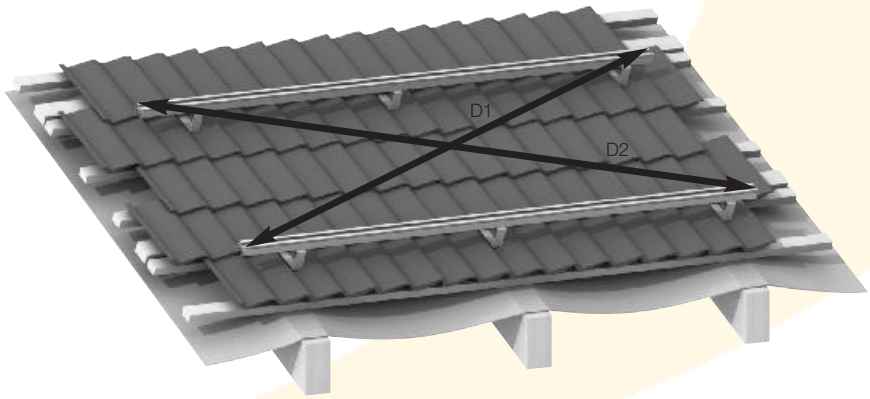


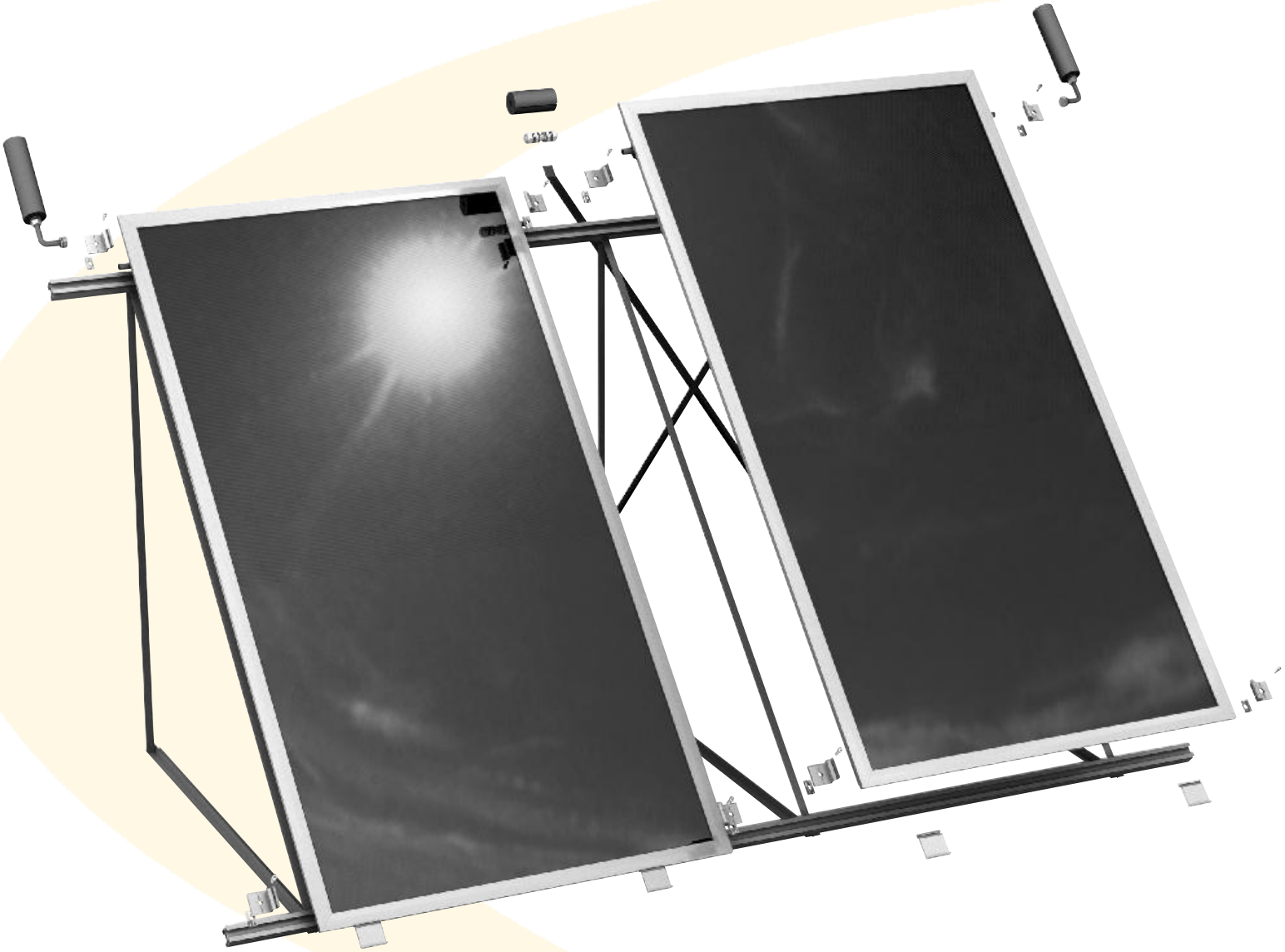
Figure 35: Aligning the Mounting Rail

Figure 36: Installing the Fishplate

Figure 37: Fixing the Fishplate

Figure 38: Joining Mounting Rails

5 Flat Roof System Installation

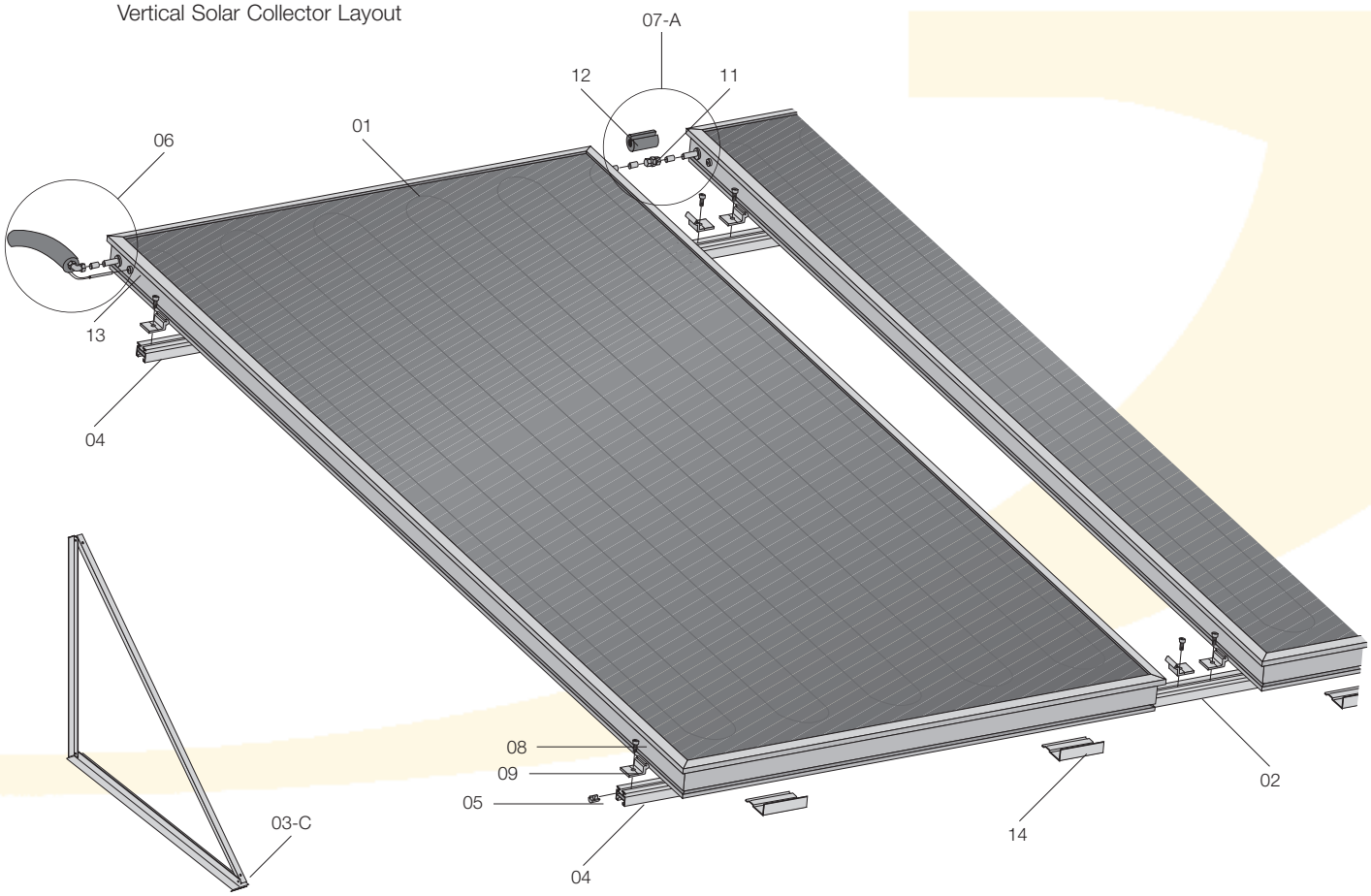


5.1 Installation Summary

The standard installation kit allows solar collectors to be fitted vertically onto horizontal mounting rails.

Item	Description
01	Collector
02	Mounting rail set
03	Roof Anchors -C to flat roof anchors
04	Rail profile
05	Anchor block
06	Collector connection kit
07	Collector to collector connection kit
08	Cylinder anchor bolt
09	Fixing Bracket
11	Hydraulic connection
12	Insulation
13	Temperature sensor
14	Mounting hooks
15	Cruciform

Figure 39: Installation Summary, Vertical Solar Collector Layout



5 Flat Roof System Installation

5.2 Flat Roof System Installation

1. Lay mounting rails on the installation surface with the wide groove uppermost. Mounting rail interval = 1770mm.

   Diagonal dimensions between mounting rails must be equal: D1 = D2

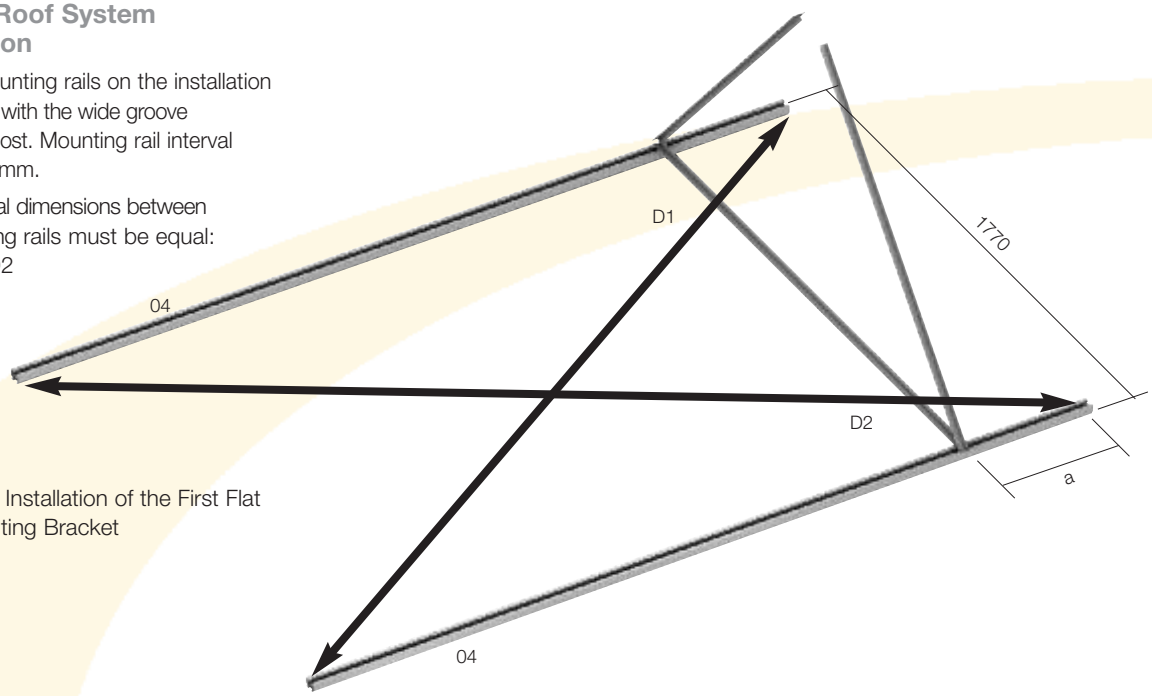


Figure 40: Installation of the First Flat Roof Mounting Bracket

2. Open out a prefabricated flat roof mounting bracket and place the long L-profile on the mounting rail so that the T-profile points backwards. For interval a, see Page 9, 3.2 Flat roof installation.
3. Fix the flat roof mounting bracket to the mounting rail using the interlocking bolts, serrated washers and nuts provided.

   Note:
   Interlocking bolts must be secured to the mounting rail using a 90° turn.
4. Place the next flat roof mounting bracket on the mounting rail and fix using the interlocking bolts. Do not tighten the bolts too tightly, as final adjustment may be required. For interval b, see Page 9, 3.2 Flat roof installation.

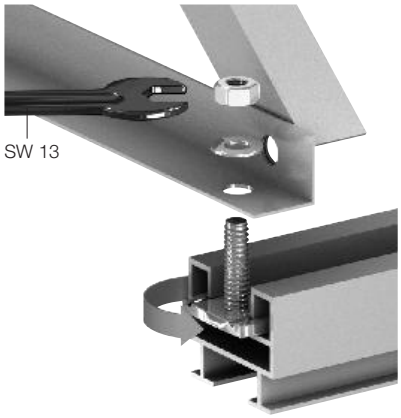
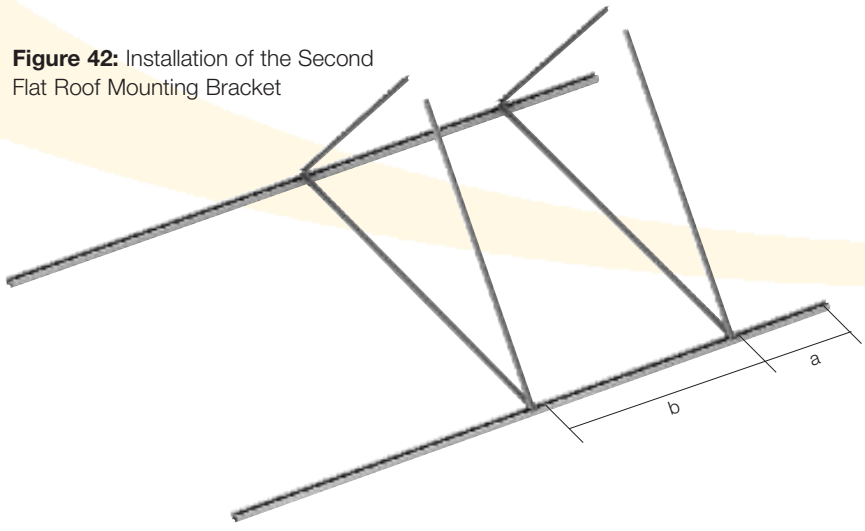


Figure 41: Fixing Using Interlocking Bolt

Figure 42: Installation of the Second Flat Roof Mounting Bracket



5. Unscrew securing cruciform (24). It is fixed to the legs of the flat roof mounting bracket and the mounting rail.

   Place the angled long ends of the securing cruciform between the flat roof mounting bracket and fix with bolts (M8x18), washers and nuts.

   Note:
   Always fit the stays of the securing cruciform to the right hand side of the flat roof mounting angles. See detail views (A and B).

6. Tighten the nuts on the interlocking bolts If necessary, modify the position of the second flat roof mounting bracket.

   Note:
   Use punching bolt (15) with offset screw tip for fixing to the mounting rail. Do not confuse with cylinder bolt (08)!

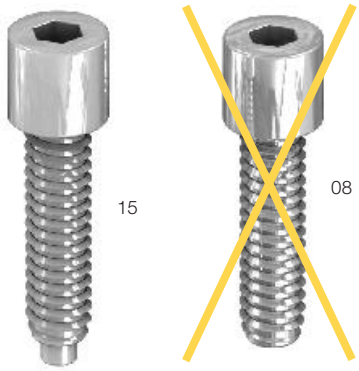


Figure 43: Punch bolt/cylinder bolt

7. Place an interlocking nut (23) in mounting rail (04) and secure it in the mounting rail by turning it 90°. Place a spacer sleeve (22) on the interlocking nut and fix the stays of the securing cruciform (24) using locking washer (21) and punching bolt (15).

   Tighten the punching bolt until a clear snap is heard. Continue to turn and tighten normally.

   Caution:
   Turning the punching screw fixes the securing cruciform into its final position; check distances and correct seating of the interlocking nuts beforehand.

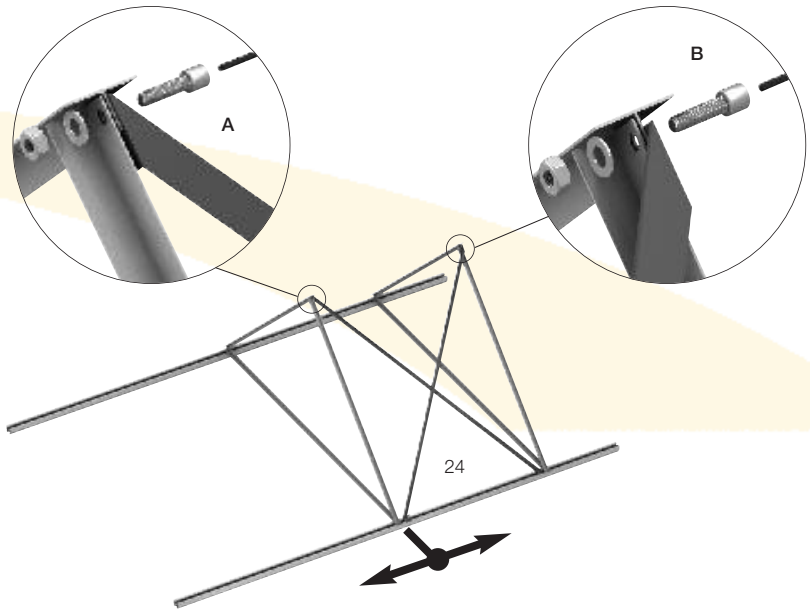


Figure 44: Installation of the Second Flat Roof Mounting Bracket

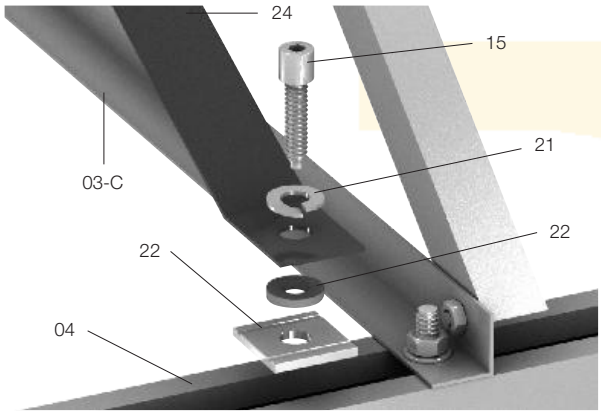


Figure 45: Fixing the Securing Cruciform and Mounting Rail

5.3 Joining Mounting Rails

1. On some installations it may be necessary to join two or more sections of mounting rail to create a longer length of rail.
2. Join the sections of rail using the screws and fishplates (supplied in the fixing kit provided). Refer to the procedure given in section 4.6 (on page 17).

5 Flat Roof System Installation

8. Fix all further flat roof mounting brackets to the mounting rails in accordance with steps 2-4, and fix the legs tightly using cylinder bolts M8x18mm.

   For mounting bracket intervals see Page 9, 3.2 Flat roof installation.

9. Place the flat roof mounting frame together with the T-profiles, align according to plan and make the structure robust.

   To prevent damage to the roof covering, it may be necessary to use protective mats. If the flat roof mounting frame is not bolted to the building structure, it must be secured according to technical requirements.

   Caution:
   The flat roof mounting frame must be adequately weighted down or bolted. If the supporting frame is secured by weights rather than being screwed down, the weights must conform to the following specifications for a wind pressure zone up to 8 m building height and a snow load zone up to 0.75 kN/m², according to the table.

Permissible roof load must not be exceeded under any circumstances, and if necessary a structural engineer must be consulted beforehand. If the substructure has been penetrated, it must be carefully re-sealed in accordance with technical standards.

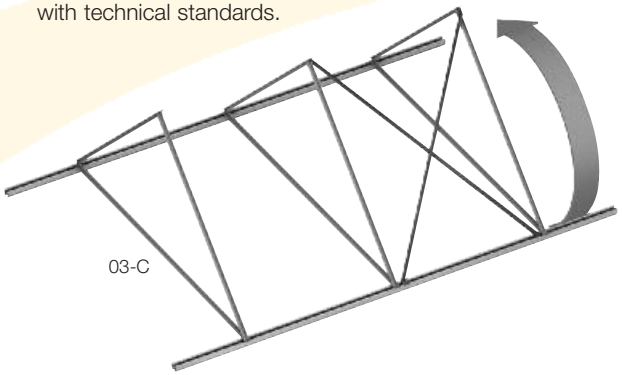


Figure 46: Fixing Additional Flat Roof Mounting Brackets

Table 3: Dead Weight Requirements

Flat roof installation	Up to 8m
1 solar collector	290 kg
2 solar collectors	580 kg
3 solar collectors	870 kg
4 solar collectors	1,160 kg
5 solar collectors	1,450 kg

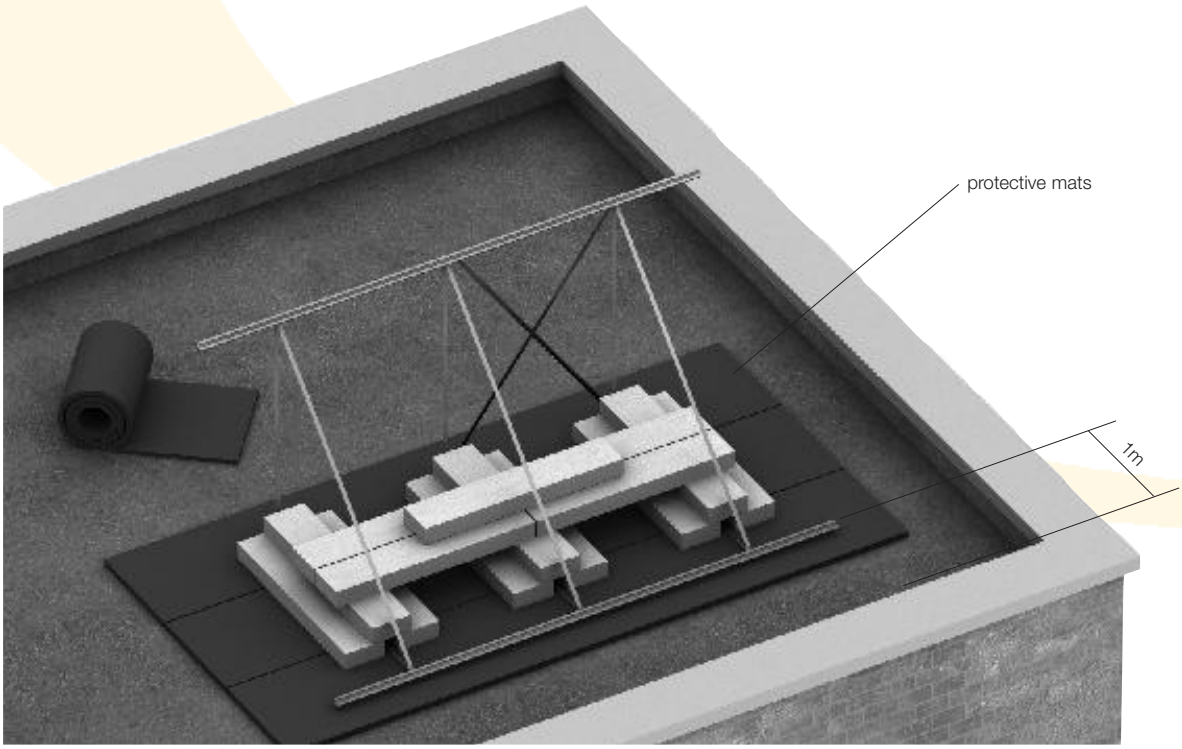
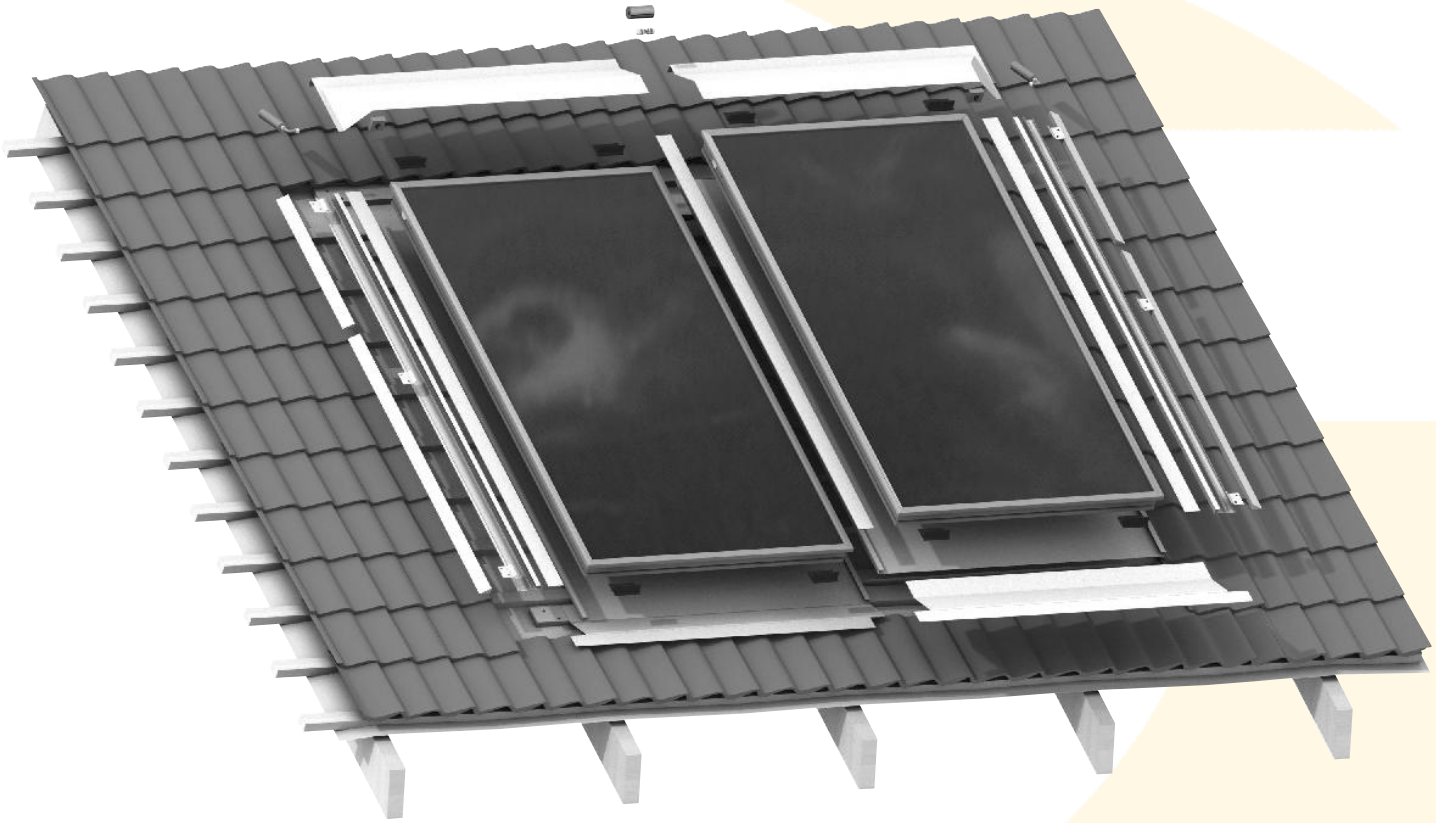


Figure 47: Robustness (Weighting)

Now go to Section 7.

6 In-Roof System Installation



6 In-Roof System Installation

6.1 Installation Summary

The In-Roof installation kit allows the solar collectors to be fitted into the roof covering (tiles or slates) either horizontally or vertically.

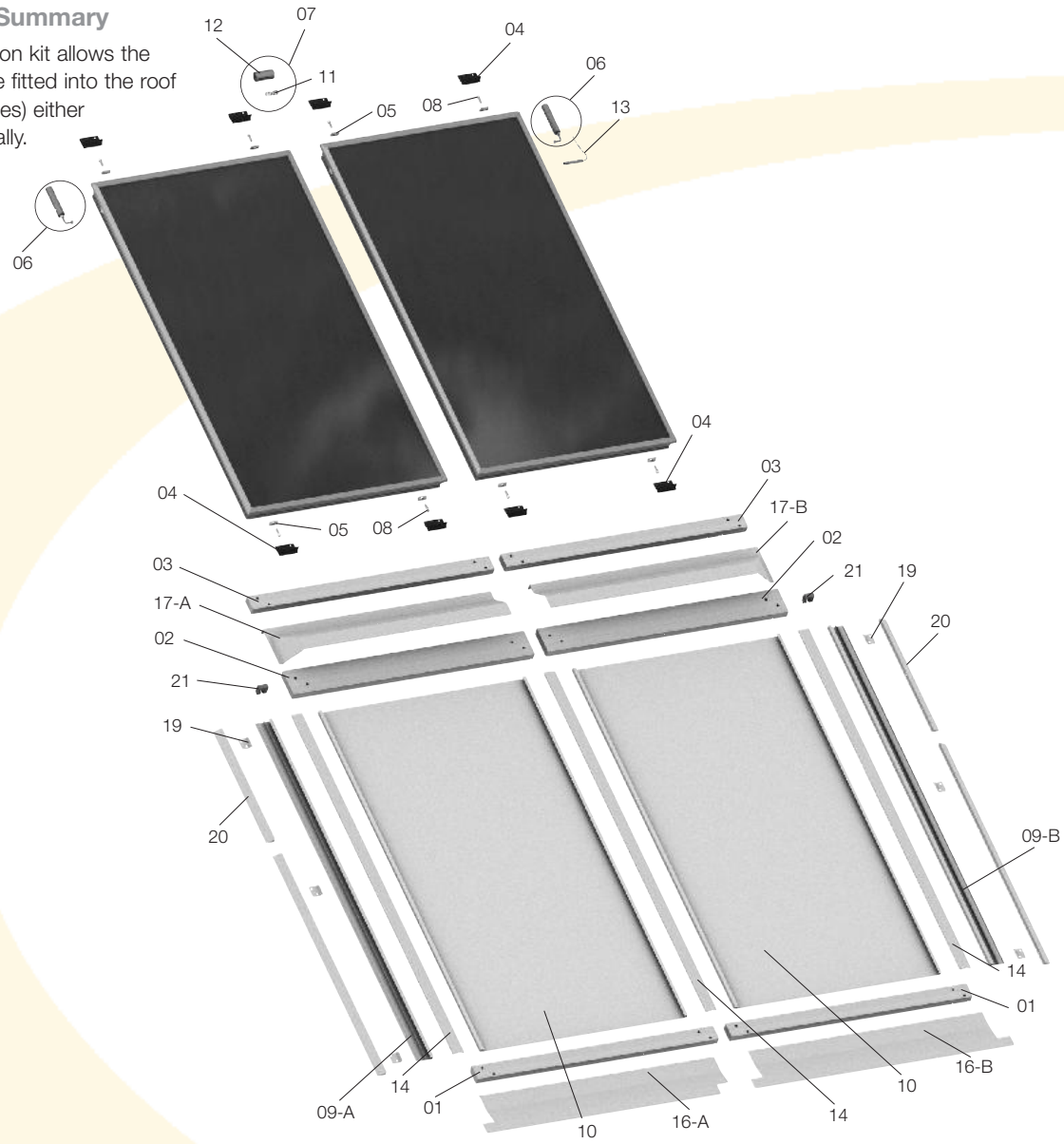


Figure 48: Installation Summary Vertical Collector Installation

Item	Description
01	Bottom batten - 2 off (30 x 50 x 1400mm)
02	Middle batten - 2 off (30 x 90 x 2835mm)
03	Top batten - 2 off (30 x 50 x 1400mm)
04	Mounting bracket
05	Anchor block
06	Collector connection kit
07	Collector to collector connection kit (portrait collectors only)

Item	Description
08	Cylinder anchor bolt
09	Side gutter - A Left hand B Right hand
10	Base tray
11	Hydraulic connection
12	Insulation
13	Temperature sensor
14	Cover strip
15	Bottom flashing - A Left hand (for slates) B Right hand

Item	Description
16	Bottom apron - A Left hand flashing (for tiles) B Right hand
17	Top cover - A Left hand flashing B Right hand
18	Fixing screw - not shown
19	Clip (with nail – not shown)
20	Foam draught seal wedge
21	Foam draught seal block

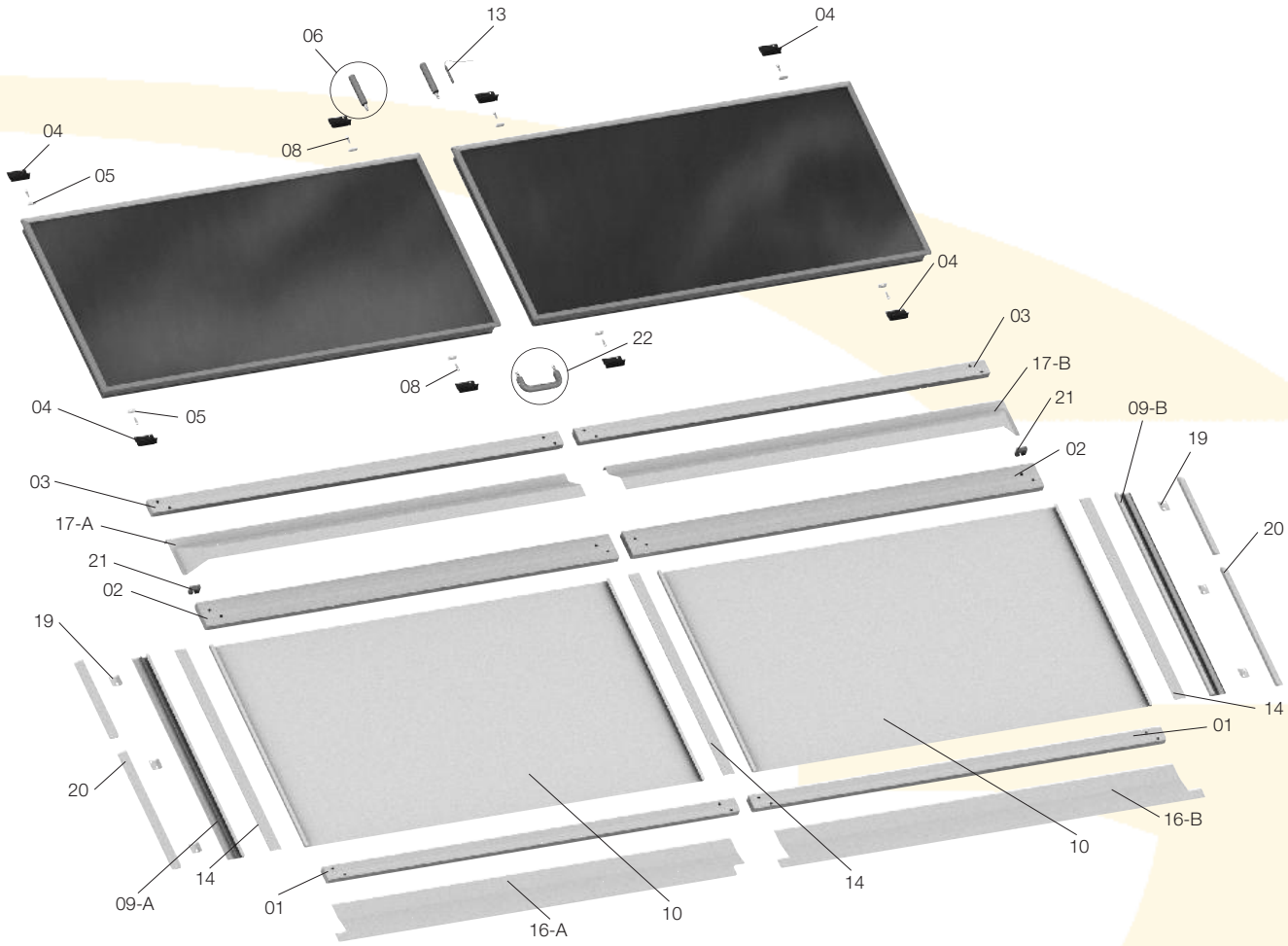


Figure 49: Installation Summary
Landscape Collector Installation

Item	Description
01	Bottom batten - 2 off (30 x 50 x 1400mm)
02	Middle batten - 2 off (30 x 90 x 2835mm)
03	Top batten - 2 off (30 x 50 x 1400mm)
04	Mounting bracket
05	Anchor block
06	Collector connection kit

Item	Description
08	Cylinder anchor bolt
09	Side gutter - A Left hand B Right hand
10	Base tray
11	Hydraulic connection
12	Insulation
13	Temperature sensor
14	Cover strip
15	Bottom flashing - not shown (for slates) A Left hand B Right hand

Item	Description
16	Bottom apron flashing (for tiles) - A Left hand B Right hand
17	Top cover flashing - A Left hand B Right hand
18	Fixing screw - not shown
19	Clip (with nail – not shown)
20	Foam draught seal wedge
21	Foam draught seal block
22	Collector to collector connection kit (landscape collectors only)

6 In-Roof System Installation

6.2 Substructure

Caution:
Do not attach safety harness to the integrated roof installation system!

1. Remove tiles in the installation area. Intervals must be above those given on Page 10/11. For ease of installation, an additional continuous row of roof tiles is required.

Caution:
Adequate rear ventilation of the integrated roof installation must be provided using suitable means (e.g. cross battens). A waterproof membrane (waterproof membrane) is absolutely essential.

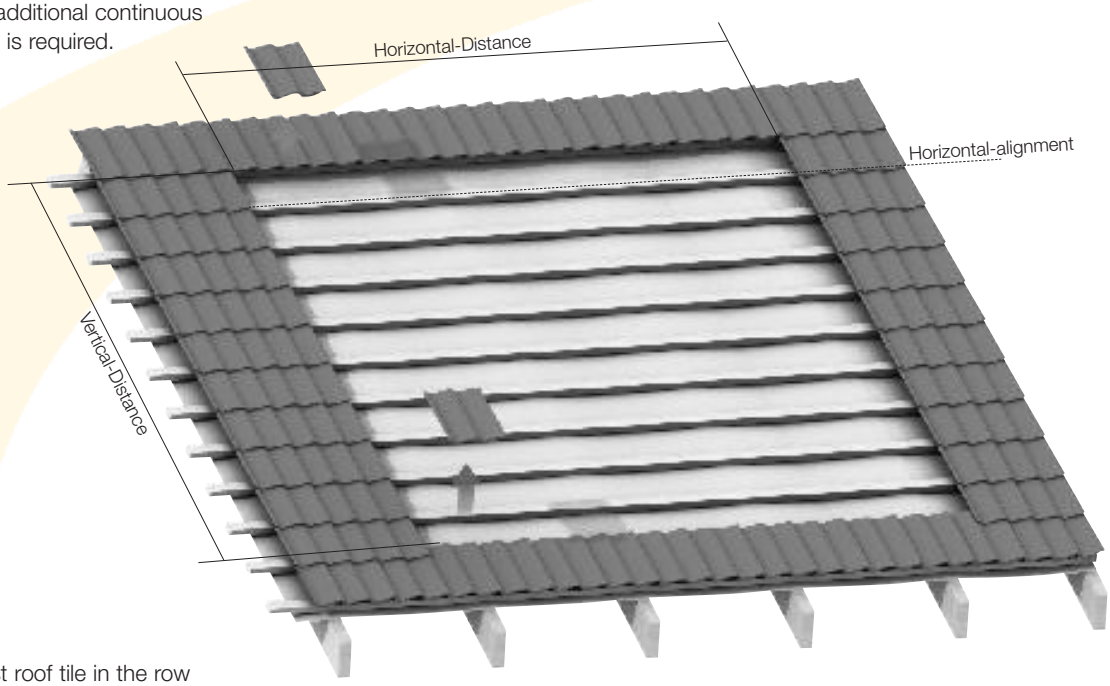


Figure 50: Remove Roof Covering

2. Remove the last roof tile in the row and position the bottom fixing batten (01) 180mm up from the existing roof batten below - see Figure 52. Secure the bottom batten to the rafters with screws (supplied by installer).

Note:
The bottom batten (01) is 30mm thick. If the existing roof battens are thicker then it will be necessary to pack out the bottom batten so the top is flush with the existing roof battens.

Note:
The screws for fixing the horizontal fixing battens must be provided by the installer.

Do not use sealing screws (16).

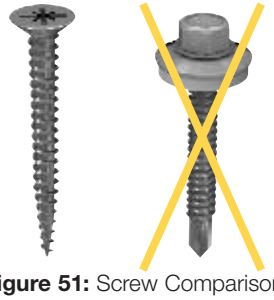
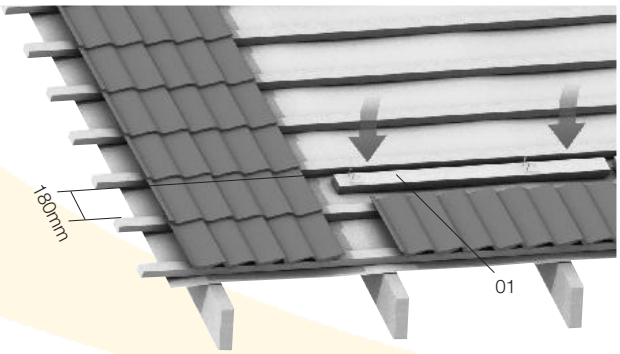


Figure 51: Screw Comparison



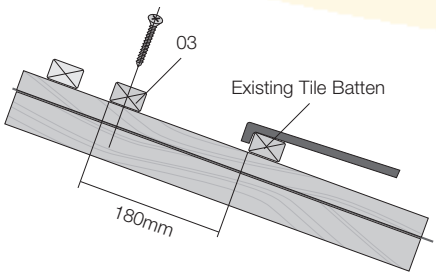


Figure 52: Bottom Fixing Batten

3. Align the middle (02) and top (03) fixing battens parallel to the bottom horizontal batten (01). Refer to table for the intervals between the battens. Secure the battens to the rafters with screws (supplied by installer).

Table 4: Fixing Batten Spacing

Intervals between fixing battens (mm) for In-roof installation		
Dimension	portrait side by side	landscape side by side
A	2025	1125
B	260	260

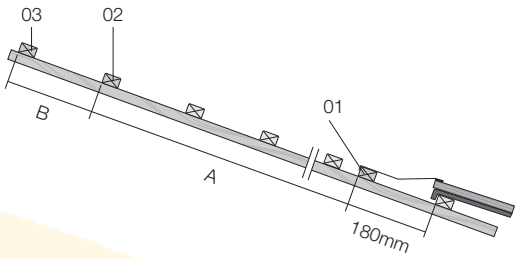
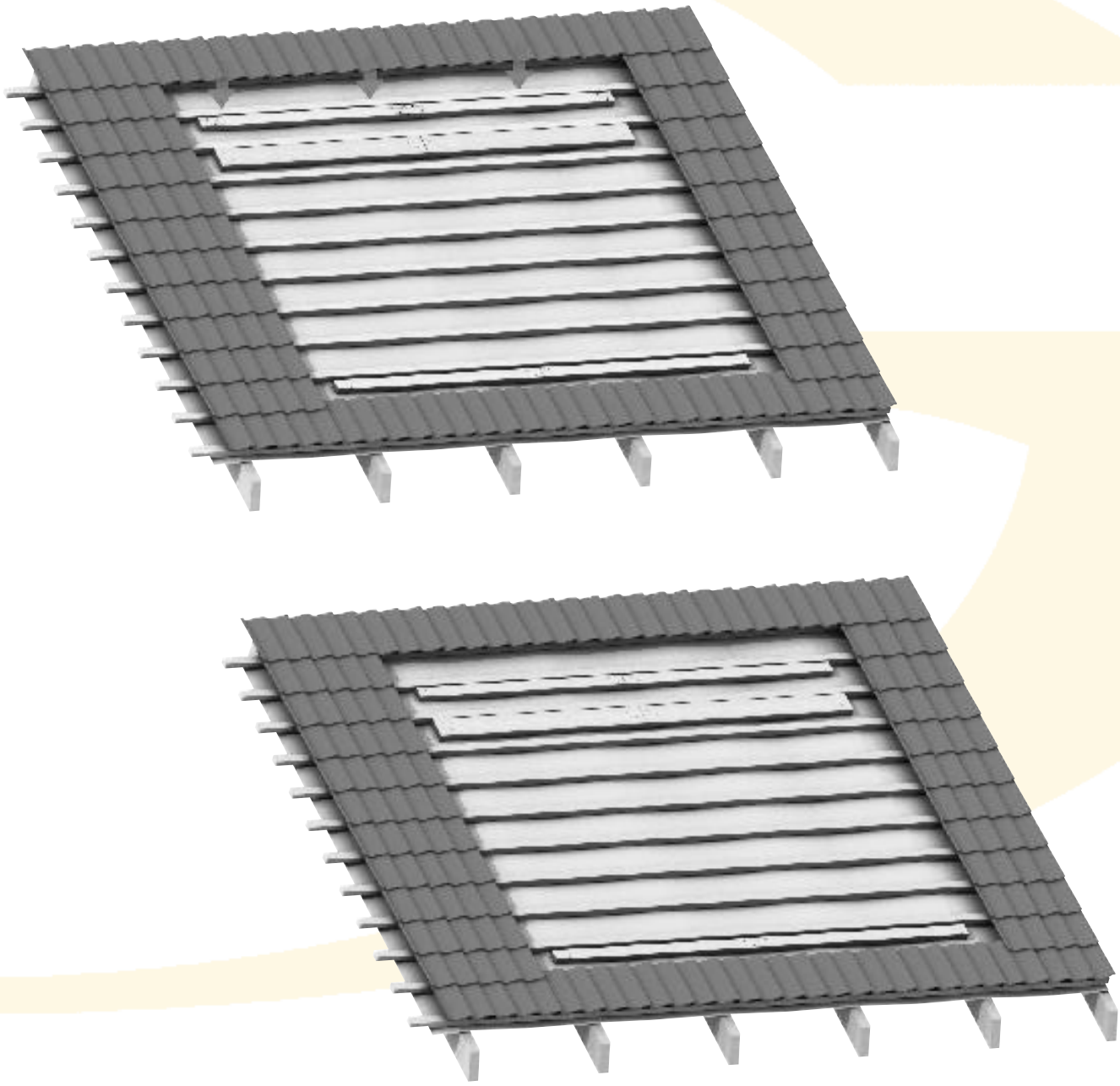


Figure 53: Top, Middle and Bottom Horizontal Fixing Battens



6 In-Roof System Installation

6.3 Installation of In-Roof Kit

1. Fit the bottom flashings.

   Note:
   The lead aprons on the bottom flashings (06-A & 06-B) for use with tiles are supplied folded back. Carefully fold out the lead aprons before installation. **Do not modify** the flashings or lead aprons. Leave the protective film in place on the butyl tape at this stage.

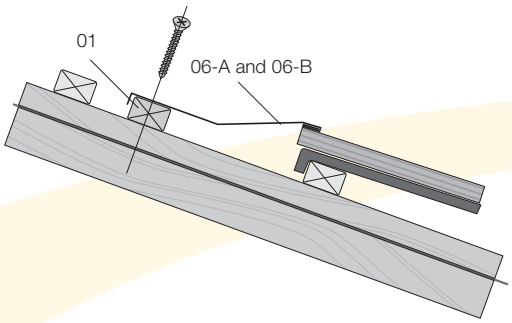


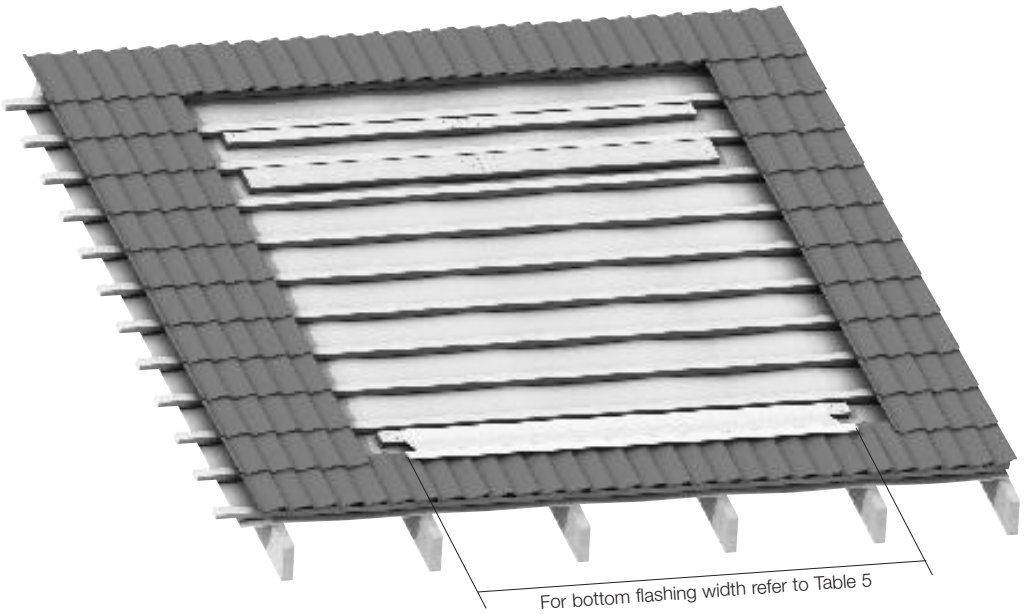
Figure 54: Installation of Bottom Flashing

Note:
butyl tape has strong adhesive properties and mistakes cannot be rectified after application!

Table 5: Overall Width Dimensions

Overall width dimensions (mm) for In-roof installation		
Qty	portrait (side by side)	landscape (side by side)
1	1460	2355
2	2645	4440
3	3835	6525
4	5025	8615
5	6215	10700

Figure 55: Installation of Additional Bottom Flashings



2. Position the bottom flashings on the bottom batten - with the left flashing overlapping the right in the centre. Adjust width of the bottom flashing to suit - see Table 5. Adjust the position of the bottom flashing as required to centre it in the opening in the roof tiles/slates or to avoid the need to cut tiles on one (or both) sides.

Mark position of both ends of bottom flashing on batten. Remove left hand flashing and fix right hand flashing to batten using suitable small screws (not supplied).

Remove the protective film from the butyl tape on the right hand flashing. Ensure left hand flashing is correctly located, re-position on batten, pressing firmly on overlap to seal. Fix left hand flashing to batten using suitable screws (not supplied).

Repeat procedure for any further bottom flashing sections, as required.

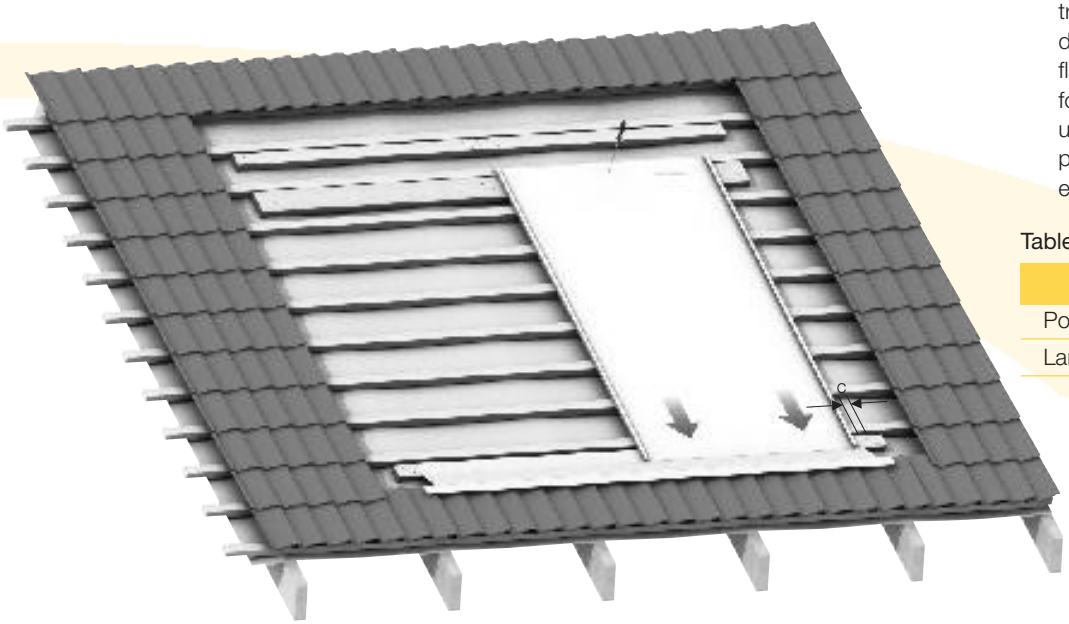


Figure 56: Installation of First Base Tray

3. Fit first base tray (10). NB. Base trays are not 'handed'. Position tray distance 'c' from end of bottom flashing with lower edge along the fold line of the bottom flashing. Fix using one of the self-drilling screws provided at the centre of the upper edge. See Figure 56.

Table 6: Position of Base Tray

Dimension C	
Portrait	145mm
Landscape	165mm

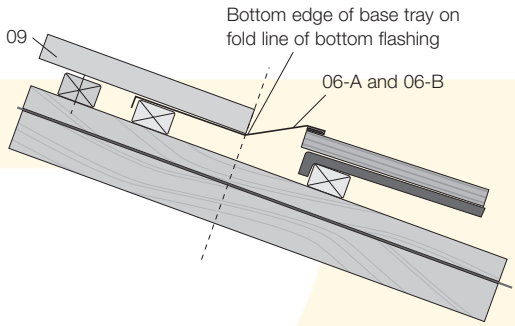


Figure 57: Section Through Bottom Flashing

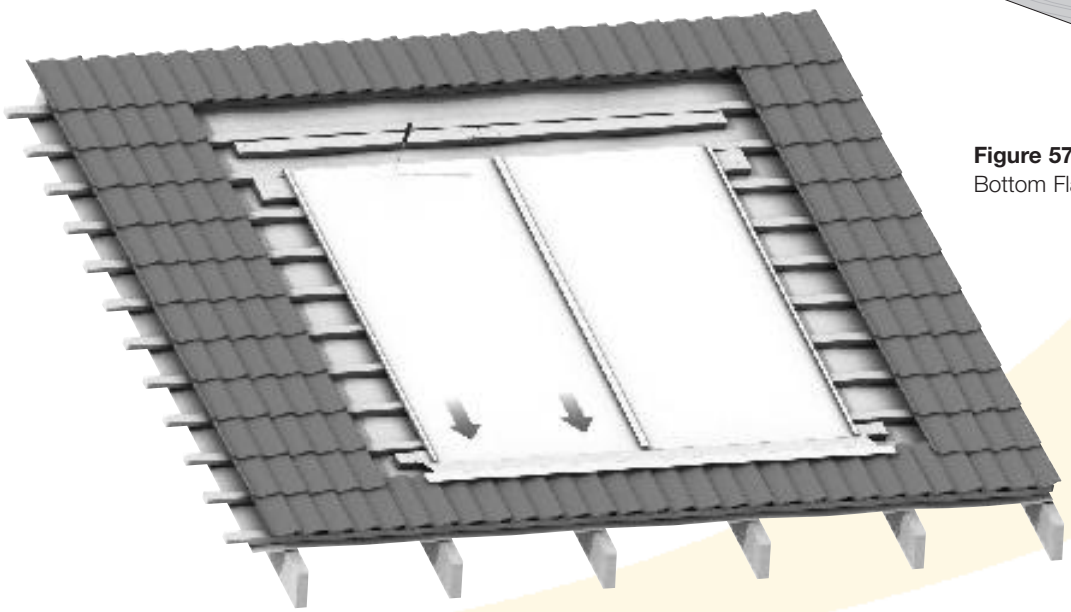


Figure 58: Installation of Second Base Tray

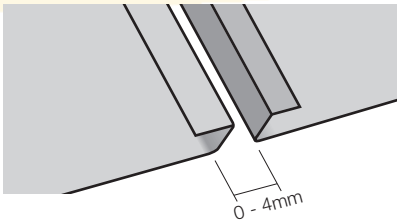


Figure 59: Maximum Gap Between Base Trays

4. Fit second base tray (10). As with the first tray, position it with lower edge along the fold line of the bottom flashing. Ensure gap between trays does not exceed 4mm. Fix as before with one of the self-drilling screws provided. See Figures 55 and 56.

   For installations using more than two collectors, repeat procedure to fit further base trays as necessary.

6 In-Roof System Installation

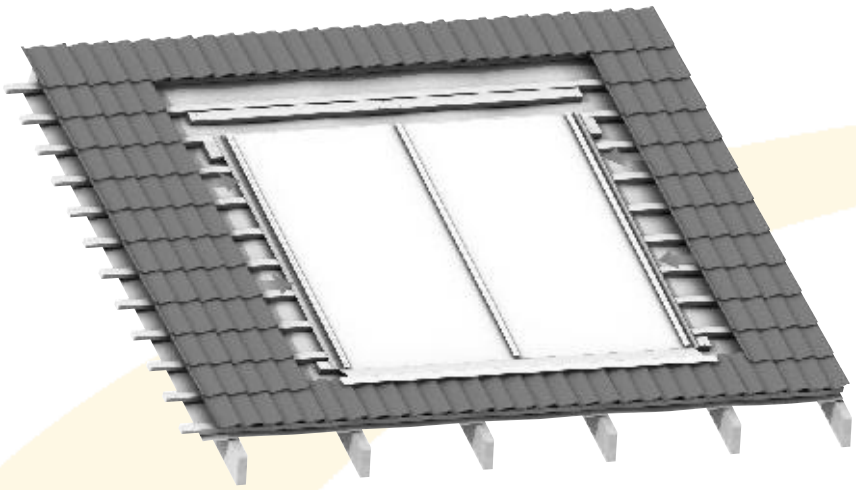


Figure 60: Installation of Side Gutter

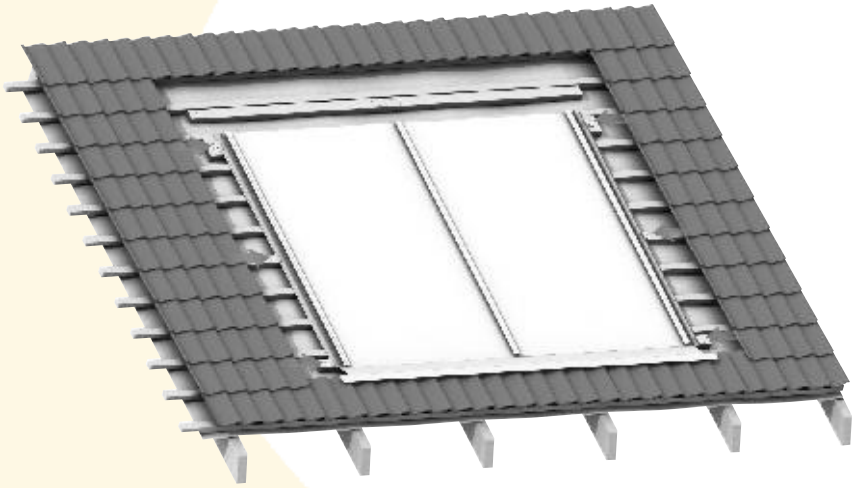


Figure 61: Location of Clips on Side Gutters

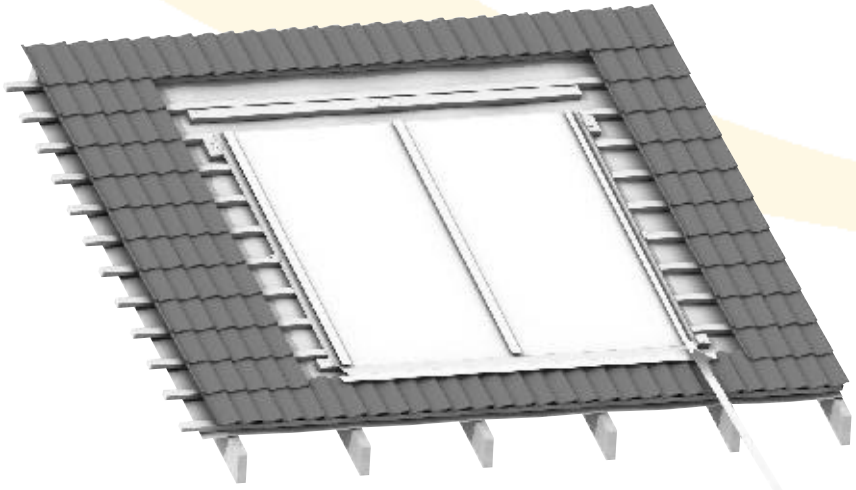


Figure 62: Fitting of Cover Strips

5. Fit side gutter (09). Position side gutters against side of base tray with bottom edge along fold line of bottom flashing. Ensure that outer edges of each side gutter is located INSIDE the return edge on the bottom flashing.
6. Secure side gutters in place using the clips provided. Hook the clips over the outer edge of the side gutters and fix to battens using the nails provided.

Figure 63: Securing Side Gutter Clips

7. Fit cover strip on the joint between the base tray and side gutter. Fit the end of the strip onto the two outward facing flanges - see Figure 64. Slide cover strip up the full length of the joint. Finally fold over at both ends of cover strip to secure - see Figure 65. Repeat to fit cover strips on the other side gutter and on all joints between the base trays.

Figure 64: Installation of Cover Sheets

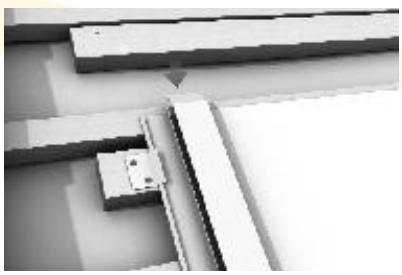


Figure 65: Installation of Cover Sheets

6.4 Installation of Collectors

1. Position mounting brackets (04) at the bottom of the base tray using the dimensions given in Figure 68. Carefully mark their position on the base tray with a pencil.

Important:
Ensure brackets are correctly positioned with the two holes at the top. Remove protective film from underside of brackets and press them into place in the correct position. Fix in place with the self-drilling screws supplied in the kit using the Torx 25 screwdriver bit provided in the kit. Refer to Figure 67.

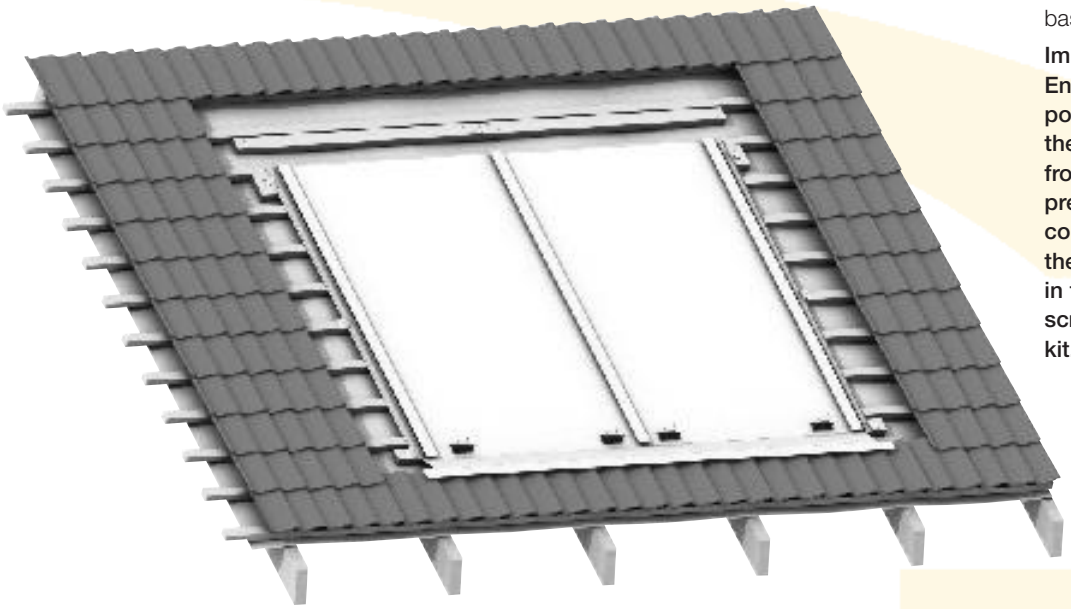


Figure 66: Location of bottom Mounting Brackets

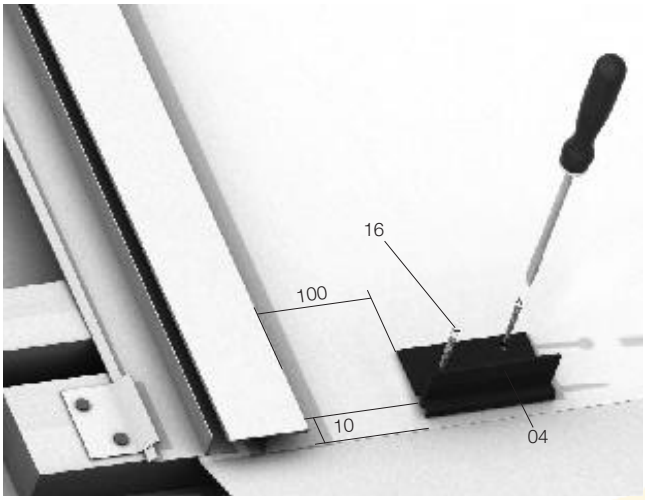


Figure 67: Fixing of bottom Mounting Brackets

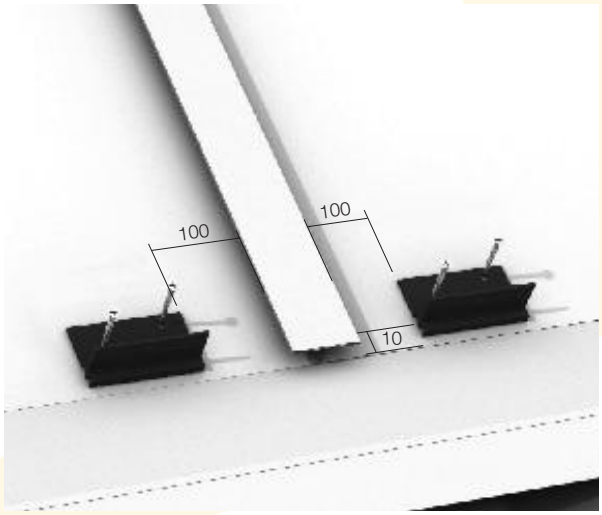


Figure 68: Bottom Mounting Bracket Dimensions

6 In-Roof System Installation

2. Fit two anchor blocks (05) into the profile at the bottom and top of each collector. Lift first collector and position on two mounting brackets. See Figure 69. Adjust position of anchor blocks to align with hole in each mounting brackets. Repeat for second collector, and so on for further collectors.
3. Install the top mounting brackets after collectors have been fitted onto bottom mounting brackets.

   Remove the protective film from the underside of two mounting brackets. Lift top end of one collector and position the two mounting brackets (with the holes at the top) against the top edge of the collector. Lower the collector and press the bracket into place on the base tray. Fix in place with the self-drilling screws supplied in the kit using a Torx 25 screwdriver. Refer to Figure 71.
4. Adjust position of the two anchor blocks in top collector profile to align with the hole in the two mounting brackets. Fit the two cylinder bolts through the top mounting brackets into the anchor blocks and tighten. Repeat for bottom mounting brackets.
5. Repeat procedure for second collector, and so on, as required.

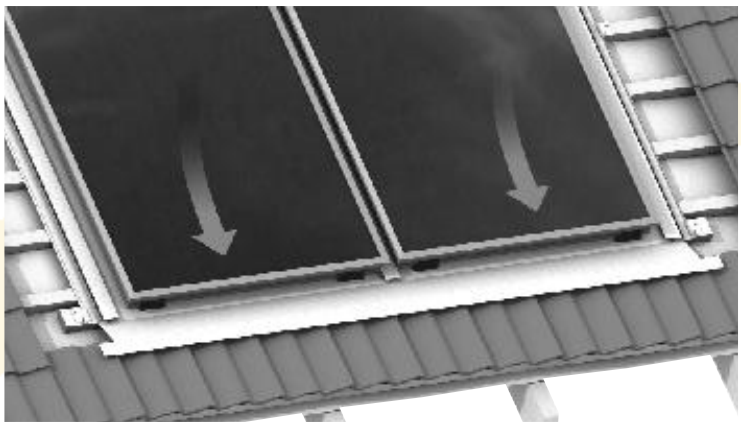


Figure 69: Installation of the Collectors on to Bracket

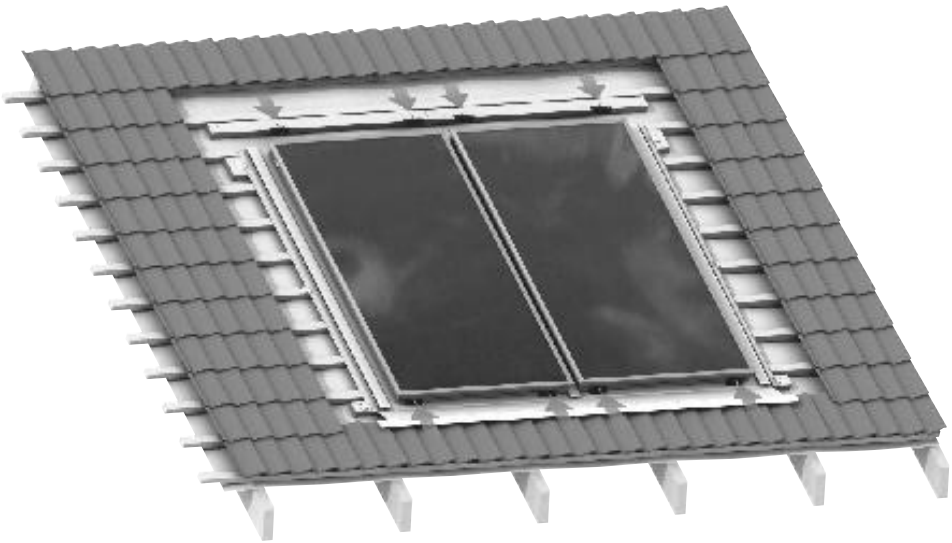


Figure 70: Installation of the Top Brackets

Figure 71: Fixing of the Top Brackets

6.5 Fitting Top Cover Flashing

Note:
Flow and return system pipework should be completed and tested before fitting top cover flashings to collectors.

1. Fit right hand top flashing first. Locate slot in lower edge of flashing onto top edge of collector. Ensure right hand end of flashing is fitted INSIDE the return edge on the right hand side gutter.
2. Fit left hand top flashing onto top edge of collector, overlapping the right hand flashing in the centre. Ensure left hand end is fitted INSIDE the return on the left hand side gutter. Fix the right hand flashing to the batten beneath using the self-drilling screws provided in the kit. See Figure 73.
3. At the centre, lift the end of the left hand top cover flashing and remove the protective film from the Butyl tape on the right hand flashing. Press down the end of the left hand flashing to seal. Fix the left hand flashing to the batten beneath using the self-drilling screws provided in the kit.

6.6 Closing the Roof

1. If necessary, the right roof tile row must be cut. It may also be necessary to remove the upstands fitted to the roof tiles on the sheet side (side cover sheet).

   Note:
   To improve the weather-tightness of the roof covering, optional foam wedges can be bonded to the side flashings before closing the roof area.
2. Roof tiles above the solar collector field are usually cut also. Overlapping for the top cover sheets must be carried out according to the following values for roof incline:

   = 35° at least 120mm
   > 35° at least 100mm
   > 50° at least 80mm

   Important:
   Following installation the collectors must be covered, to stop solar radiation reaching them, until completion of filling and commissioning.

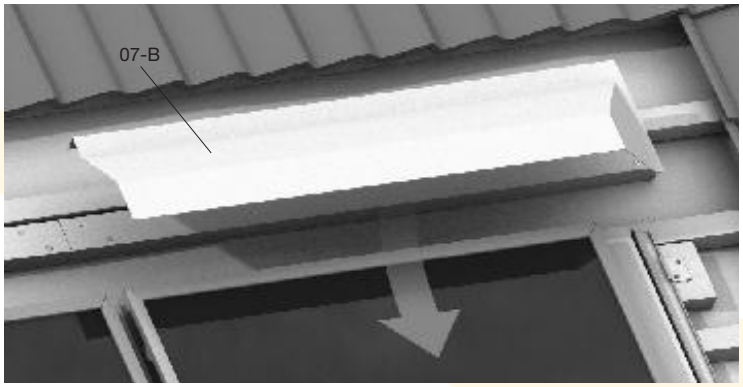


Figure 72: Fitting right Top Cover Flashing (07-B) to Collector

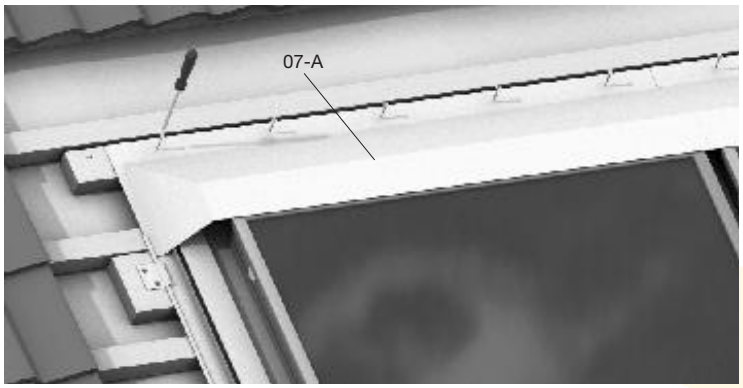


Figure 73: Fixing left hand Top Cover Flashing (07-A)

Figure 74: Fitting Foam Block (14)

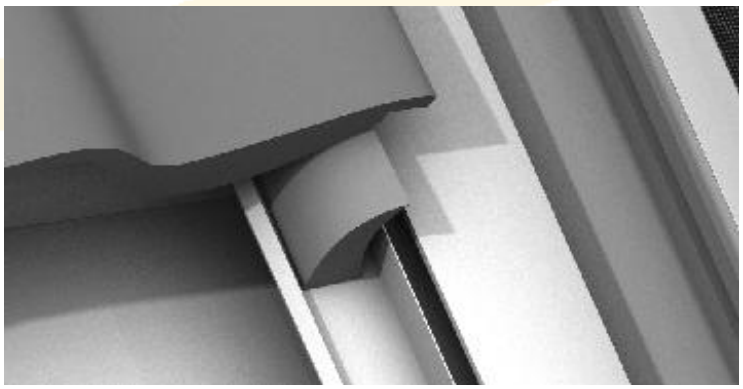


Figure 75: Position of Foam Sealing Wedges

7 Installation of Solar Collectors

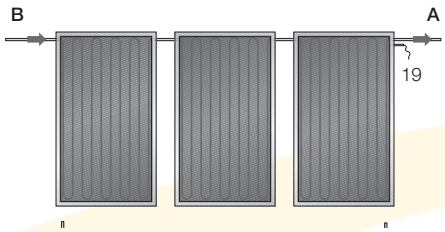


Figure 76: Connections for Portrait Format Collectors Mounted Side by Side

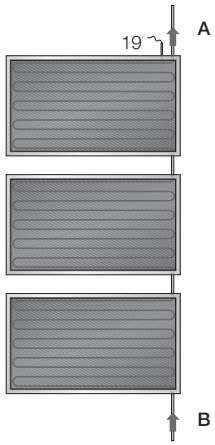


Figure 77: Connections for Landscape Format Collectors Mounted one Above the Other

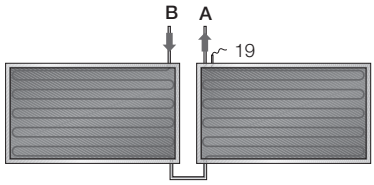


Figure 78: Connections for Two Landscape Format Collectors Mounted Side by Side

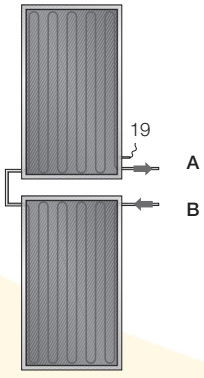


Figure 79: Connections for Two Portrait Format Collectors Mounted one Above the Other

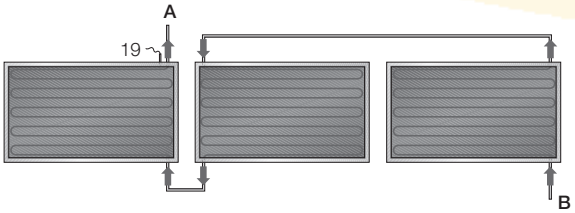


Figure 80: Connections for Three Landscape Format Collectors Mounted Side by Side

7.1 Installation Sequence of Solar Collectors

In accordance with solar collector connection and installation type, there are small differences in the installation sequence of solar collectors.

- If the installation kit contains **straight** compression fittings, these **must** be installed **during** solar collector installation. Refer to section 8.1
- If the installation kit contains **angled** compression fittings, these **must** *be installed* **after** solar collector installation. Refer to section 8.2

The choice of Outlet (flow) connection 'A' and inlet (return) connection 'B' for the collector array is up to the installer - to suit the installation.

Caution:
Locate the temperature sensor of the solar controller in the sensor pocket next to the outlet (flow) connection of the collector array

Now go to Section 7.

7.2 Installation of Solar Collectors - On-Roof and Flat Roof

1. Note:
   Do not carry the solar collectors by their connections. Use carry handles!

   To install carry handles, fit anchor blocks (05) to the solar collector profile and fix the carry handles using two cylinder bolts M8x14 (08).
2. Fit two mounting hooks (14) per solar collector in the lower mounting rail.

   Fit the mounting hooks into the mounting rail so that they will be 100mm away from the edge of the solar collectors

   Distance c :
   For portrait collector format approx. 800mm
3. Place the first solar collector on the mounting rail/mounting hook and align.

   Distance to left-hand mounting rail edge = 39mm
4. Remove carry handles from the first solar collector and attach them to the next solar collector.
5. Install anchor blocks (05) at the end of the mounting rail (04) and place them so that the fixing brackets (09) can be screwed flush to the ends of the mounting rail.

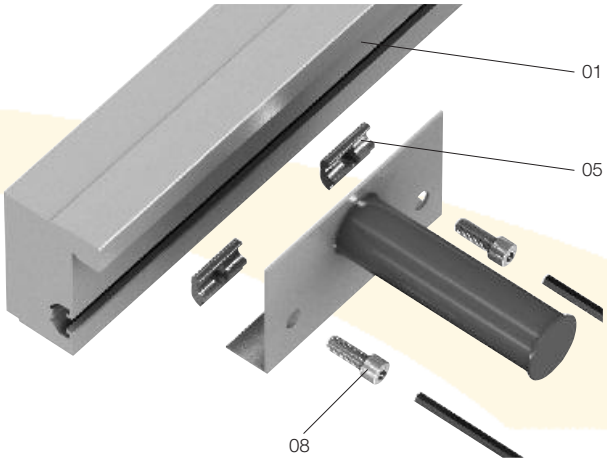


Figure 81: Fixing the Carry Handles

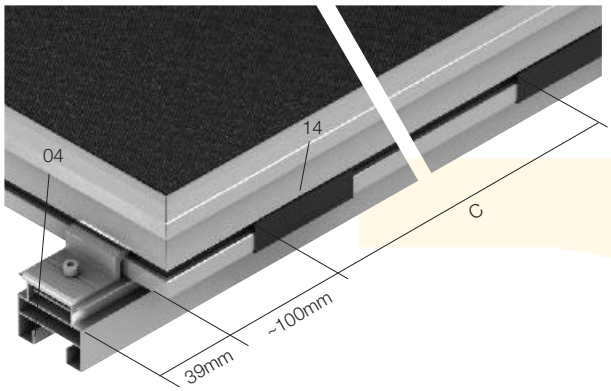


Figure 82: Positioning the Mounting Hooks

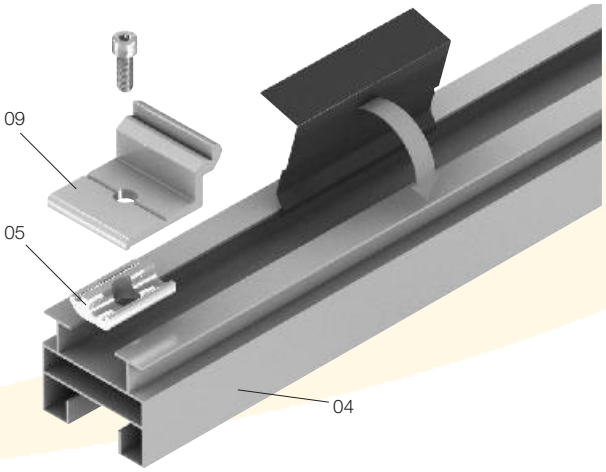


Figure 83: Installing the Anchor Blocks for the Fixing Brackets

7 Installation of Solar Collectors

6. On the left outer edge of the solar collector (01), hook in two fixing brackets (09) into the solar collector profile (a) and push them down on to the mounting rails (b).

   Secure the fixing brackets in the anchor blocks using M8x14 cylinder bolts.

7. Secure the solar collector using two further fixing brackets on the opposite side:
   - Place anchor blocks in the mounting rails
   - Hook fixing brackets into the solar collector
   - Secure using cylinder bolts M8x14

8. Place the compression fitting (11) on the connector of the first solar collector.

9. Hook two further mounting hooks into the lower mounting rail, see Figure 82, Positioning the Mounting Hooks.

10. Place another solar collector on the mounting rail/mounting hooks and remove the carry handles.

11. Place anchor blocks for the second solar collector in the mounting rail and align so that the fixing brackets can be fixed finally side by side.

12. Install fixing brackets into the solar collector profile and push them down onto the mounting rails.

13. Push the second solar collector up to the first solar collector until the ends of the fixing brackets touch using cylinder bolts M8x14.

    Note:
    Take care with compression fitting! Guide the second solar collector's connector into the compression fitting!

14. Continue in the same way to install additional solar collectors.

    Important:
    Following installation the collectors must be covered, to stop solar radiation reaching them, until completion of filling and commissioning.

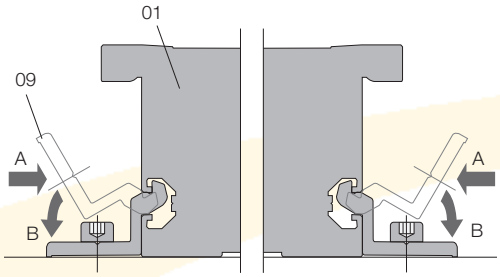


Figure 84: Hook Fixing Brackets in the Solar Collector Profile

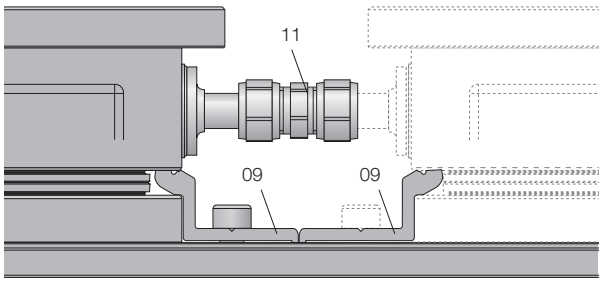


Figure 85: Align Anchor Block for Additional Fixing Brackets

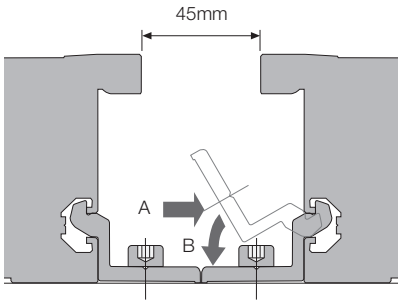


Figure 86: Hook Fixing Brackets in the Solar Collector Profile

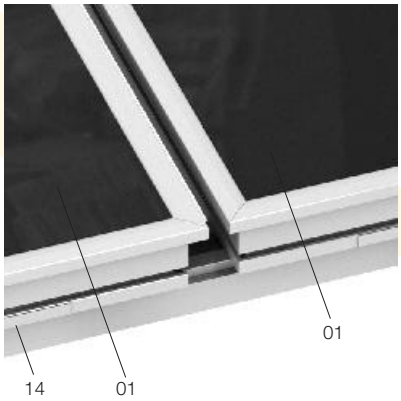


Figure 87: Align Second Solar Collector

8 Hydraulic Connections

8.1 Compression Connection, Straight

1. Tighten the nuts on the compression connection (11).

   Caution:
   Apply opposite force when tightening the compression connection, otherwise the pipes on the solar collector can be damaged!
2. After successfully checking the seal of the solar collectors, place thermal insulation (12) around the hydraulic connection, and remove the protective film from the adhesive strip to secure it in place.
3. Continue in the same way to install additional solar collectors.
4. Inlet connection (A) and outlet connection (B) for the solar collector field is left to the installer to choose.

   Caution:
   Locate the solar collector temperature sensor (19) in the sensor pocket next to the Outlet (flow) connection of the collector array.
5. Push back the thermal insulation on the solar collector connection kits, place the compression connections onto the connectors and secure.
6. Take the temperature sensor seal (13) out of the solar collector hole next to the outlet (flow) connection, pierce the centre and push it over the temperature sensor. Finally, guide the temperature sensor fully into the sensor pocket of the solar collector and seal by re-inserting the temperature sensor seal.

   Caution:
   Push the solar collector temperature sensor to the end of the hose sleeve so that the correct measuring point is reached.

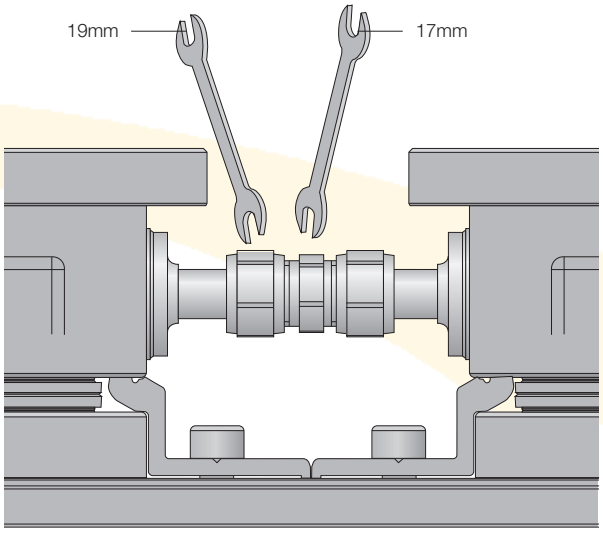


Figure 88: Hydraulic Connection

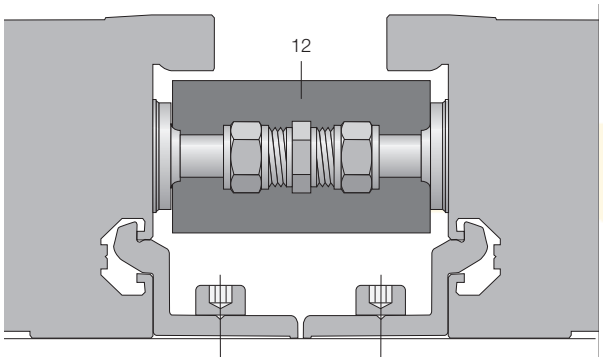


Figure 89: Fit Thermal Installation

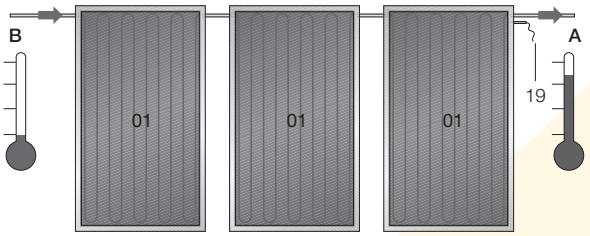


Figure 90: Solar Collector Field Attachment

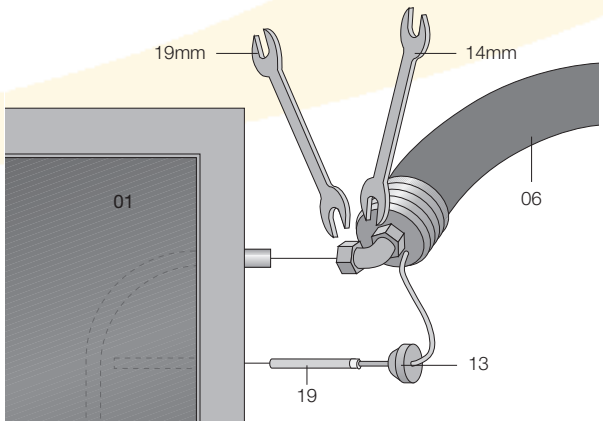


Figure 91: Connection of Temperature Sensor

8 Hydraulic Connections

8.2 Compression Connection, Landscape Systems Only

1. Fit the two compression elbows supplied on to the two adjacent solar collector connections. Turn the elbows so the openings face each other as shown.
2. Measure the length of the 12mm copper pipe required to connect the two elbows. Cut the 12mm copper pipe supplied to the required length using a pipe cutter.
3. Remove the elbows from the collectors. Fit the insulation onto the copper pipe, fit the pipe between the elbows and refit them to the collector connectors.
4. Tighten the compression elbows.

   Caution:
   Apply opposite force when tightening the compression connections, otherwise the pipes on the solar collector can be damaged!
5. After successfully checking the seal of the solar collectors fit the thermal insulation on the pipe and elbows.
6. Continue in the same way to install additional solar collectors.

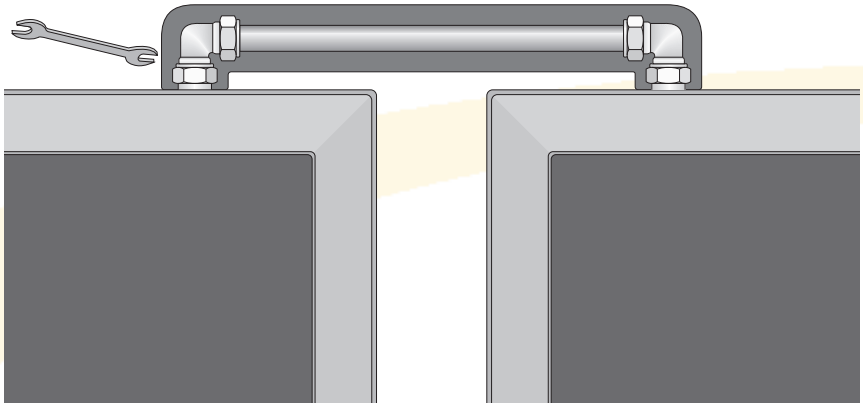


Figure 92: Hydraulic Connection, Landscape Installation

9 Roof Penetrations

9.1 Roof Penetration

For On-Roof Systems Only

1. There are several options for making weathertight roof penetrations, including:

   Ventilation Tiles
   Increase the opening in the ventilation tile to allow the Insulated pipes to pass through, or remove the grill inserts if possible.

   Locate the ventilation tiles adjacent to the collector connections.

   Lead Flashings
   Remove the tiles adjacent to the collector connections. Drill a 25mm hole in the tile using a diamond tipped bit.

   Locate the flashing below the drilled tiles, with the copper pipe passing through the drilled hole

   'SolarDek' Flashings
   These have a coated lead base with a silicone centre section that is cut off to suit the diameter of the pipe.

   These can replace the tiles adjacent to the collector connections.

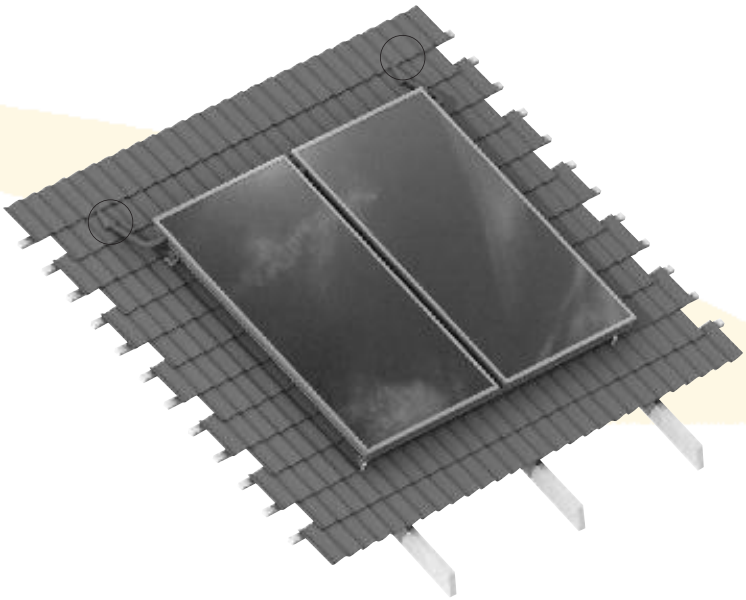


Figure 93: Solar Collector Field Attachment for On-Roof Systems

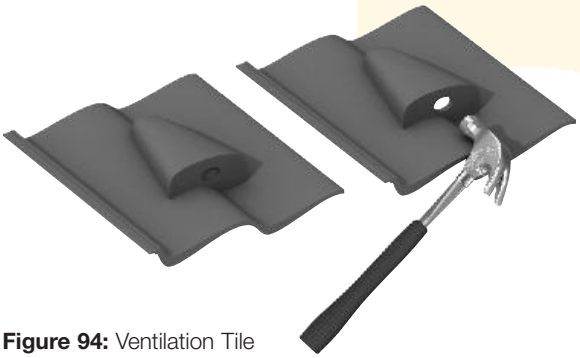


Figure 94: Ventilation Tile

Figure 95: Lead Flashing

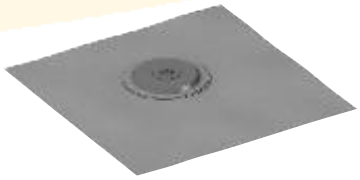


Figure 96: SolarDek Flashing

9 Roof Penetrations

2. Push the thermal insulation for the solar collector connection kits (06) up to the solar collector.

   For Ventilation Tiles
   Pass the insulated pipes through the opening in the ventilation tile for connection inside the roof space.

   For Lead Flashings
   Cut the insulation and fit over the copper pipe on the flashing. Pass the flexible connection pipe through the copper pipe/flashing for connection inside the roof space.

   For 'SolarDek' Flashings
   Cut the insulation to fit on to the silicone seal. Cut the silicone seal to give the required diameter hole for the pipe. Pass the pipe through the silicone seal for connection inside the roof space.

3. If the substructure is punctured, the roof covering must be re-sealed afterwards! Guide the connection pipes into the correct position through the waterproof membrane.

   The seal can be restored by attaching overlapping strips of waterproof membrane, for example. Overlap must be a minimum of 100mm!

For In-Roof Systems Only

4. The flow and return connection pipes can be located beneath the top flashing where they can pass through the waterproof membrane.

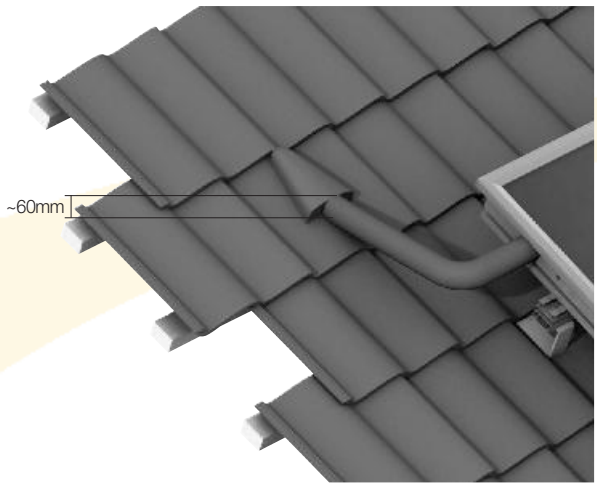


Figure 97: Detail View of Solar Collector Field Connection - On-Roof Systems

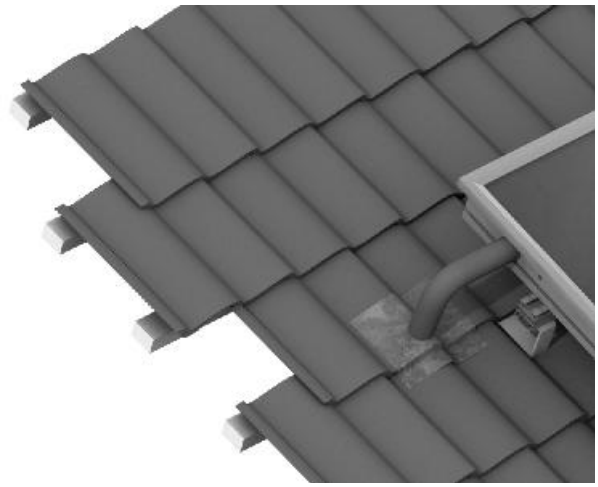


Figure 98: Detail View of Solar Collector Field Connection - On-Roof Systems

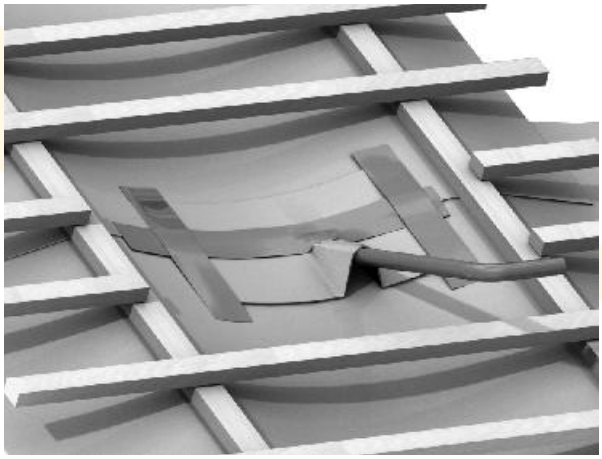


Figure 99: An Example of Passing Through the Waterproof Membrane

10 Differential Controller

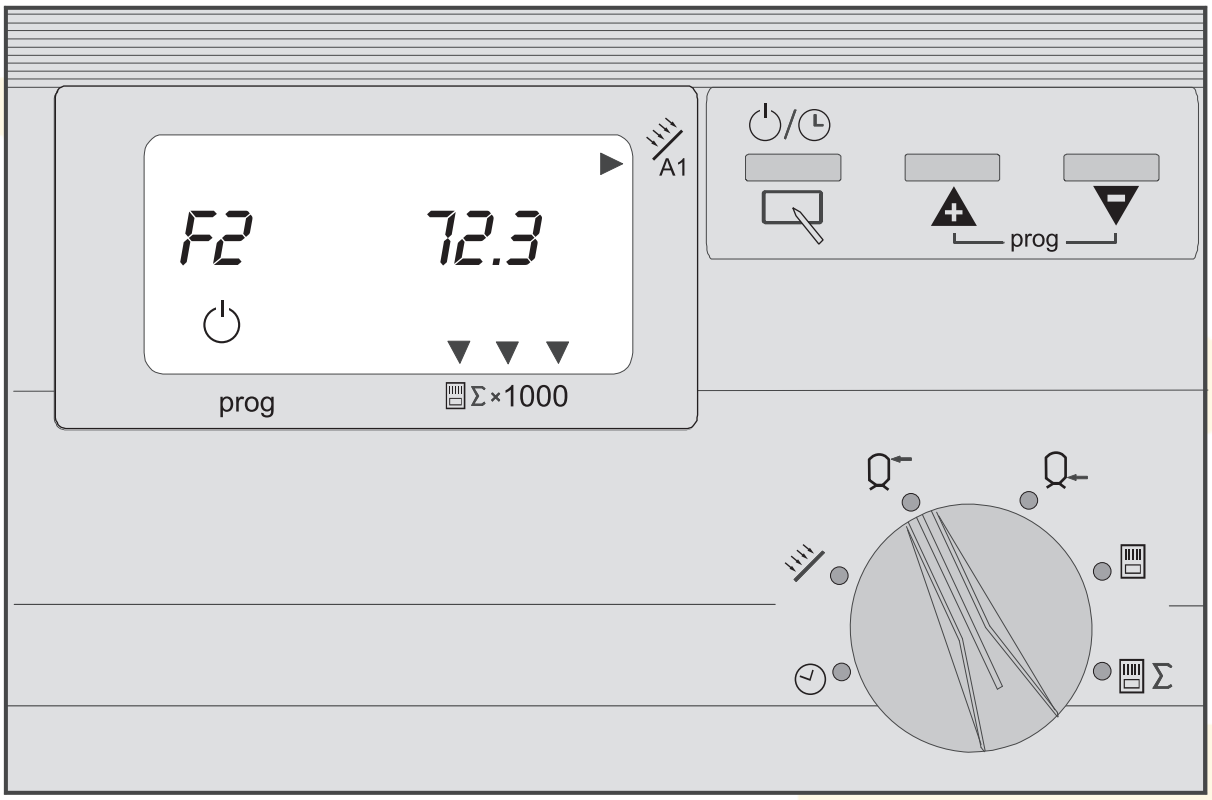


Figure 100: Grant GSD1 Differential Controller

10.1 General Information

Safety Information
Power Connection Regulations
Please install as per current electrical regulations.

Your heating control system must be installed and serviced only by appropriately authorized specialists.

If this system is not installed properly, there is a risk of fatal or severe personal injury.

Warranty Conditions
If the system is not installed, commissioned, serviced and repaired professionally, this will render the manufacturer's warranty null and void.

Important Text Passages

Important information is highlighted with an exclamation mark.

This attention symbol indicates dangerous situations.

Installation
For information on connection of the Differential Controller, see page 42.

Safety Information
Declaration of Conformity

CE

This device corresponds to the requirements of the relevant guidelines and standards, if the corresponding regulations and the manufacturer's instructions are complied with.

Function
This controller enables the regulation of various types of system:

1) Solar regulation
2) Solid fuel boiler regulation

The device is simple to operate and easy to control due to the direct temperature display in the first operating level.

Note: Please follow the safety information and read these instructions carefully before putting the system into operation.

10.2 Technical Data

Supply voltage complying with DIN IEC 60 038	230 V AC ± 10%
Power consumption	Max 4 VA
Switching capacity of the relays	250 V 2(2) A
Maximum current on terminal L1´	6.3 A
Type of protection complying with DIN EN 60529	IP 40
Protection class complying with DIN EN 60730	II, Totally insulated
Power reserve of the timer	> 10 hours
Permitted ambient temperature during operation	0 to 50°C
Permitted ambient temperature for storage	-30 to 60°C
Sensor resistances F1, F3 and F4:	Multiplier PT1000, 1kΩ +/- 0.2% at 0°C

10 Differential Controller

10.3 Operation

System 1 = Solar Differential Regulation
230V~; Switching capacity of relays 2(2)A, 250V~

Mains power:

20	Supply to device and pump A1
19	N-conductor for device
17	N-conductor for collector pump (A1)
16	Supply connected to collector pump L1´ (A1)

Sensors:

1+7	Collector sensor (F1)
4+5	Sensor, bottom of storage tank (F4)

Optional:

3+6	Sensor, top of storage tank (F3)

Switching conditions for A1 (P = set value): Refer to pages 46 & 47.
Heat production - difference to storage tank and min. temp.:
ON: F1 - F4 > P30 + P31 and F1 > P40 + 5K
OFF again: F1 - F4 < P30 or F1 < P40

Maximum storage tank temperature:
OFF: F4 > P50
ON again: F4 < P50 - 5K

Maximum collector temperature:
OFF: F1 > P41
ON again: F1 < P41 - 10K

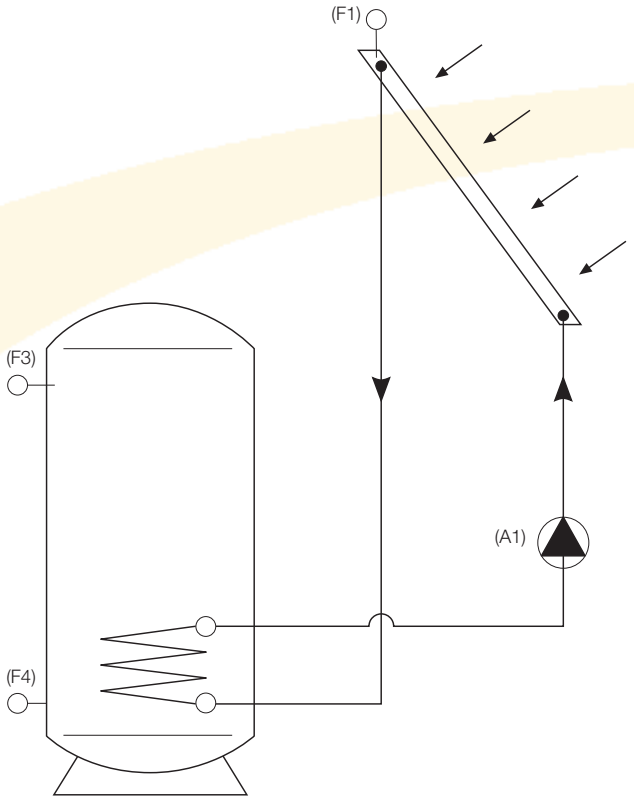


Figure 101: Sensor F1+F4: PT1000

10.4 Sensors

F1, F3 + F4:

- silicone cable 1m length.
- PT1000 sensor with 1kΩ +/- 0.2% at 0°C.

Table 7: Sensor Characteristics

Temperature in °C	Resistance in Ω
-20	922
-10	961
0	1,000
10	1,039
20	1,078
30	1,118
40	1,155
50	1,194
60	1,232
70	1,270
80	1,309
90	1,347
100	1,385
110	1,422
120	1,460

If an error occurs, the ⚠ symbol appears in the display and the associated error number appears, flashing.

On pressing the three operating keys simultaneously, the parameters are reset to their default factory settings.

Table 8: Sensor Errors

Sensor fault		
No.	**Designation**	**Significance**
E71	Collector sensor F1 defect	The collector sensor has short circuited or there is an interruption
E73	Storage tank sensor F4	The storage tank sensor has short circuited or defect there is an interruption
E79	Storage tank, top, sensor F3 defect	The additional sensor F3 has short circuited or there is an interruption
E81	Eeprom	A fault has occurred in the Eeprom. Please check values

Note: Functional defects resulting from incorrect operation or settings are excluded from the terms of warranty.

11 Differential Controller
Electrical Installation

11.1 Electrical Connection

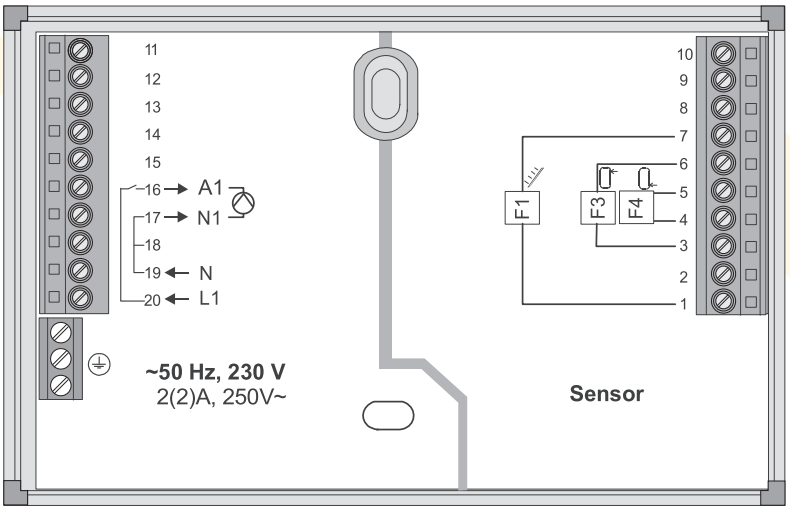


Figure 102: Electrical Connection

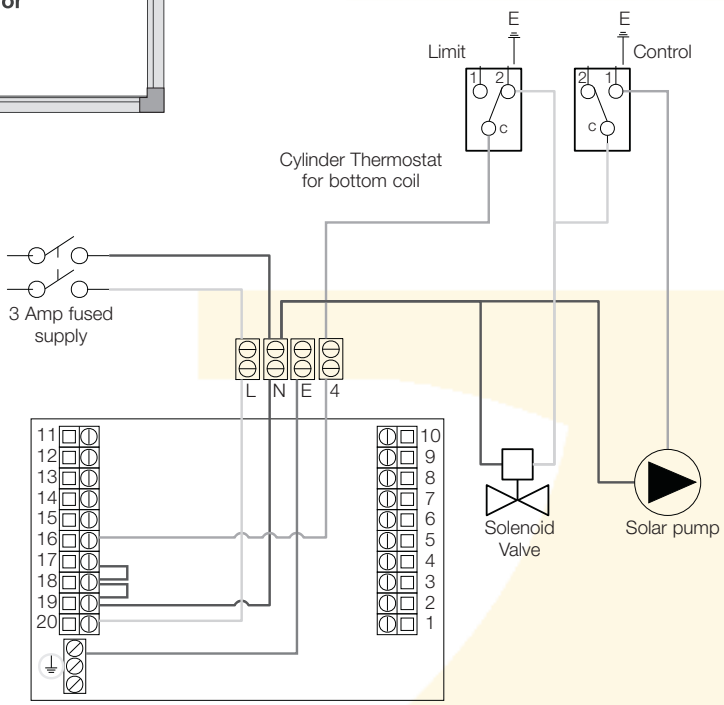


Figure 103: Wiring Diagram

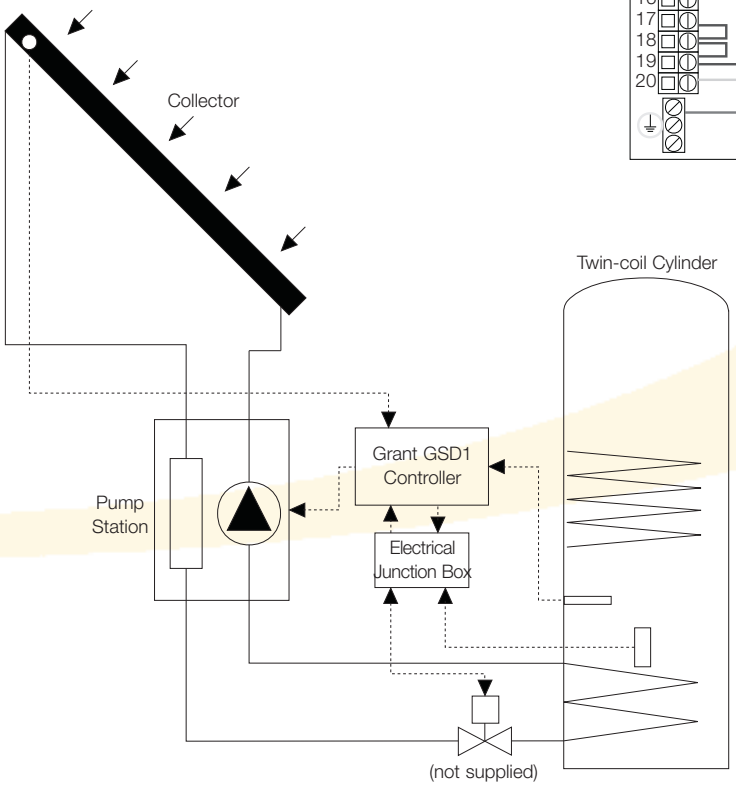


Figure 104: System Schematic Diagram

12 Differential Controller
User Guide

12.1 Operation

Explanation of the Operating Elements
In Display Level (Normal Mode)

OFF/ON/MANUAL switch (⏻/🕒/☀)

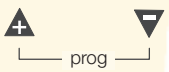
Access the operating level by pressing the Plus and Minus keys simultaneously. (Automatic reset after 2 min. without operation).

In Operating Level (Setting Parameters)

Programming key (selection or input)

Plus key (next value or increase value)

Minus key (previous value or decrease value)



Press the Plus and Minus keys simultaneously to return to the display level.

Program Switch Settings

⏻ OFF:	The pump is not activated.
🕒 ON:	Normal operation; regulation according to settings.
☀ MANUAL:	All pumps operate (all relays closed). The function is reset to Automatic mode after 30 min.

Display (Normal Mode)
When in Normal mode, select the display required with the rotary knob at the front:

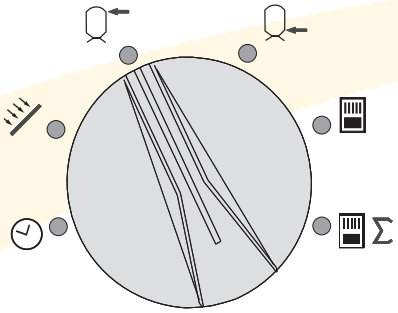


Figure 105: Rotary Knob

A Designation of Temperature Displayed

🕒	--	Time
	F1	Temperature of collector or solid fuel boiler
	F3	Temperature of storage heater at top
	F4	Temperature of storage heater at bottom
	C1	Day's production in kW
Σ	C2	Total production in kW. From 10 MW, display in MW (=> Arrow appears on " Σ x 1000")

B Display the selected temperature / or time

C Weekday 1=Monday - 7=Sunday; here Saturday

D Pump operation indicator (Arrow = Pump ON)
a = Pump A1 is ON (see connection diagram)

E Operation indicator ⏻ = OFF, 🕒 = ON, (☀= Hand => Pumps ON max. duration = 30 min.)

F When the total solar production in display C2 exceeds 10 MW, the three arrows appear above the text: " Σ x 1000".

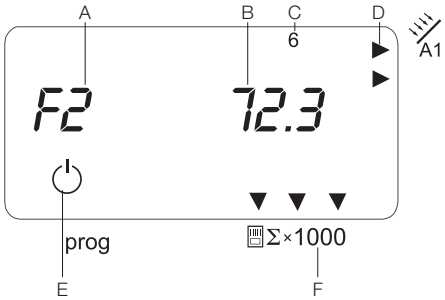


Figure 106: Temperature Display

Note: Please follow the safety information and read these instructions carefully before putting the system into operation.

12.2 Starting Up

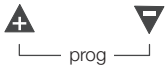
Basic Setting of the Controller

After the device has been properly installed, switch on the power supply:

The software number for your device appears briefly in the display. Finally, the standard display indicators appear.

The controller is now in operation and uses standard values. To define the correct display, the time and weekday can now be entered.

Time / Weekday



Press the Plus + Minus keys simultaneously => Operating level with set value display "01" [left]

Press the Prog key => LED beside Prog lights up

Set the time with the Plus/Minus keys

Setting mode can be ended at any time by pressing the Plus and Minus keys simultaneously. Changes which have been entered but not stored by pressing the Prog key have no effect.

Press the Prog key => Save the new time

Press the Plus key => Set value display "02" [left]

Press the Prog key => LED beside Prog lights up

Set the weekday (1-7) with the Plus/Minus keys

Press the Prog key => Save the weekday

Press the Plus + Minus keys simultaneously => Normal mode with standard display.

The standard display can be selected/changed using the rotary knob.

12.3 Explanatory Information

Modify Set Values

Access the operating level by pressing the Plus and Minus keys simultaneously.

Display: **Left** No. of the set value, **Right** set value

Use the Plus/Minus keys to select the number of the set value required [Display: left].

A list of all the set values is provided on the following pages.

Press the Prog key => Select the set value. The LED beside the Prog key lights up. This means that the set value can now be modified with the Plus/Minus keys.

Change the set value using the Plus/Minus keys.

Press the Prog key => The modified value is saved.

Setting mode can be ended at any time by pressing the Plus and Minus keys simultaneously. Changes which have been entered but not stored by pressing the Prog key have no effect.

Exit from the operating level by pressing the Plus and Minus keys simultaneously.

Set Values Protected by Code No. (from No. 20)

It is only possible to change the set values from No. 20 after entering the code number. These set values may only be modified by an authorized fitter.

If these values are set incorrectly, they may cause malfunctions or damage to the system.

- Select set value 20 (code No. input).
- Press the Prog key and enter the 1 to 4-digit code number. Confirm each digit by pressing the Prog key.
- Select the set value to be modified.
- Press the Prog key and change the set value.
- Conclude the input by pressing the Prog key.

If an attempt is made to enter an impermissible value, the system automatically returns to set value 20 (enter code number).

12 Differential Controller
User Guide

Table 9: Set Values List

No.	Designation	Setting Range	Setting Ex Works	Own Settings
	User Set Values			
01	Set time	0.00 - 24.00	10.00	
02	Set weekday	1 - 7	1 (Monday)	
03	Day's production	Display only/Clear	0	
04	Total production	Display only/Clear	0	
05	Pump kick function switch-on time	00.00 - 24.00	07.00	
06	Pump kick function switch-off time	00.00 - 24.00	22.00	
	Fitter Set Values			
20	Enter code No.	0000-9999		
21	Code No.	0000-9999	0000	
22	Select system	1 - 7	1	
	Switching Thresholds / Hystereses			
30	Switching threshold for difference 1	1K – 30K	3	
31	Hysteresis to switching threshold for 1	1K – 10K	3	
	Special Functions			
40	Enable temperature, collector(s)	(-20)°C – (+90)°C	35°C	
41	Maximum collector temperature	80°C – 180°C	110°C	
42	Enable temperature 2nd heat generator	0°C – 90°C	60°C/40°C [6]	
43	Maximum solid fuel boiler temperature	30°C – 130°C	90°C	
50	Maximum storage tank temperature	10°C – 130°C	60°C	
	Pump Kick Function (Temperature Test Function)			
60	Kick duration	0.2s – 59s	0 = OFF	
61	Kick pause	10 min – 60 min	30 min	
62	Measuring time for 0.5K increase	1 min – 5 min	1 min	
	Production Estimate			
75	Volume flow fix for collector 1 [litre/min]	0-100	0.0 = OFF	
78	Mixing ratio	0 – 70 vol. %	40 %	
79	Glycol type	0 – 1	0	

Explanation of the Set Values/Functions
In order to modify the standard settings, refer to the chapter 'Electrical connections', select the relevant system according to the hydraulic systems illustrated and define these settings first of all.

The chapter 'Explanation of Set Values/Functions' describes the various set values according to their dependence on the selected/realized system (1-2).

If the controller, e.g. for System 1 is used, only refer to the function descriptions related to this system.

User Set Values
01 Set Time
Set the current time (Indicators, pump kick function and reheating function).

02 Weekday
Set the current weekday (1-7, 1=Monday) (Display only).

Resetting the Production Indicators
03 Day's Production Indicator
System 1 Only (System 2 -> No Function):
Reset the value to "0000" by pressing the Prog key
(for at least 2 seconds). The value is reset to "0000" at 24h.

04 Total Production Indicator
System 1 Only (System 2 -> No Function):
This value is updated at 24:00. => To determine the current total value accurately, the day's production value must be added to the "indicated" total production value. Reset the value to "0000" by pressing the Prog key (for at least 2 seconds).

Pump Kick Function (Temperature Test Function)
System 1 Only (System 2 -> No Function):
The pump kick function can be executed during the time period of the day in which solar production is expected [P05-P06]. This function should ensure that the actual collector temperature can be measured by the collector sensor even when the collector pumps are not operating. The function is deactivated when P05=P06="----" or P60=0.

Each time the kick pause [P61] has ended, the corresponding collector pump is activated for the period of the kick duration [P60] (heat transport to the sensor). If a temperature increase of 0.5K is detected on the respective collector sensor during the measuring period [P62], the collector pump is activated for one minute. Finally, the switch-on conditions for the collector pump are checked.

05 Pump Kick Function Switch-On Time
(Refer to "Pump kick function" section).

05 Pump Kick Function Switch-Off Time
(Refer to "Pump kick function" section).

Fitter – Set Values
20 Enter Code No.
After entering the code number, the set values assigned to the fitter level can be modified. Standard value: 0000.

21 Valid Code No.
The code number currently valid can be modified with this setting (Value only visible after entering the currently valid code No.).

22 System Selection (See Appended Diagrams)
On selecting the system, the function of the device is redefined. Set the system number according to the connection descriptions (System 1 solar or System 2 solid fuel).

! After changing the System Selection parameter, all the set values are reset to the default factory values (including the code No.). The fitter level is closed.

Switching Thresholds/Hystereses
30 Switching Threshold for Difference 1
The feeding function for storage tank I via pump A1 is activated when the temperature difference between sensor F1 (collector) and sensor F4 (bottom of tank) has exceeded the temperature [switching threshold + hysteresis = P30+P31].

The feeding function for storage tank I is deactivated when the difference falls below the set switching threshold.

31 Hysteresis to Switching Threshold for Difference 1.

Special Functions
40 Enable Temperature, Collector
System 1 Only (System 2 -> No Function):
The collector pump is activated when the associated collector temperature exceeds the limit value set here by 5K. It is stopped when the collector temperature falls below the threshold temperature. This function prevents the pumps continuing to run when no relevant heat production is required.

41 Maximum Collector Temperature
System 1 Only (System 2 -> No Function):
The collector pumps are deactivated when the related collector temperatures exceed the safety limits set here. -> System protection The pumps are reactivated when the temperature falls below the temperature [maximum collector temperature – 10K].

12 Differential Controller
User Guide

42 Enable Temperature of 2nd Heat Generator
System 2 Only (System 1 -> No Function):
Pump A1 is activated when the temperature of the 2nd heat generator exceeds the limit value set here by 5K. It is stopped when the temperature of the heat generator drops below the enable temperature. This function ensures that the heat generator can reach its operating temperature.

43 Maximum Solid Fuel Boiler Temperature
System 2 Only (System 1 -> No Function):
The charge pump of the solid fuel boiler is deactivated when the temperature of the boiler exceeds the limit temperature set here . -> System protection.The pump is reactivated when the, temperature falls 10K below the limit value.

43 Maximum Storage Tank Temperature

If a top of tank sensor (F3) is mounted, it is used to monitor the maximum temperature. If this sensor is not installed, the maximum storage tank temperature is monitored by F4. In this case, the tank covering must be taken into account.

The pump is deactivated when the temperature falls below the temperature [maximum storage tank temperature - 5K].

Pump Kick Function (Temperature Test Function)
System 1 Only (System 2 -> No Function):
60 Kick Duration [sec]
Collector pump runtime following pump kick.

61 Kick Pause [min]
If the collector pump has not run for the duration set here, the pump is activated for the kick duration period [P60].

62 Measuring Time for 0.5K Increase [min]
The course of the collector temperature is controlled during this period following a pump kick. If an increase of 0.5K is detected, the pump is started for a further minute.

Production Estimate
System 1 Only (System 2 -> No Function):
The controller can perform an estimated **production calculation**. To do this, enter the average volume flow through the respective collector when the charging pump is in operation [P75]. Refer to page 53 for volume flow rate.

The volume flow is totalled during the runtime of the collector pump.

The controller can calculate the solar heat production from the volume flow and the temperature difference F1 to F4.

For the calculation, the heat transport medium used in the system (glycol type = P79) and the mixture ratio with water [P78] must be set.

The day's production and total production are displayed in [kWh]; in the case of values in excess of 10 MW, the display of the total production changes to [MWh]. The change is indicated in the display by means of three arrows. The total production is updated on the same day. The day's production is reset to zero at midnight. Both values can be reset to zero at user level by means of the Prog key.

75 Volume Flow Fix for Collector 1 [Litre/min]
Enter the average volume flow through the collector while the collector pump is in operation. The accuracy of this value directly influences the accuracy of the production calculation.

78 Mixture Ratio
System 1 Only (System 2 -> No Function):
Refer to the documents supplied for information on the mixture ratio of the heat transport medium (filling of the solar energy system) or ask the installation technician.

79 Glycol Type
System 1 Only (System 2 -> No Function):
(Solar-electricity system documents / installation technician).

0 = Propylene glycol

1 = Ethylene glycol

Pump Blocking Protection
The controller effectively prevents the pumps blocking following longer periods out of operation. The integrated protection function activates all the pumps which have not operated within the last 24 hours each day for approx. 5 seconds between 12:00 and 12:01.

13 Solar Pump Station

13.1 Solar Pump Station

Introduction

A two-line solar pump station which include flow and return isolation valves. All other fittings for safe operation of the system are housed within this unit.

Components

- System bleeding
- Flowmeter
- Special solar pump
- Compact heat insulation
- Shut-off valve with gravity braking
- 6 bar safety valve
- Pressure gauge
- Connector expansion vessel
- Filling and flushing connector

Features & Benefits

- Flow meter - volume flow rate setting
- Solar pump - tailored to solar installation (low volume flow rate - high pressure difference)
- Compact insulation - Efficient and attractive - prevents heat loss
- Stop valves with gravity breaking
- 6 bar safety valve - low vapour build-up - Long service life of component
- Connection to expansion tank - Quick installation
- Flush/filling connections - For high pressure filling unit

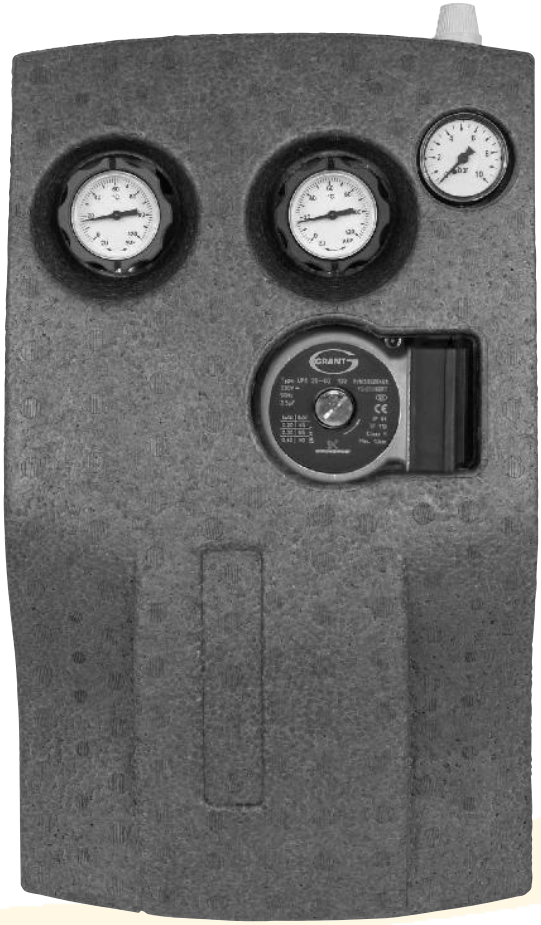


Figure 107: Solar Pump Station

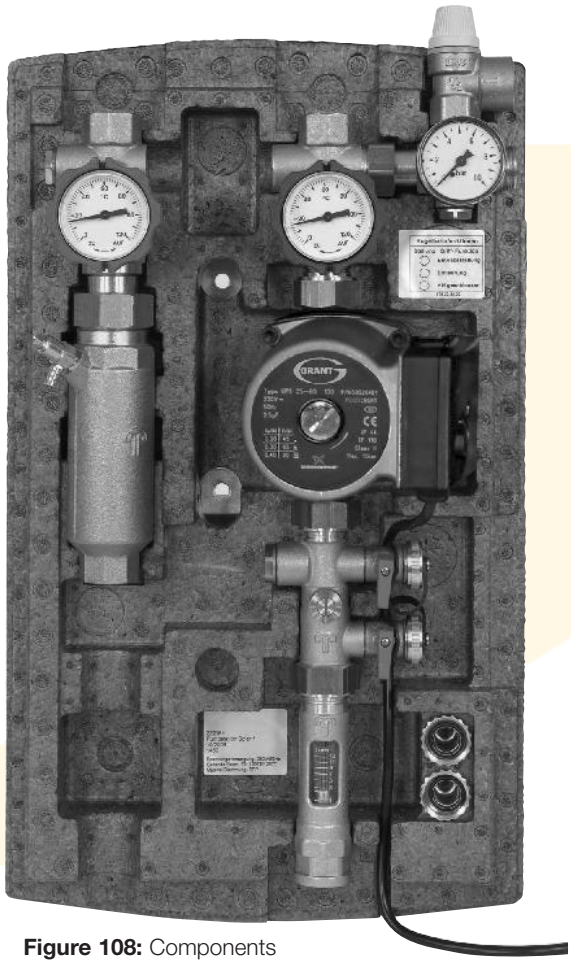


Figure 108: Components

13 Solar Pump Station

13.2 Installation and Operating Instructions for OEM Solar Pump Station

Art. No.s	Description	Circulating pump
222154 Station –1	Solar RS 15/6	GRUNDFOS SOLAR 15-60 130

Technical Data

Operating pressure:	Max. 6 bar
Operating temperature:	Flow: Max. 140°C Return: Max. 120°C
Medium:	Water with max. 50% glycol
Internal dimension:	DN 20
Screw connections:	Flat-sealing union nut G1, 1 ¼"

Materials:

Gaskets:	EPDM
Housing/ connecting parts:	GK-Cu Zn 37 Pb (2.0340.02) CuZn39Pb3 (2.0401)
Insulation:	Expanded polypropylene (EEP) foam
Thermal conductivity:	0.025 W/mK

Item	Description
42	Flow ball valve with thermometer, integrated gravity brake
43	Return ball valve with thermometer, integrated gravity brake
44	Pressure gauge
45	Solar safety valve, 6 bar
46	Circulating pump
47	Flush/fill gate valve
48	Flow meter
49	Air collector
50	Bleed valve
51	Connection supports G ½" IG, closed off with plastic plugs
52	Expansion vessel connector

For maintenance purposes (e.g. pump replacement) the flow and return ball valves must be closed (Figure 109, item 42 and 43)

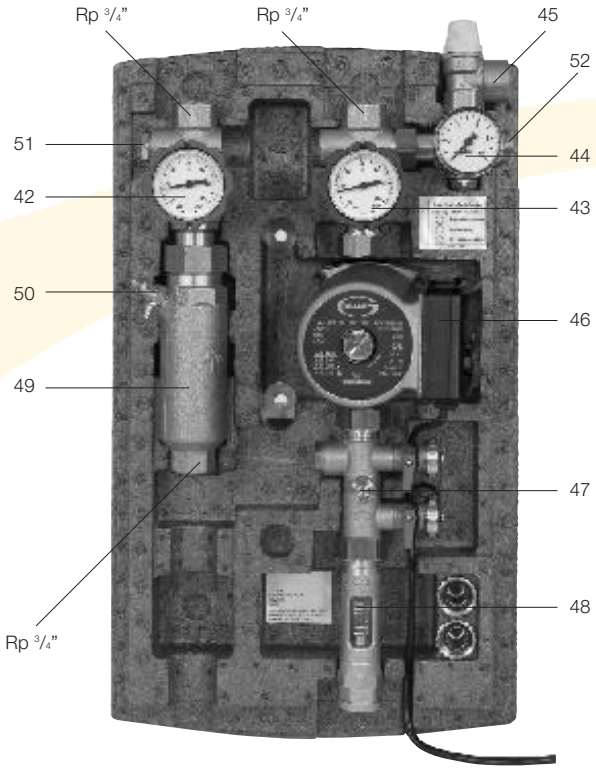


Figure 109: Pump Station Components

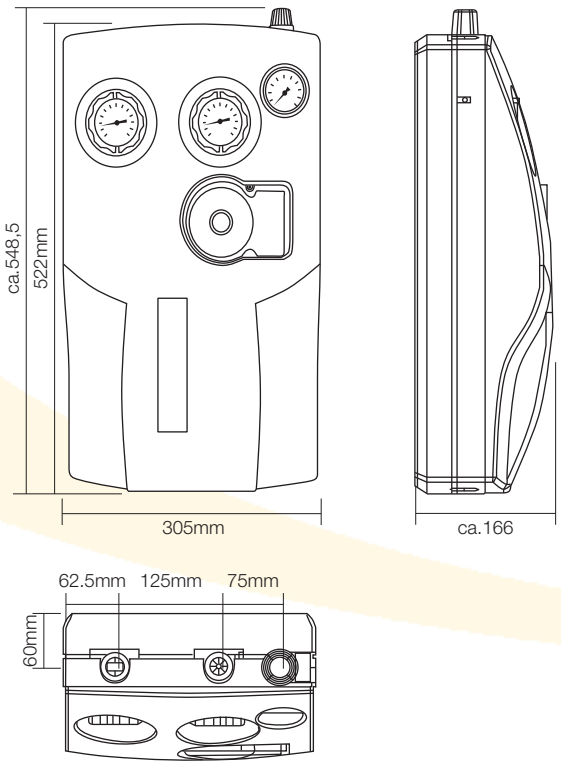


Figure 110: Dimensions

Air Separator
System Air Venting

- **No roof air venting required!**
- Expanded cross-section reduces flow speed
- Venting in “calming zone”
- Upstream installation: High temperature promotes air separation
- Hand aspirator for bleeding air.

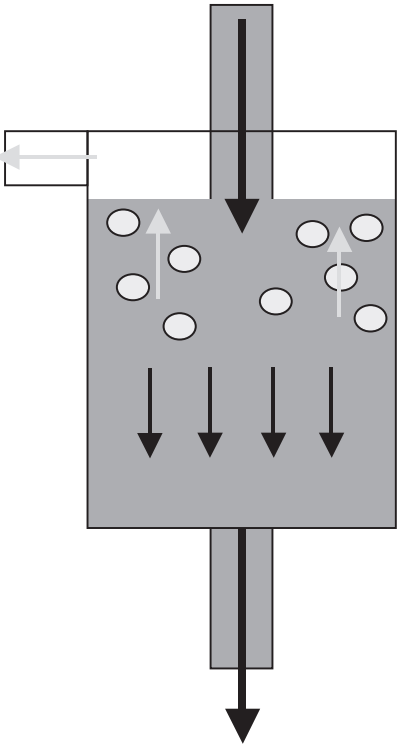


Figure 111: Air Separator

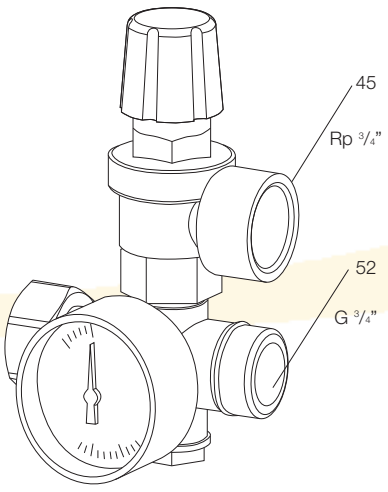


Figure 112: Safety valve and expansion vessel connections

Function of Gravity Brakes
Opening pressure of gravity brakes: 20 mbar each.

The gravity brakes are incorporated into both the flow and return ball valve assemblies. They are operated by turning the handle on the ball valve.

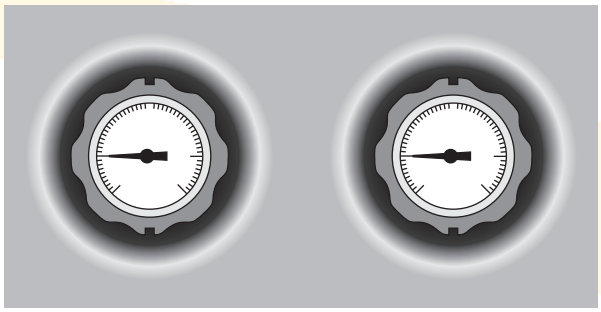


Figure 113: Ball Valve Opened

To prevent the circulation of gravity pressure, the gravity brake must be in the operating position (closed). This means that the slots in the handles are in the vertical position.

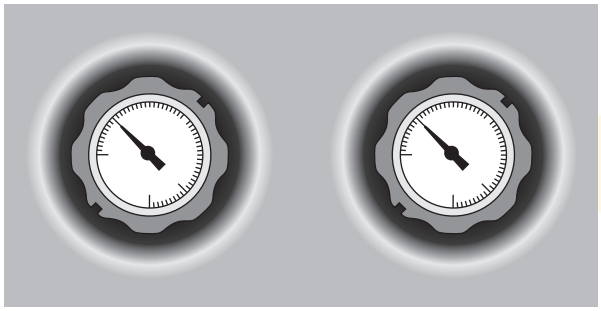


Figure 114: Gravity Brakes Opened

To fill and completely empty the solar thermal installation, the gravity brake is opened by turning the handles to the right. The slots in the handles are at an angle of 45°.

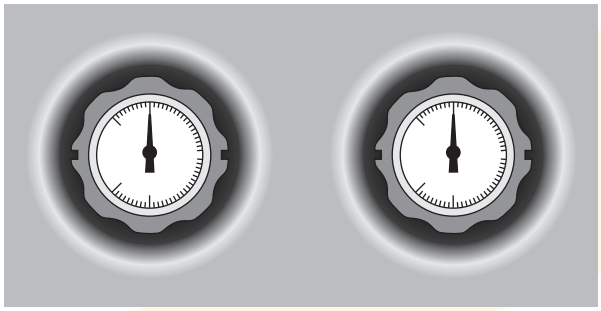


Figure 115: Ball Valve Closed

Turning the handles by 90° to the right. The slots in the handles are in the horizontal position. The ball valves are closed.

13 Solar Pump Station

Connectors
A submersible sleeve with a G ½" outer thread can be screwed into the ball valve (Figure 109, item 51) to enable a temperature sensor to be added.

Wall Mounting

- Drill 2 anchor point holes Ø 10mm, insert anchors
- Screw the entire solar station with the accompanying plates and screws to the wall through the rear insulation jacket

Important:
The solar pump station must only be installed vertically as shown.

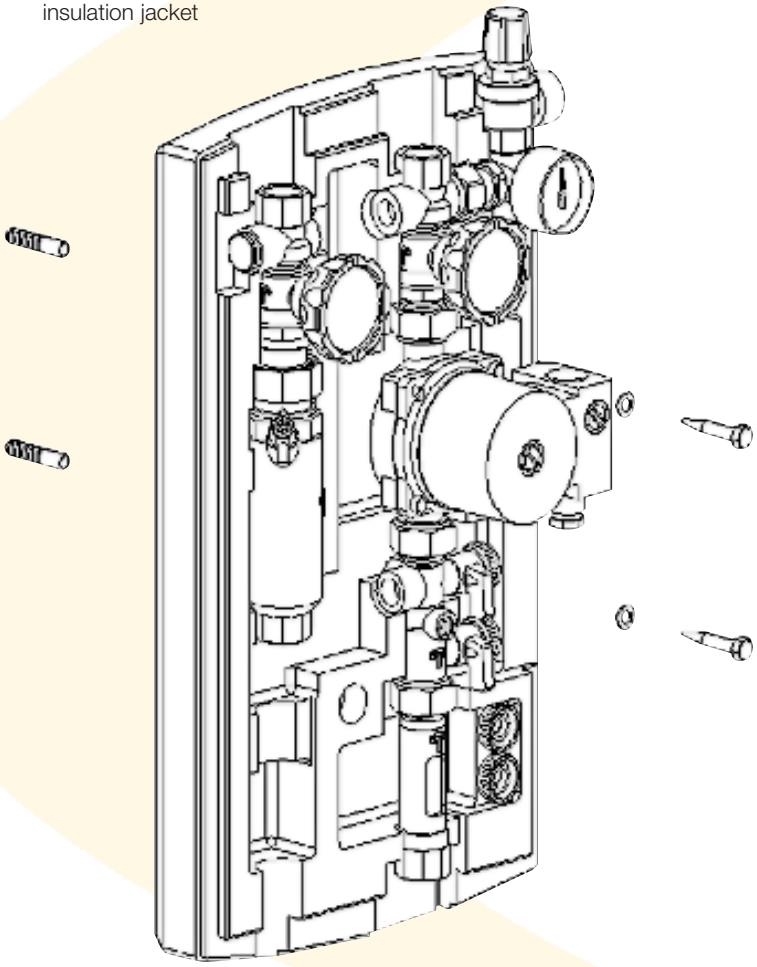


Figure 116: Wall Mounting Fixings

Note: These Instructions are to be left with the Solar System Operator/Building Owner

Item	Description
42	Flow ball valve with thermometer, intergrated gravity break
43	Return ball valve with thermometer, intergrated gravity break
44	Pressure gauge
45	Solar safety valve, 6 bar
46	Circulating pump
47	Flush/fill gate valve
47a	Filling valve
47b	Flushing valve
48	Flow meter
49	Air collector
50	Bleed valve
52	Expansion vessel connector
53	Filling station tank
54	Filling hose
55	Flushing hose
56	Filling station frame
57	Filling pump

For maintenance purposes (e.g. pump replacement) the flow and return ball valve must be closed (item 42 and 43).

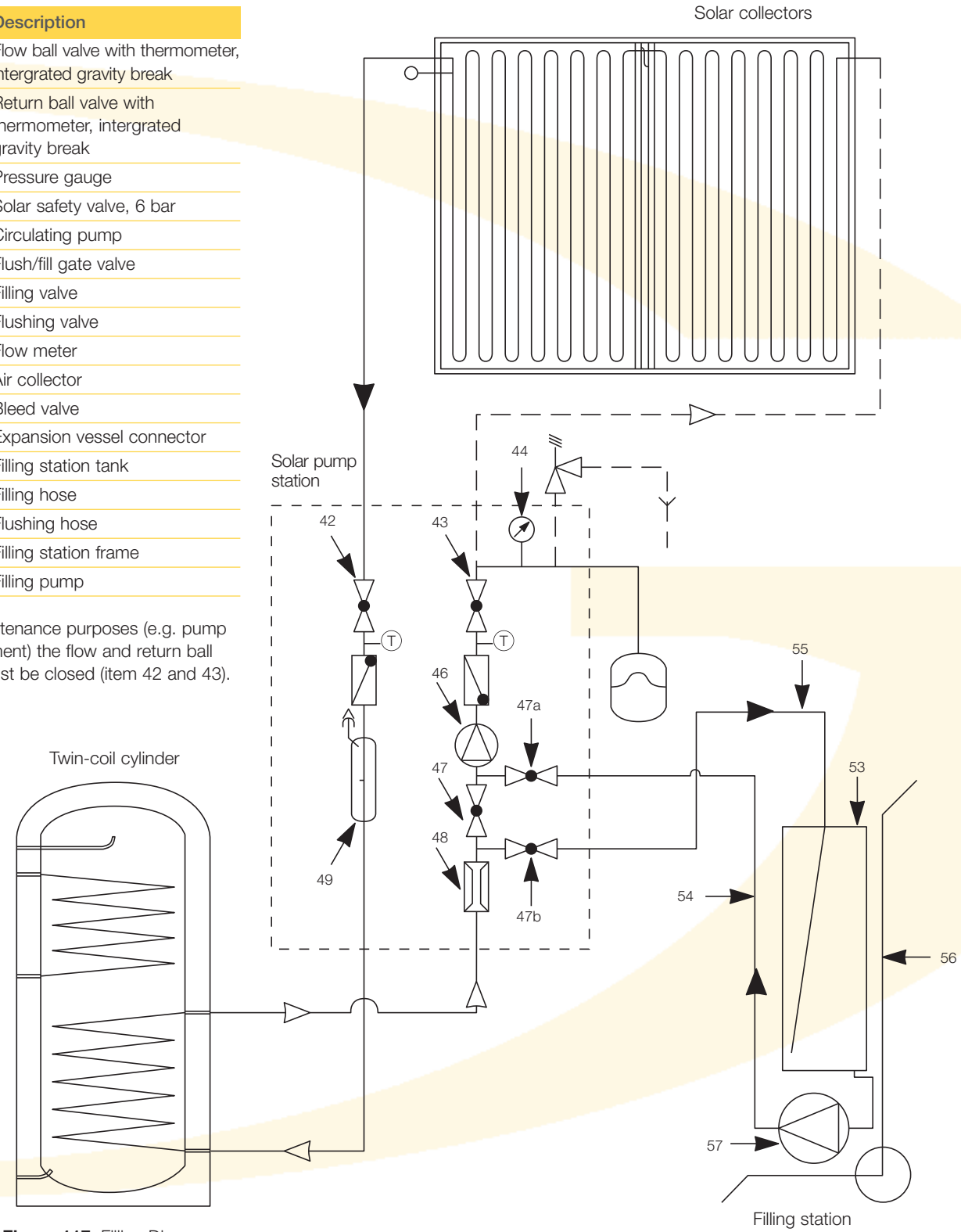


Figure 117: Filling Diagram

14 Commissioning the System

Following installation of the solar collectors and hydraulic connection of the collectors and piping, the system can be filled. When doing so, the thermal conditions and the particular features of the installation must be taken into account. For this reason, the system may only be filled, commissioned and maintained by a suitably authorised technician.

To prevent damage to the system, the heat transporting fluid used to initially fill the system must be consistently used thereafter.

14.1 Heat Transporting Fluid

In order to prevent frost and corrosion damage to the solar collectors and connections, the system may only be filled with a high-quality heat transporting fluid (propylene glycol and water mix). If the recommended ready-mixed fluid is used, this provides adequate frost protection to approx. -24 °C.

14.2 Instructing the Operator

The installer must instruct the system operator in the function, operation and required servicing intervals of the system.

The system operator must be given the instructions for installation and use for safekeeping.

Figure 118: Filling Station

14.3 Filling and Flushing the System

Heat Transfer Fluid

- Blue non-toxic heat transfer fluid
- Practically odourless based on 1.2 propylene glycol
- Good corrosion inhibitor
- Remains stable over long period of time
- Nitrate, phosphate and ammonia free
- 40% solution of propylene glycol in water
- Supplied ready mixed in 10 or 20 litres containers

Filling and Flushing Valves

The stop valves on the flush/fill valve assembly are used for filling and flushing the solar thermal installation.

To enable filling/flushing, the slot in the flush/fill valve spindle must be in the horizontal position. See Figure 120.

Important:
The collectors must be cool before filling the system can commence. The collectors must be covered, to stop solar radiation reaching them, until completion of the filling and commissioning procedure.

Figure 119: Heat Transfer Fluid

Filling the System

Before filling the system, check the expansion vessel charge pressure and adjust as required. Refer to Table 10.

- Connect pressure hose to the filling valve connection and open the valve
- Connect the flushing hose to the flushing valve connection and open the valve
- Using a slotted head screwdriver, close the flush/fill valve. Refer to Figure 120
- Fill the filling station tank with sufficient solar fluid for the system
- Check that Flow and Return ball valves are set half open. Refer to Figure 114
- Using filling station, fill the solar circuit and then flush for approx. 15 minutes
- When the filling pump is running, close the flushing valve and set the system pressure to around 4 - 5 bar
- When the pressure is reached, close the filling valve and immediately switch off the filling pump
- Check that the device is leak-free. If the pressure gauge shows a significant drop in pressure, this points to a leakage in the system

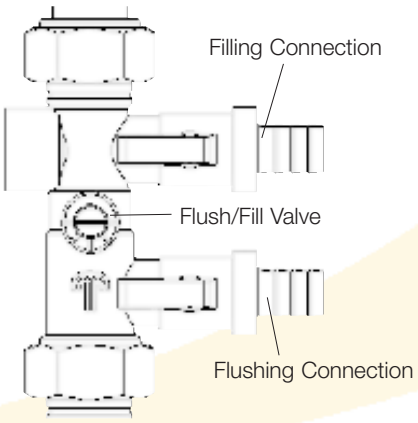


Figure 120: Flush/Fill Valve Closed - For Filling

- Re-open the flush/fill valve
- Switch on the circulating pump (control position “manual”) to the highest pumping level (III) and allow it to circulate for at least 15 minutes
- Set the controller to “stand by” (pump = OFF) and then bleed the system using the hand ventilator on the air jet until the heat transfer fluid begins to escape
- Set the operating pressure (as in Table 10) by carefully opening the flushing valve and releasing the fluid into the catchment tank of the filling pump
- Switch on the circulating pump (controller set to manual)
- Set the flow rate on the flow indicator (as in Table 11) by selecting the appropriate pump speed (I, II or III) and by using the flush/fill valve
- Remove the hoses from the filling connections and screw the caps on the filling and flushing valves. Release the flushing valve first and then the filling valve
- **Note:**
  Now switch the controller to automatic operation

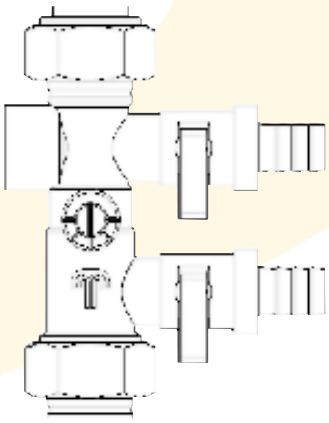


Figure 121: Flush/Fill Valve Open - For Normal Operation

14 Commissioning the System

Table 10: Initial Expansion Vessel Pressure and Operating Pressure

Height Difference (height of collector field - height of expansion tank)	Initial Pressure for Expansion Tank (setting on valve, behind cover cap)	Operating Pressure at 20°C (0.2 to 0.5 mbar greater than initial pressure)
-5m	~1.0 bar	~1.3 bar
< 0m	~1.0 bar	~1.3 bar
< 5m	~1.5 bar	~1.8 bar
< 10m	~2.0 bar	~2.3 bar
< 15m	~2.5 bar	~2.8 bar
> 15m	Separate dimensioning of safety device required	

Table 11: Initial Expansion Vessel Pressure and Operating Pressure

Number of Solar Collectors	≤ 5	6	8	9	12
Type of Connection	Up to 5 in series	2 x 3 parallel	2 x 4 parallel	3 x 3 parallel	4 x 3 parallel
Diameter of forward and return flow pipe	15mm	18mm	18mm	22mm	22mm
Minimum volume flow	2-3 l/min	4-5 l/min	4-5 l/min	6-8 l/min	6-8 l/min

Setting the Flow Rate

The setting of the volume flow for the heat transfer fluid is made via the setting for the revolution levels (I, II, III) of the circulating pump and the restrictor in the flush/fill panel.

The flow indicator displays the volume flow set. The display range is between 1 and 13 litres per minute.

Note:
For larger installations, please contact Grant Technical Department for assistance.

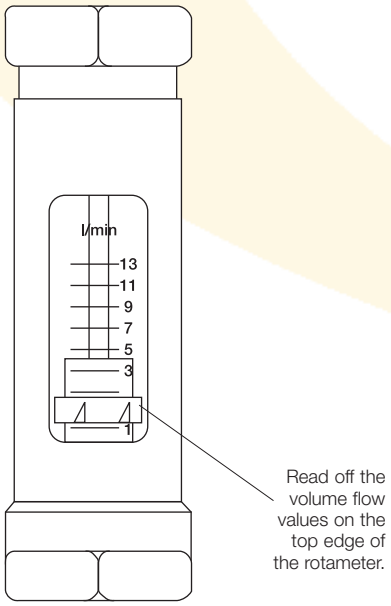


Figure 122: Flow Indicator

Releasing Trapped Air

The residual air from the heat transfer fluid is collected in the air separator and manually released via the air vent.

To do so, push a plastic tube on to the the air vent outlet and catch the fluid that is released in a suitable container.

Ventilation may be carried out only by trained specialists. Unchecked ventilation leads to pressure loss and disruption in the system.

Caution:
Danger of scalding!
The temperature of both the escaping air and the heat transfer fluid can exceed 100°C.

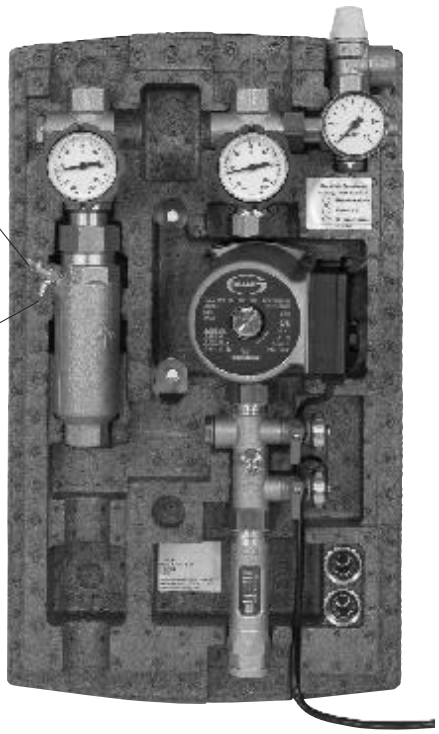


Figure 123: Releasing Trapped Air

15 Commissioning
Commissioning Check List

Grant Solar Thermal	
User Instructions explained and handed over?	Yes/No
Decommission schedule for collector and cylinder left on site?	Yes/No
Installation and maintenance instructions left on site?	Yes/No
Specialist maintenance schedule (including frequency, maintenance and list of parts to be replaced during normal maintenance) left on site?	Yes/No
System drawing indicating hydraulic, valve and electrical connections?	Yes/No
Store commissioning certificate completed and signed?	Yes/No
Conformity declarations for EU directives?	Yes/No
All documentation to be kept visibly near store protected from heat, water and dust. Name of location where documentation is left:	
Glazing format of solar collector:	Flat
Absorber type:	Selective
Net absorber or aperture area.	2.32m² Absorber
Copy of EN 12975 conformity certificate left on site?	Yes/No
What is max design temperature.	°C
Will system prevent collector overheating?	Yes/No
Manufacturer's name:	Grant UK
Unique serial no:	
Maximum stagnation temperature of collector.	209 °C
Maximum design pressure of collector.	10 Bar
Maximum design pressure of pre-heat store exchanger.	10 Bar
Primary pressure limit of weakest component.	Bar
System pressure setting adjusted when cold.	2 Bar
Minimum allowable primary system pressure/level before user action required.	0.5 Bar
Procedure for user to follow if primary pressure/level is below limit.	
Location of primary system pressure gauge.	
Frequency of regular test of pressure safety device:	Yearly
Location of pressure safety device.	Pumpstation
Location of electrical fused isolating switch.	
Fuse rating.	3 Amps
Electrical controls and temperature sensors operating correctly?	Yes/No
Non-solar DHW heating fitted with a thermostat responding to the solar pre-heat store?	Yes/No
Differential pump control setting.	35 °C
Hysteresis setting about differential switching points.	3 °C
Expansion vessel pre-charge.	2.5 Bar
Expansion vessel capacity.	Litres
Expansion capacity suitable to be inherently secure?	Yes/No
Written warning left on site if there's potentially no automatic resumption of normal operation after stagnation?	Not required
Lowest ambient temperature of primary system without freeze damage.	-25 °C
The heat transfer fluid provides freeze protection to.	-25 °C
Type of transfer fluid.	Water/Glycol
Maximum Ambient temp for pump.	30 °C
Minimum ambient temperature for pump.	0 °C
Circulation rate setting. Litres per minute	
Noise at full circulation acceptable.	Yes/No
Direction of circulation through collector heat exchanger matched to sensor positions?	Yes/No

15 Commissioning
Commissioning Check List

Grant Solar Thermal	
Solar pre-heat store type.	Combined with DHW/ Separate from DHW
Solar primary heat exchanger type.	Copper/ Steel/ Plain/ Ribbed
Solar primary heat exchanger area.	m^2
Volume of dedicated solar pre-heat.	Litres
Location of DHW isolation valve.	
Method of anti-scalding in DHW distribution.	
Pump control/thermostatic mixer valve	
Location of digital temperature gauge fitted to monitor risk of DHW overheating.	
Limescale risk to heat exchanger.	Low/ Medium/ High
Limescale control in heat exchanger:	Cleaning hatch/ Thermostat on primary circulation
Expected annual delivered solar energy to taps.	kWh
Expected annual solar fraction of DHW.	per cent
Method of performance calculation.	SAP2005/ Other
Daily DHW load assumption	Litres per day at °C
Date of site visits for bacterial, water quality and access risk assessments.	
Commissioned by	
On behalf of	
Date system commissioned and handed over	
Signature of commissioning engineer	
Signature of user to confirm receipt and understanding (optional)	

16 Notes

EFFICIENT HEATING SOLUTIONS

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EFFICIENT HEATING SOLUTIONS

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