Installation & User Guide

Solar Thermal Systems

On-Roof, Flat Roof
and In-Roof Systems

clearskies

GRANT
EFFICIENT HEATING SOLUTIONS

System Options

On-Roof

Portrait (side by side)

Landscape (one above other)

Portrait (one above other)

Landscape (side by side)

Flat Roof

In-Roof

Portrait (side by side)

Landscape (one above other)

Grant Aurora

The Aurora collector has a slender, extremely durable aluminium frame with a high quality silver adonised finish.

This contemporary look is a stylish feature to accentuate your property and looks great on dark roofs such as slate.

Grant Sahara

The Sahara collector also has a slender, extremely durable aluminium frame but features a tasteful bronze finish.

This blends with most roof types on domestic dwellings, thus providing an aesthetically pleasing solution.

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1 General

The following information is a step-by-step guide to the installation and operating instructions.

1.1 Product Description

Installation kits have been put together as a fixing system for solar panels and must only be used in accordance with their stated structural capability. They are intended for roofs with inclines from 22° to 65°.

In-Roof Systems only:
A water channelling membrane (waterproof membrane) is absolutely necessary. It should end in the eaves (roof guttering). Short-term damp can occur beneath the roof covering on roof inclines smaller than 22° or greater than 65°, or where there are long rafters or joined roofs, and as a result of extreme weather conditions (e.g. driving rain, snow drifts, ice formation and snow covering). This can be avoided by using additional sealing wedges, however adequate rear ventilation must be provided!

Installation kits are designed for roofing comprising standard pantiles. Where roof tiles are particularly high, please speak to your specialist adviser.

If necessary, installation must be modified to suit site conditions. However, this must adhere to any technical and local regulations that are in force. Inappropriate use of the design and changes that are not permitted to the installation invalidate all claims as to liability.

1.2 Package Contents

Solar panels and accessories must be handled with care during storage and transport. If the packaging is damaged during transit, the extent of the damage must be pointed out to the driver.

Prior to installation, check the installation kit for completeness.

Packaging must be disposed of appropriately after installation.

1.3 Organisation of the Installation Instructions

The installation instructions describe the installation of vertical or horizontal solar panels for an integrated roof construction. As the kits are identical up to the point of fixing mounting rails to the building structure, solar panel installation and hydraulic solar panel connection are described in the same chapters.

1.4 Safety Instructions and Symbols

When installing the panels, 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.

In-Roof and On-Roof Systems only:
With both the In-Roof and On-Roof systems uplift may occur. When installing either system please ensure they are installed no less than three tiles in from any edge.

1.5 Safekeeping of the Installation Instructions

The instructions for installation and use should be handed over to the system operator. The operator is then responsible for their safekeeping so that they can be referred to in the future if necessary.

1.6 Installation

Installation must be carried out by appropriately qualified personnel. The installer is also responsible for compliance with the applicable legislation, regulations, accident prevention regulations, and generally recognised technical regulations and standards.

All electrical work must be carried out by a qualified electrician and must conform to the applicable standards, specifications, safety regulations and the requirements of the local electricity supplier.

1 General

1.7 Equipment and Materials to be Provided

- Temperature sensor
- Heat conducting paste for temperature sensor (optional)

Roof-Mounted Installation:

- 2 ventilation tiles/flashing for the solar panel connection kit
- Fixing bolts for mounting 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: Weights

Flat Roof installation	Up to 8 m
1 solar panel	290 kg
2 solar panels	580 kg
3 solar panels	870 kg
4 solar panels	1160 kg
5 solar panels	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.

Integrated Roof Installation:

- 2 ventilation tiles
- 2 roof battens (corresponding to existing roof battens). For length, see horizontal sizes in section 3, 3.2 or 3.3
- Fixing bolts for mounting battens
- 4 wood screws approx. 3.9x25 mm

1.8 Tools Required

Roof-Mounted and Flat Roof Installation:

- 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

Integrated 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 panel carrying handles

Commissioning:

- Filling station

1 General

1.9 Standards and Guidelines

DIN EN 12975: Thermal solar energy systems and their components - Solar panels.

2 Package Contents

2.1 Standard Installation Kits and Roof Fixings

Article	Standard 2 Panel Kit	Standard 3 Panel Kit	Standard 4 Panel Kit	Standard 5 Panel Kit
Mounting rail	2	2	2	2
Mounting hook	4	6	8	10
Cylinder bolt	8	12	16	20
Fixing bracket	8	12	16	20
Anchor block	8	12	16	20
Installation and operating instructions	1	1	1	1
On-Roof installation				
Roof anchor	6	8	12	14
Mounting battens (batten-mounted installation only)	4	4	6	6
Flat Roof installation				
Flat roof angle bracket	3	3	4	5
Securing cruciform kit	1	1	1	1

3 Dimensions & Fixing Intervals

3.1 On-Roof System Installation

Position of Roof Anchors and Mounting Rails

Figure 1. On-Roof Installation kit 1

Figure 2. On-Roof Installation kit 2

Figure 3. On-Roof Installation kit 3

Figure 4. On-Roof Installation kit 4

Figure 5. On-Roof Installation kit 5

3 Dimensions & Fixing Intervals

3.2 Flat Roof System Installation

Position of Roof Anchors and Mounting Rails

Figure 6. On-Roof Installation kit 1

Figure 7. On-Roof Installation kit 2

Figure 8. On-Roof Installation kit 3

Figure 9. On-Roof Installation kit 4

Figure 10. On-Roof Installation kit 5

3 Dimensions & Fixing Intervals

3.3 In-Roof System Installation

Position of Roof Anchors and Mounting Rails

2-5 Solar Panels, Vertical, Side by Side

Figure 11. Solar panels

Figure 12. Solar panels

Figure 13. Solar panels

Figure 14. Solar panels

Note: Dimensions include cover frame

3 Dimensions & Fixing Intervals

3.3 In-Roof System Installation

Position of Roof Anchors and Mounting Rails

2 Solar Panels, Horizontal, Side by Side / 2 Solar Panels, Vertical One Above the Other

Figure 15. Solar panels

Figure 16. Solar panels

2-5 Solar panels, horizontal, One Above the Other

Figure 17. Solar panels

Figure 18. Solar panels

Note: Dimensions include cover frame

3 Dimensions & Fixing Intervals

3.3 In-Roof System Installation

Position of Roof Anchors and Mounting Rails

2-5 Solar Panels, Horizontal, One Above the Other

Figure 19. Solar panels

Figure 20. Solar panels

Note: Dimensions include cover frame

4 On-Roof System Installation

4 On-Roof System Installation

4.1 Installation Summary

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

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

Figure 21. Installation Summary, Vertical Solar Panel Layout

4 On-Roof System Installation

4.2 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 22. Dimensions of Roof Anchor A

Figure 23. Horizontal and Vertical Alignment

3. Place roof anchor (03) 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 24. Installation of Roof Anchors A

4 On-Roof System Installation

4.3 Roof Anchors Not Fixed to Rafters

1. On tiled roofs, additional mounting battens are fixed to the roof substructure. Roof anchors ‘B’ are hooked into and fixed 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 tiles is sufficient. Horizontal positioning of roof anchors is dependent on the rafters and the tile valleys.

Figure 25. Dimensions of Roof Anchor B

Figure 26. Horizontal and Vertical Alignment

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

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

4. In the tile valley, hook roof anchor (17) into the 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 (follow roof tile valleys).

Figure 27. Fixing Mounting Battens and Roof Anchors

4 On-Roof System Installation

4.4 Roof Anchors Fixed to Slate Tiles

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 28. Horizontal and Vertical Alignment

Figure 29. Horizontal and Vertical Alignment

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

   Note:
   The distance of 185 mm 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.

Figure 30. Fixing Mounting Battens and Roof Anchors

4 On-Roof System Installation

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.

Figure 31. Roof Covering with Roof Anchors

Figure 32. Fixing the Mounting Rail

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 panels:
   See page 37

Figure 33. Aligning the Mounting Rail

Now go to Section 7.

5 Flat Roof System Installation

5 Flat Roof System Installation

5.1 Installation Summary

The standard installation kit allows solar panels 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	Panel to panel connection kit
08	Cylinder anchor bolt
09	Fixing Bracket
11	Hydraulic connection
12	Insulation
13	Temperature sensor
14	Mounting hooks

Figure 34. Installation Summary, Vertical Solar Panel Layout

5 Flat Roof System Installation

5.2 Standard Installation Kit

Collector Carrying Handles (optional extra)

Anchor block

Collector connection kit (bent)

Mounting Rail

Collector to collector connection kit

Punching Bolt (15) and Cylinder Bolt (08)

Securing cruciform

Fixing Bracket

Flat Roof Angle Bracket

Temperature Sensor (supplied with controller)

5 Flat Roof System Installation

5.3 Flat Roof System Installation

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

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

Figure 35. 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 36. Fixing Using Interlocking Bolt

Figure 37. Installation of the Second Flat Roof Mounting Bracket

5 Flat Roof System Installation

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 39. 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 38. Installation of the Second Flat Roof Mounting Bracket

Figure 40. Fixing the Securing Cruciform and Mounting Rail

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/m^2, 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 41. Fixing Additional Flat Roof Mounting Brackets

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

Figure 42. 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 flat solar panels to be fitted horizontally or vertically onto horizontal mounting rails.

Item	Description
04	Mounting rail
14	Mounting hook
29	Rafters
30	Waterproof membrane
31	Cross-batten
32	Roof battens
33-A	Top cover plate, left
33-B	Top cover plate, right
34-A	Side cover plate, left
34-B	Side cover plate, right
35	Mounting board
36-A	Bottom cover plate, left
36-B	Bottom cover plate, right
37	Mounting batten
38-A	Base plate, side section
38-B	Base plate, centre
39	Sealing screw
40	Cover
41	Grip with nail

Figure 43. Installation Summary, Vertical Solar Panel Layout

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 8/9. 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 (30)) is absolutely essential.

Figure 44. Remove Roof Covering

2. Remove the last roof tile in the row and push on the lower fixing batten (37) as far as the next roof tile.

   Secure the horizontal fixing batten to the cross-batten ensuring a vertical interval of 220mm from the roof batten below.

   Note:
   Horizontal fixing battens (37) are constructed for 30 m roof battens (32). For thicker roof battens, the horizontal fixing battens must be appropriately padded!

   Note:
   The bolts for fixing the horizontal fixing battens must be provided by the customer.

   Do not use sealing screws (39)!

Figure 45. Lower Horizontal Fixing Batten

Figure 46. Bolt Comparison

6 In-Roof System Installation

3. Calculate the horizontal dimension for the left lower cover plate:

   fit the last covering tile (bottom left), mark the right edge on the lower horizontal fixing batten (37) and remove the tile again.

   From the mark, 110 mm to the left = start of the lower cover plate.

4. Place the **left** lower cover plate (36-A) flush to the left on the horizontal fixing batten (37), pushing the edge up to the horizontal fixing batten (37) on from the top.

   Secure the left lower cover plate using two **small wood screws approx. 3.9x25 mm (by others)** in the horizontal fixing batten (37).

   Note:
   The lead flashings are supplied folded in. Open out before installation of the lower cover plate! **Do not** carry out modification of the lead flashing of the lower cover plate (36-A and 36-B) and do not remove the protective film from the butyl tape.

5. Apply the right lower cover sheet (36-B) overlapping and align to outer dimension. Mark the left end on the left lower cover sheet, remove the protective film from the butyl tape of the right lower cover sheet and lay on top of it the lower cover sheet. Then secure using small screws (Fig. 48 Installation of Lower Cover Sheet).

Outer dimensions (mm) (In-Roof)				
Qty	vertical side by side	horizontal side by side	horizontal one above the other	vertical one above the other
2	2602	4402	4402	2305
3	3791	-	4402	-
4	4980	-	4402	-
5	6169	-	4402-{}-	-

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

Figure 47. Horizontal Calculation for the Lower Fixing Batten

Figure 48. Installation of Lower Cover Sheet

Figure 49. Installation of Additional Lower Cover Sheets

6 In-Roof System Installation

6. Align the top horizontal fixing batten (37) flush with the lower horizontal fixing batten. Secure with screws (by others) to the cross battens.

Interval A (mm) (In-Roof)				
Qty	vertical side by side	horizontal side by side	horizontal one above the other	vertical one above the other
2	2290	1390	2580	2578
3	2290	-	3770	-
4	2290	-	4960	-
5	2290	-	6145	-

7. Place the fixing battens (35) onto the lower horizontal fixing battens (37). The horizontal starting point is the left edge o the left lower cover sheet. The vertical position is determined by Fig. 52 Vertical Dimension for Mounting Battens.

Layout	B	C
Vertical	544	594
Horizontal	994	1044

Note:
The outer distance B for horizontal fixing battens is 50mm smaller!

8. The vertical distance between mounting battens must match the illustration.

Caution:
Fix mounting battens (35) with screws (by others) only on roof battens and not on the lower cover sheets (36-A and 36-B).

Figure 52. Vertical Dimension for Mounting Battens

Figure 50. Top and Bottom Horizontal Fixing Batten

Figure 51. Fixing Mounting Battens

6 In-Roof System Installation

Figure 53. Installation of First Section

6.3 Sections & Side Cover Sheet Assembly

Caution:
Side section assembly is always:

from left to right and in row order **from the bottom upwards.**

9. Place the first side section (38-A) **left** with the **narrow** flange between the fixing battens and align it flush with the edge of the lower cover sheet in accordance with the next illustration. Secure the section using a **sealing screw (39)** centrally in the flange of the left ridge base.

   Caution:
   Screw the sealing screw in the right corner to the sheet!

   Note:
   The side sections (38-A) are 50mm narrower than the centre sections (38-B).

10. Place the first **centre** section (38-B) to the left so that the ridge bases overlap on the horizontal fixing battens. Align vertically and secure against slipping using a **sealing screw (39)** at the centre of the top flange.

11. Fix all further sections in the same way.

    Note:
    The last section is a narrow section (38-A).

Figure 54. Installation of Further Sections

Figure 55. Installation of Last Section

6 In-Roof System Installation

12. Note:
    Section assembly is the same for horizontal, one above the other installation, in that the top sections must overlap as far as the markings.

    The markings must still be visible.

Figure 56. Section Assembly (one above another)

13. Push side cover sheets, left (34-A) and right (34-B) under the outer slopes of the sections.

    Note:
    The inner edges of the side cover sheet must be **under** the outer section edges.

Figure 57. Fixing the Side Cover Sheets to the Side Sections

Note:
For horizontal, one above the other installation there are two types of left and right side cover sheets.

The side cover sheets with chamfered standing seams must be fixed to the top sections. They are covered later by the top cover sheets.

Figure 58. Fixing the Side Cover Sheets to the Side Sections

6 In-Roof System Installation

Figure 59. Grip Installation on Side Cover Sheet

Figure 60. Grip Installation on Side Cover Sheet

Figure 61. Grip Installation on Side Cover Sheet

14. Secure the side cover sheets (34-A and 34-B) using grips (41) on the outer edge on the roof battens.

    Note:
    The bevelled sides of the slopes must be at the top, the long legs point outwards.

    For horizontal, one above the other installation, overlapping of the side cover sheets is oriented to the long sides of the sections. Installation of one above another side cover sheets is also from the bottom up.

15. Place the **left** top cover sheet (33-A) flush to the left of the sections (38-A) and (38-B) and to the left side cover sheet, pushing the edge from the top, up to the top horizontal fixing batten.

    Remove the protective film from the butyl tape of the right top cover sheet (33-B) and place the right cover sheet (33-B) with the seam to the horizontal fixing batten and place it on the section.

Figure 62. Installation of Left Top Cover Sheet

16. Secure the top cover sheet with a sealing screw (39) on the top flange of each section.

    Note:
    Butyl tape has strong adhesion and mistakes cannot be corrected after application!

6.4 Installation of Blanking Plates & Mounting Rails

17. Push blanking plates between fixing battens and the section flanges (38-A and 38-B). They must finish flush with the section ends.

    Fixing is completed later when the mounting rails are attached.

Figure 63. Installation of Blanking Plates

18. Mark out 110mm on the top flanges. Remove the protective films from the butyl tapes of the bottom mounting rails (04) and place the bottom mounting rails (04) in accordance with the illustration **precisely** on the top flanges.

    Note:
    Butyl tape has strong adhesion and mistakes cannot be corrected after application!

    It is important that butyl tape lies between the to flange and the mounting rail where the hole is.

19. Check correct positioning of the blanking plates (40) and fix the mounting rail (04) to the fixing batten using sealing screws through the pre-drilled holes.

Figure 64. Installation of Bottom Mounting Rail

6 In-Roof System Installation

6.5 Installation of the Top Mounting Rail

20. Install the top mounting rail (04) so that the outer edges are flush with the outer top flange edge.

Figure 65. Installation of the Top Mounting Rail

22. Secure the top mounting rail (04) for horizontal, one above the other installations in the same way, referring to the intervals shown.

Note:
The lengths given in Fig. 66 Installation of further Mounting Rails must be observed. Intervals have been optimised for the hydraulic connection pipes and solar panel field connection kits.

Figure 66. Installation of further Mounting Rails Horizontal, One Above the Other

6 In-Roof System Installation

6.6 Closing the roof

23. Close the roof.

    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 sheeting before closing the roof area.

Figure 67. Closing the Roof Area (Right)

23. Roof tiles above the solar panel 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

Figure 68. Closing the Roof Area (Top)

24. For vertical, side by side and horizontal, side by side layouts, ventilation tiles must be fitted left and right above the solar panel field for pass through of pipes and sensor cables.

    For horizontal, one above the other layouts, the ventilation tiles must be placed alongside the solar panel field on one side at the top and bottom.

    Note:
    The ventilation tile pass-through must be large enough for the connection hoses **incl. Thermal insulation** and sensor cable.

Figure 69. Installation of Ventilation Tile/Flashing

Now go to Section 7.

7 Installation of Solar Panels

Figure 70. Possible Solar Panel Connections for Vertical, Side by Side Panels

7.1 Installation Sequence of Solar Panels for In-Roof Systems Only

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

- *If the installation kit contains **straight** clamping ring fittings, these **must** be installed **during** solar panel installation.*

Figure 71. Possible Solar Panel Connections for Horizontal, One Above the Other Panels

- *If the installation kit contains **angled** clamping ring fittings, these **must** be installed **after** solar panel installation.*

Figure 72. Possible Solar Panel Connections for Horizontal, Side by Side and Vertical, One Above the Other Panels

- *Inlet connection (A) and outlet connection (B) for the solar panel field is left to free choice.*

  Caution:
  Locate the solar panel temperature sensor (19) in advance of the solar panel field outlet (A).

7 Installation of Solar Panels

7.2 Installation of Solar Panels

1. Note:
   Do not carry the solar panels by their connecting supports. Use carry handles!

   To install carry handles, fit anchor blocks (05) to the solar panel profile and fix the carry handles using two cylinder bolts M8x14 (08).

2. Fit two mounting hooks (14) per solar panel 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 panels

   Distance c :
   Solar panel layout, vertical approx. 800mm

3. Place the first solar panel on the mounting rail/mounting hook and align.

   Distance to left-hand mounting rail edge = 39mm

4. Remove carry handles from the first solar panel and attach them to the next solar panel.

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 73. Fixing the Carry Handles

Figure 74. Positioning the Mounting Hooks

Figure 75. Installing the Anchor Blocks for the Fixing Brackets

7 Installation of Solar Panels

Figure 76. Fit Anchor Block/Mounting Hook

For In-Roof Systems Only

2. *Fit two mounting hooks (14) per solar panel 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 panels

   Distance c :
   Solar panel layout, vertical approx. 800mm
   Solar panel arrangement, horizontal approx. 1800mm

3. *Clip in anchor block (05) – with the ball side facing in – at the left end of the top mounting rail (04) and position it so that the outer fixing bracket (09) can be fixed flush to the end of the mounting rail and in the solar panel groove.*

4. *Place the first solar panel on the mounting rail/mounting hook and align.*

   Distance to left-hand mounting rail edge = 39mm

5. *Remove carry handles from the first solar panel and attach them to the next solar panel.*

Figure 77. Lower Fixing for First Solar Panel

7 Installation of Solar Panels

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

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

7. Secure the solar panel using two further fixing brackets on the opposite side:

   - Place anchor blocks in the mounting rails
   - Hook fixing brackets in the solar panel
   - Secure using cylinder bolts M8x14

Figure 78. Hook Fixing Brackets in the Solar Panel Profile

8. Place the clamping ring fitting (11) on the connectors of the first solar panel.

   For In-Roof Systems Only
   Note:
   The clamping ring fittings can be assembled after fixing the solar panels.

   In-Roof Systems Installation continues on page 40.

9. Hook two further mounting hooks into the lower mounting rail, see Fig. 74, Positioning the Mounting Hooks.

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

Figure 79. Align Anchor Block for Additional Fixing Brackets

11. Place anchor blocks for the second solar panel 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 panel profile.

Figure 80. Hook Fixing Brackets in the Solar Panel Profile

13. Push the second solar panel up to the first solar panel and secure the fixing brackets using cylinder bolts M8x14.

    Note:
    Take care with clamping ring fitting!
    Guide the second solar panel's connectors into the clamping ring fitting!

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

Figure 81. Align Second Solar Panel

7 Installation of Solar Panels

Figure 82. Distance Between Mounting Hooks

Figure 83. Hook Fixing Brackets in the Solar Panel Profile

Figure 84. Align Second Solar Panel

For In-Roof Systems Only

9. *Place anchor blocks for the second solar panel in the mounting rail and align so that the fixing brackets can be fixed finally side by side.*
10. *Fit two mounting hooks (14) per solar panel in the lower mounting rail.*

    For intervals, see Fig. 76, Fit Anchor Block/Mounting Hook
11. *Place another solar panel on the mounting rail/mounting hooks and remove the carry handles.*
12. *Install fixing brackets into the solar panel profile.*
13. *Push the second solar panel up to the first solar panel, or slide it down until the fixing brackets lie side by side. Secure fixing brackets using cylinder bolts M8x14*

    Note:
    Take care with the solar panel compression connection (Fig. 84 Align Second Solar Panel and anchor block for additional fixing brackets)!

    Guide the second solar panel's connectors into the compression connection!
12. *Continue in the same way to install additional solar panels.*

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 panel can be damaged!

2. After successfully checking the seal of the solar energy units, place thermal insulation (12) around the hydraulic connection, and remove the protective film from the adhesive strip to apply it.

3. Continue in the same way to install additional solar panels.

4. Inlet connection **(A)** and outlet connection **(B)** for the solar panel field is left to free choice.

   Caution:
   Locate the solar panel temperature sensor (19) in advance of the solar panel field outlet **(A)**.

5. Push back the thermal insulation on the solar panel field connection kit, place the compression connection onto the connectors and secure.

6. Take the temperature sensor seal (13) out of the solar panel hole at the inlet connection and push it over the temperature sensor. Finally, guide the temperature sensor fully into the hose sleeve of the solar panel and seal by re-inserting the temperature sensor seal.

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

Figure 88. Connection of Temperature Sensor

Figure 85. Hydraulic Connection

Figure 86. Fit Thermal Installation

Figure 87. Solar Panel Field Attachment

8 Hydraulic Connections

8.2 Compression Connection, Landscape for In-Roof Systems Only

1. *Push back the thermal insulation (12) on the solar panel field connector (11) and push the compression connection onto the solar panel connectors.*
2. *Tighten the nuts on the compression connection (11). After successfully checking the seal on the solar energy unit, push the thermal insulation up to the solar panel.*

   Caution:
   Apply opposite force when tightening the compression connection, otherwise the pipes on the solar panel can be damaged!
3. *Continue in the same way to install additional solar panels.*

Figure 89. Hydraulic Connection, Landscape View

8.3 Hydraulic Solar Panel Connection for In-Roof Systems Only

1. *Push back the thermal insulation on the solar panel field connection set, place the compression connection onto the connectors and secure.*
2. *Take the temperature sensor seal (13) out of the solar panel hole at the inlet connection and push it over the temperature sensor. Finally, guide the temperature sensor fully into the hose sleeve of the solar panel and seal by re-inserting the temperature sensor seal.*

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

   Note:
   Thermal transmission between the hose sleeve and the temperature sensor can be improved by the application of thermal conducting paste.
3. *After successfully checking the seal on the solar energy unit, push the thermal insulation up to the solar panel.*

Figure 90. Connection of Temperature Sensor

9 Roof Penetrations

9.1 Roof Penetration

1. Increase the holes in the ventilation tiles (20) to allow the pipes to pass through, or remove the grille inserts.

For On-Roof Systems Only

2. *Directly beside the solar panel connections, exchange the roof tile for a ventilation tile (20) or flashing.*

For In-Roof Systems Only

3. *Re-seal the roof covering directly beside the ventilation tile (20) or flashing. In most cases, it is sufficient to push up the roof tiles.*

Figure 91. Ventilation Tile

Figure 92. Lead Flashing

Figure 93. Solar Panel Field Attachment for On-Roof Systems

Figure 94. Solar Panel Field Attachment for In-Roof Systems

9 Roof Penetrations

4. Push the thermal insulation for the solar panel connection kits (06) up to the solar panel. Afterwards, guide the connection kit pipes through the ventilation tile and connect them.
5. 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 (30).

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

Figure 95. Detail View of Solar Panel Field Connection - On-Roof Systems

Figure 96. Detail View of Solar Panel Field Connection - In-Roof Systems

Figure 97. Detail View of Solar Panel Field Connection - On-Roof Systems

Figure 98. Detail View of Solar Panel Field Connection - In-Roof Systems

Figure 99. An Example of Passing Through the Waterproof Membrane

10 Differential Controller Installation

Figure 100. 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

Information on installation of the system is provided in section 10 Differential Controller Installation, see pages 45 to 54 of this manual, together with connection diagrams.

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

Safety Information

Declaration of Conformity

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.

10 Differential Controller Installation

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):
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: KLF1000; F4+F3: SPF

10 Differential Controller Installation

10.2 Sensors

F1:

- KLF 1000: collector sensor without spring;
- silicone cable 2.5m;
- PT1000 sensor with 1kΩ +/- 0.2% at 0°C:

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

F3 + F4:

- SPF: Storage tank sensor with spring;
- PVC cable, 3.0m;
- NTC sensor with 5 kΩ +/- 1% at 25°C:

Temperature in °C	Resistance in Ω
-20	48,535
-10	27,665
0	16,325
10	9,950
20	6,245
30	4,029
40	2,663
50	1,802
60	1,244
70	876
80	628
90	458
100	339
110	255
120	194

10.3 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 5kΩ NTC +/- 1% at 25°C

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.

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 defect	The storage tank sensor has short circuited or 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 User Guide

11.1 Electrical Connection

Figure 102. Electrical Connection

11.2 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 pumps are 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.

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

11 User Guide

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

Figure 103. 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 104. Temperature Display

11.3 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.

! It is still necessary to enter the number of the system installed [P22] (refer to 'Modify set values').

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.

11.4 Explanatory Information

Modify Set Values

prog — 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.

prog — 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).

11 User Guide

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	016	
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	6	
22	Select system (see hydraulic diagrams)	1 - 7	6	
	Switching Thresholds / Hystereses			
30	Switching threshold for difference 1	1K – 30K	4	
31	Hysteresis to switching threshold for 1	1K – 10K	1	
	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	

11 User Guide

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 or System 2).

! 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.

11 User Guide

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].

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]. The volume flow can be established by installing a counter for a short time by calculation (installation technician).

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.

Guideline for Volume Flow Quantity:
Approx. 0.8 [l / min] sq. meter of collector surface.

Caution! This value does not apply to low flow systems.

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.

12 Solar Pump Station

12.1 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.

Figure 105. Solar Pump Station

Components

- System bleeding
- Integrated solar regulation
- 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 106. Components

12 Solar Pump Station

12.2 Installation and Operating Instructions for OEM Solar Pump Station

Art. No.s	Description	Circulating pump
222154	Solar Station –1	WILO RS 15/6
222458	Solar Station –1.1	

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 ¹/₄”	
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 Stopcock with thermometer
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 ¹/₂” 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 (fig. 107, item 42 and 43)

Figure 107. Design

Figure 108. Dimensions

12 Solar Pump Station

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 109. Air Separator

Figure 110. SIV/MAG Connection

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

The gravity brakes (SKB) are incorporated into both the flow and return ball valve assemblies. They are operated by turning the handle on the ball valve (fig. 112).

Figure 111. 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 112. SKB Opened

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

Figure 113. 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.

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Figure 114. Filling Diagram

12.3 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 solar concentrate in water
- Available ready mixed
- Supplied in 10 or 20 litres containers

Figure 115. Heat Transfer Fluid

Filling and Flushing Valves

The KFE stop valves on the flush/fill valve are used for filling and flushing the solar device.

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

Figure 116. Valve Closed - For Filling

Figure 117. Valve Open - For Normal Operation

Filling the System

- Connect pressure hose to the filling valve and open the valve
- Connect the flushing hose to the flushing valve and open the valve
- Using a slotted head screwdriver, close the flush/fill valve
- Fill the containers of filling station with sufficient solar fluid for the system
- 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 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 manometer shows a significant drop in pressure, this points to a leakage in the system
- 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 1) 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 2) 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

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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	

Initial Expansion Vessel Pressure and Operating Pressure

Number of Solar Panels	≤ 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

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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 2 and 8 l/min or 2 and 16 l/min.

Note:
For larger devices or if the minimum volume flow required exceeds 8 l/min, the flow indicator of the solar station should be replaced with a flow indicator having a display range of 2 - 16 l/min.

Figure 118. 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 119. Releasing Trapped Air

12 Solar Pump Station

Connectors
A submersible sleeve with a G ½" outer thread can be screwed into the ball valve (fig. 107, 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

Figure 120. Wall Mounting Fixings

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

13 Commissioning

Following installation of the solar panels and hydraulic connection of the panels 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.

13.1 Heat Transporting Fluid

In order to prevent frost and corrosion damage to the solar panels 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.

13.2 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 121. Filling Station

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