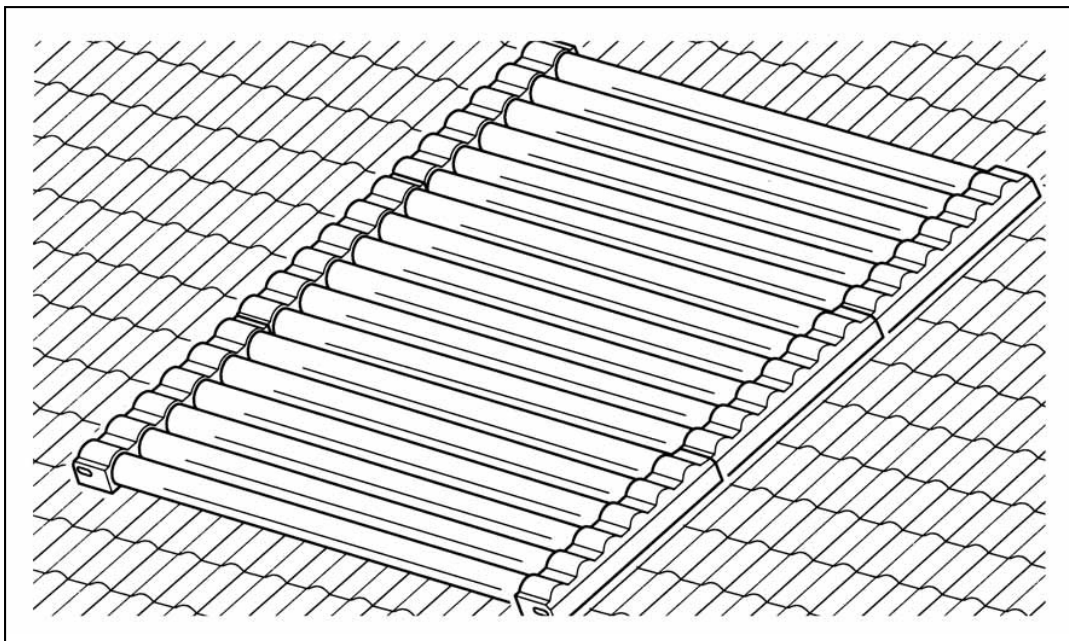
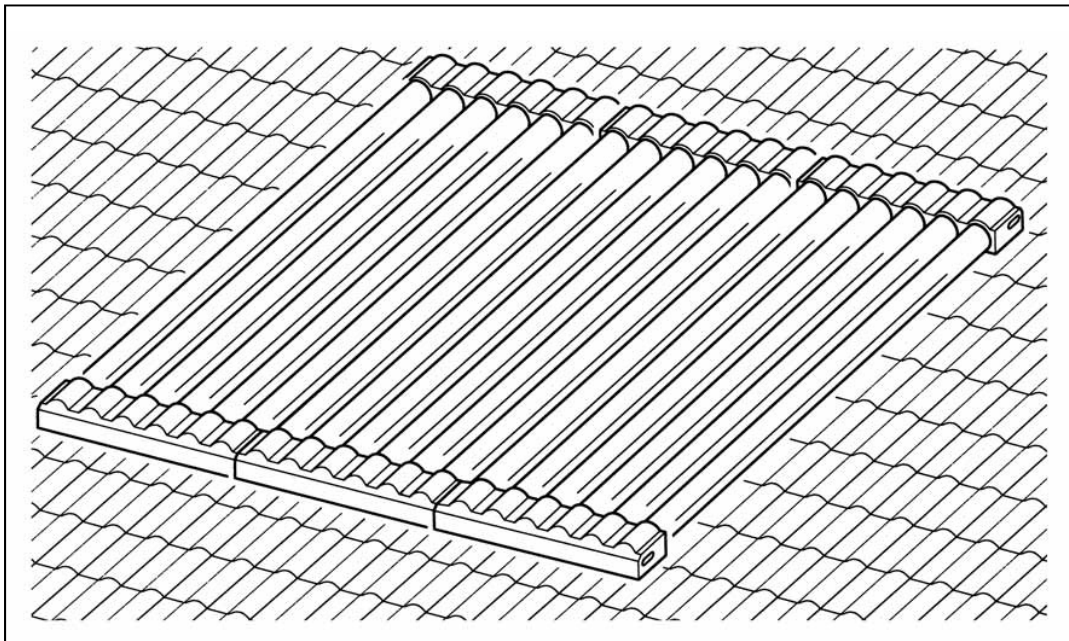


Strebel **AS 100-DF6** Solar Tube Collectors

Installation Instructions



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Who are these instructions aimed at?

These installation instructions have been written for specialists who are authorised to carry out work in this area (installation trade).

They must have the required basic knowledge and be well informed of the relevant accident prevention measures.

1. Safety instructions

The accident prevention regulations (APR) for work on roofs must be observed.

If necessary, use barriers to prevent any parts falling down.

According to APR, when carrying out work on a roof people must either use safety harnesses or there must be safety scaffolding.

Suitable measures must be taken to prevent the collector slipping during installation.

Do not fill systems in sunlight. There is a risk of scalding caused by emitted steam. If necessary, cover the collectors or wait for the sun to go in.

Never fill the system with water or perform a pressure test on it if there is a risk of frost. Even with air temperatures of 5°C frost damage could occur due to the irradiation of heat in the cold night sky.

2. Required resources and tools

A minimum of the following materials and tools are required for the installation of the collectors:

- Piece of chalk, chalk line
- 2 ladders, scaffolding etc.
- Rope, approx. 8 – 10 m long, at least 6.5 mm thick.
- Spirit level
- Drill and drill bit set
- Allen Key (5mm)
- Socket wrench with ratchet, bolt and extension (SW 17 mm)
- Spanner wrench (SW 17 mm)
- Adjustable spanner wrench (up to approx. SW 30 mm)
- Set of screwdrivers (3-4 sizes)
- Angle grinder with cut-off wheel for stone
- Jigsaw with wood and metal blades
- Spanner 5 + 6 mm
- Spanner 8 mm (contained in the scope of delivery)
- Phillips screwdriver

3. Installation

3.1 General instructions on fixing the collectors to a roof

If the collectors are stored temporarily before the start of installation, it must be ensured that they are kept dry and away from any sunlight. We recommend that Solar Collectors are completely covered during the installation process.

WARNING:

Installation of the Solar Collectors must be carried out in a situation where the panels are not exposed to any sunlight. Failure to do so may damage the panels and/or be a safety risk.

Warranty of the equipment may be invalidated if damage occurs as a result of panels being exposed to sunlight prior to the installation being complete.

Exposure of the panels to sunlight will cause any moisture in the tubes to become super-heated. If the Glycol Solution is added to a panel which has been exposed to sunlight, there is a risk of scalding due to the solution becoming super-heated upon contact with the collector/s.

It must be checked that the roof construction is in a sound condition (construction inquiry and structural calculations could be required).

The fastening elements for the installation of the collectors are calculated and designed to withstand a snow load of 0.75 kN/m² and a wind load of 0.5 kN/m² (DIN 1055 and DIN 18800). If the loads are higher than this, more roof clamps must be used or shingle sheeting must be placed underneath.

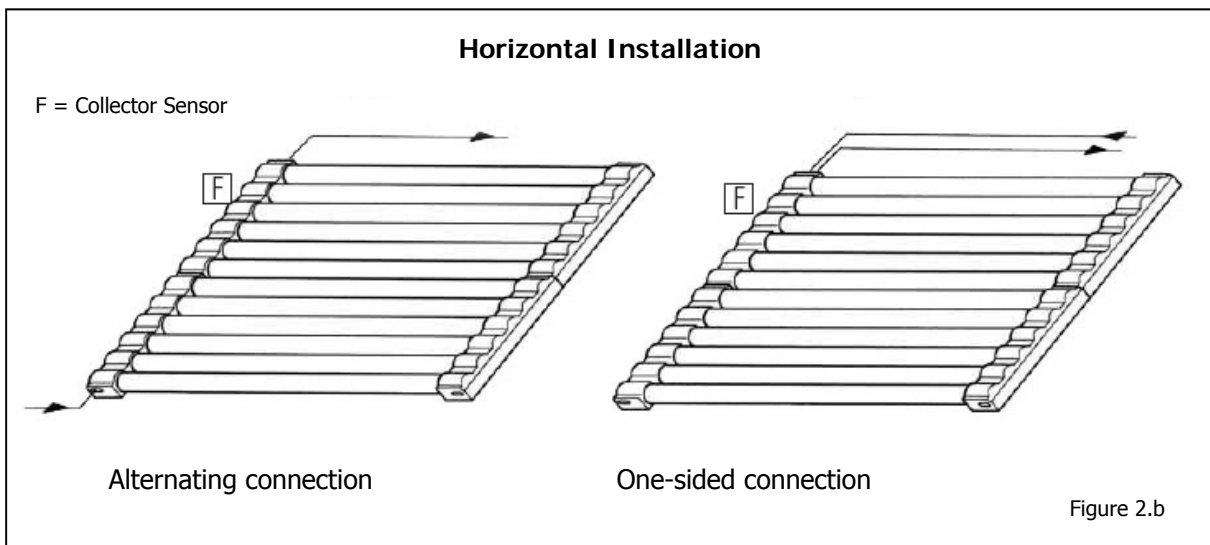
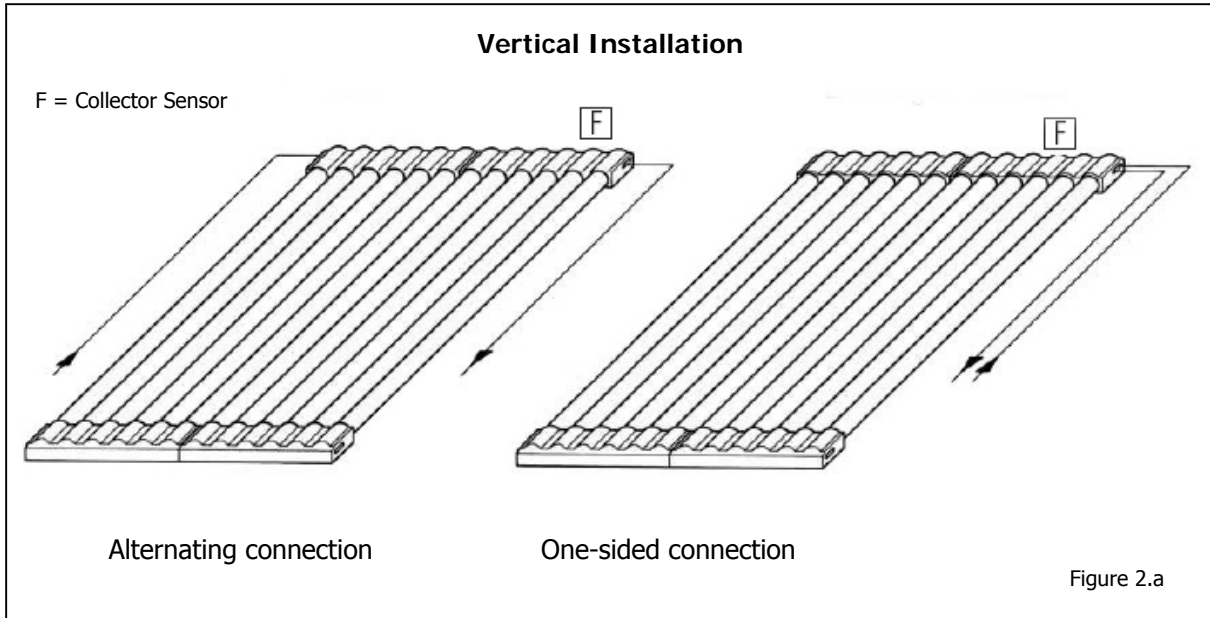
Note:

Installation work on concrete roof tiles may only be carried out with extreme caution during the usual hardening time of approx. 6 months.

When installing collectors more than 1m below the ridge, a snow-collecting grid must be installed immediately above the collector field. If possible the collectors should face south.

3.2 Connection possibilities

The collectors can either be installed vertically or horizontally. In both cases the connection can be one-sided or can alternate, see figure 2.a & 2.b.



Important:

When carrying out horizontal installation with alternating connection it must always be ensured that the direction of flow is from the bottom to the top to guarantee venting. The direction of flow is marked with arrows on the housing.

Important:

When carrying out horizontal installation the connecting lines must be installed from above to guarantee that venting.

3.3 Combination possibilities

Figure 3 and the table below show some combination possibilities. When there is high-flow, a maximum of 6 collectors can be connected in series, and when there is low-flow the maximum is 8 collectors. Several groups can be connected in parallel as a reverse return system. Different combinations are always possible, the great range of possibilities means that only a few examples can be shown here.

If groups of different sizes are to be connected, a temperature-resistant (up to at least 150°C) pressure regulator is needed to adjust the pressure loss.

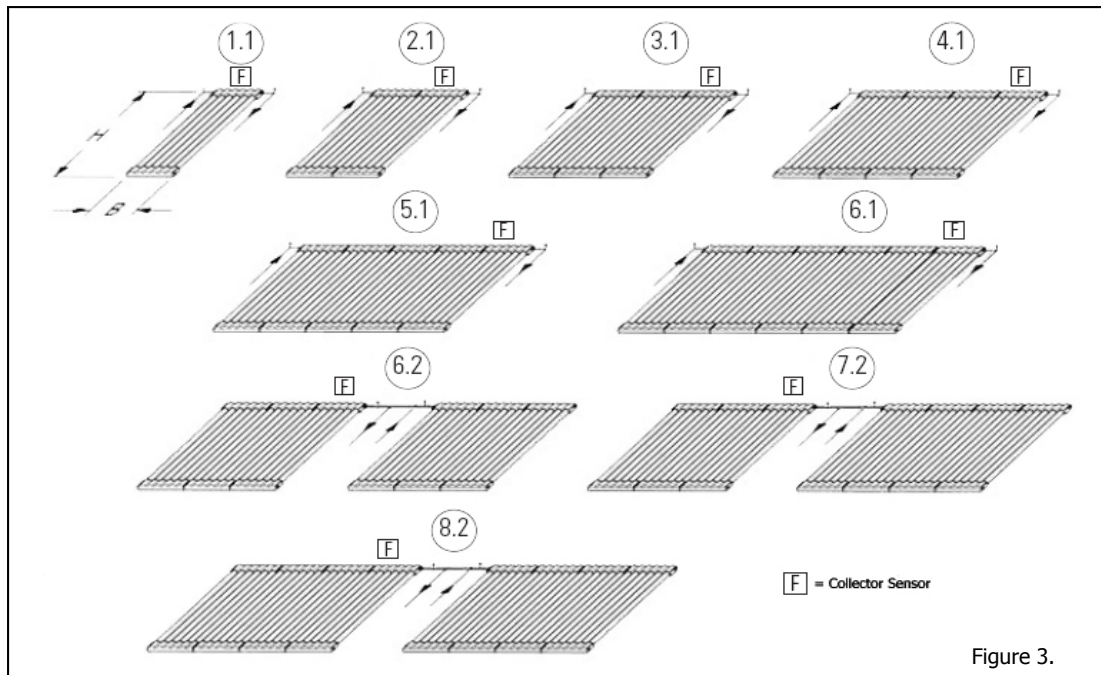


Figure 3.

Drawing Number	No. of Collector Sensors	No. of Collectors without Sensors		Required installation area WxH (mm)
1.1	1	-	1 x 1-piece installation set	720 x 2250
2.1	1	1	1 x 2-piece installation set	1140 x 2250
3.1	1	2	1 x 3-piece installation set	2180 x 2250
4.1	1	3	1 x 4-piece installation set	2880 x 2250
5.1	1	4	1 x 5-piece installation set	3600 x 2250
6.1	1	5	1 x 6-piece installation set	4320 x 2250
6.2	1	5	2 x 3-piece installation set	2160/2160 x 2250
7.2	1	6	1 x 3-piece & 1 x 4-piece installation set	2160/2880 x 2250
8.2	1	7	2 x 4-piece installation set	2880/2880 x 2250
9.2	1	8	1 x 4-piece & 1 x 5-piece installation set	2880/3600 x 2250
10.2	1	9	2 x 5-piece installation set	3600/3600 x 2250

Important:

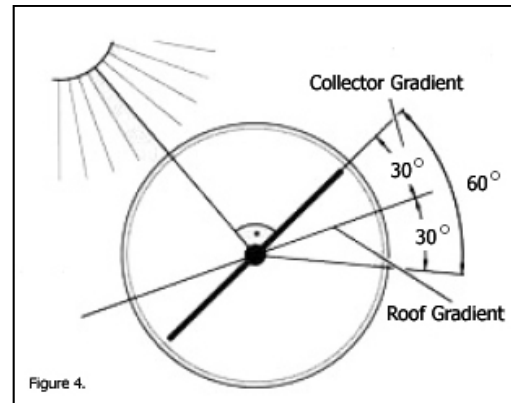
When the collector groups are in 2 different directions, an additional sensor and special regulation will be required.

3.4 Absorber gradient

Note: The absorber gradient may only be set when the system is un-pressurised.

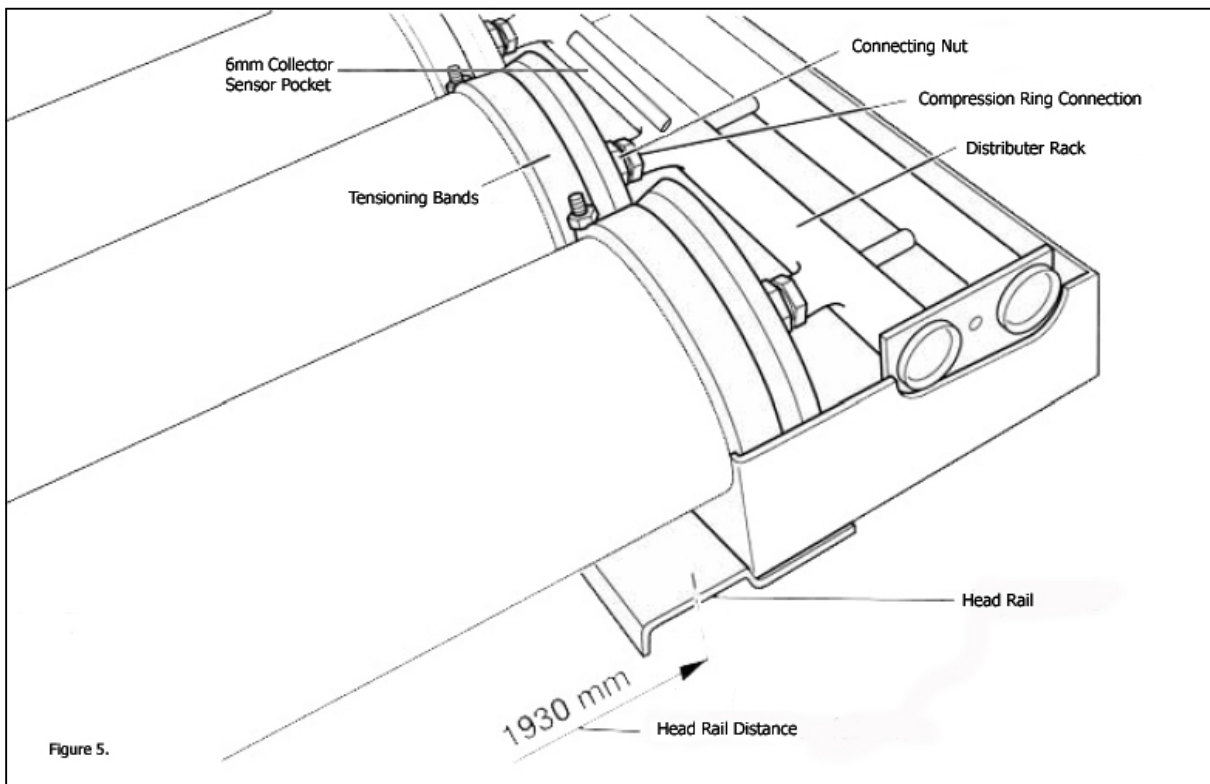
If the system is not south-facing or the gradient is anything other than the ideal gradient (approx. 40°), the individual vacuum tubes can be rotated by $\pm 25^\circ$. Example figure 4.

- Open both collector housings and pop out the heat insulation.
- Loosen the upper and lower tensioning bands (M8 nuts).



Important: If the absorber gradient is set before the collectors are installed, it must be ensured that the distance of the head rail (1900 mm) (figure 5) does not change.

- Loosen the compression ring connection to the vacuum tubes. To do this, hold the connection to the distributor rack with a spanner wrench and at the same time open each of the connecting nuts with a spanner wrench (figure 7).

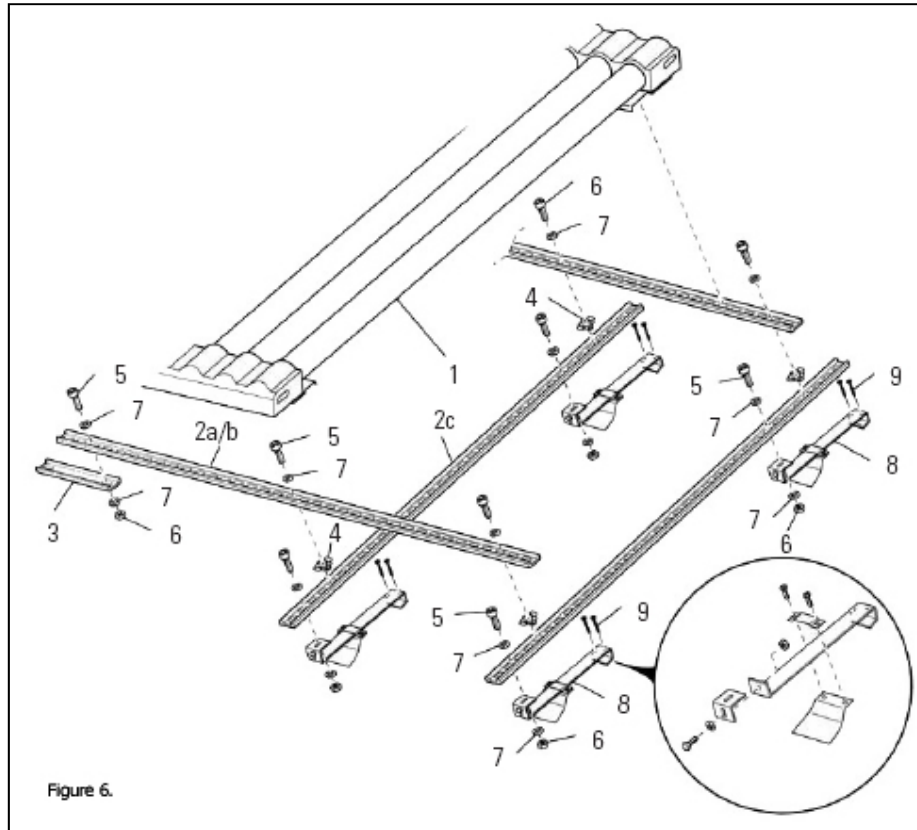


- Set each individual vacuum tube to the required gradient. The gradient of the absorber can be checked using a protractor or using a template.
- Retighten the compression ring connection to the vacuum tubes (torque 15Nm).
- Carry out a leak test.
- Push in the heat insulation and shut the housing.

3.5 Collector installation work sequence

3.5.1 Fastening elements

Fastening elements for one or more collectors according to the table below.



Fastening set components for tiled pitched roofs, flat roofs and fascias		Quantity					
Ser. no.	Description	1 collector	2 collectors	3 collectors	4 collectors	5 collectors	6 collectors
1	Collector	1	2	3	4	5	6
2a	Installation rails 720 mm	2	-	-	-	-	-
2b	Installation rails 1440 mm	-	2	-	4	2	-
2c	Installation rails 2160 mm	2	2	5	3	6	9
3	Rail connector	-	-	-	2	2	2
4	Wing nut MKN-FW VZ 10	4	4	6	6	8	10
5	Cheese head screw M10 x 20	8 (4*)	8 (4*)	12 (6*)	16 (10*)	20 (12*)	24 (14*)
6	Nut M10	4 (-*)	4 (-*)	6 (-*)	10 (4*)	12 (4*)	14 (4*)
7	Washers A 10.5	??	??	10 (8*)	20 (14*)	32 (18*)	38 (18*)
8	Roof clamps	4 (-*)	4 (-*)	6 (-*)	6 (-*)	8 (-*)	10 (-*)
9	Spax screws with internal star (Torx) 5 x 30	8 (-*)	8 (-*)	12 (-*)	12 (-*)	16 (-*)	20 (-*)
10	Spax screws with internal star (Torx) 5 x 60	4 (-*)	8 (-*)	10 (-*)	12 (-*)	14 (-*)	

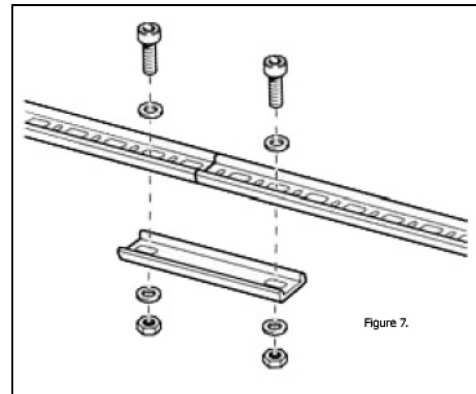
* Different numbers for flat roofs/fascia assembly are given in brackets

3.5.2 Vertical and horizontal roof installation of collectors

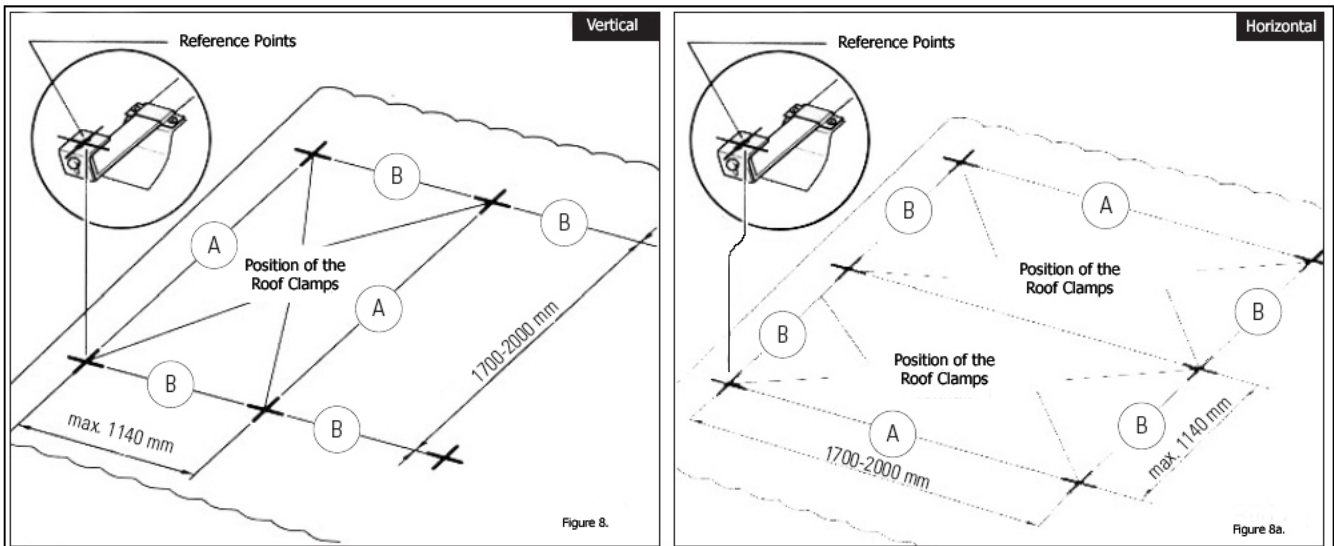
It must be determined whether the collectors should be installed vertically or horizontally on the roof. If the roof gradient is between 25° and 65° the collectors can be installed either vertically or horizontally.

Important: If the roof gradient is smaller than 25° or larger than 65° the collectors may only be installed horizontally. When installing the frame it must be ensured that the collectors are arranged so that the collector field can be ventilated.

A. If necessary, pre-assemble the supporting rails
If more than 3 collectors are used, the supporting rails must be extended to be flush with each other, see figure 7.



B. Mark the position of the roof clamps
Mark the position of the roof clamps in accordance with figure 8/figure 8a.



Important:
Distance B may not be any larger than 1140 mm.
The overhang of the guide bars over the roof clamps may be a maximum of 300 mm.
Distance A is between 1700 and 2000 mm.
Always position the roof clamps in the trough of the roof tiles.

C. Check the load-carrying capacity of the roof battens and screw together

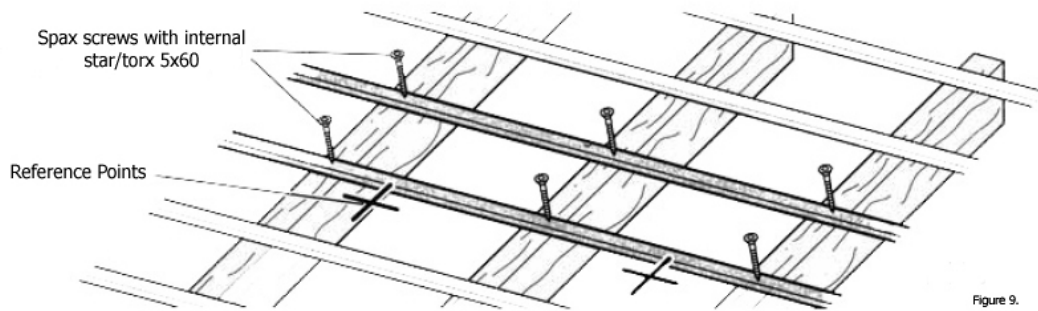


Figure 9.

- Test the roof battens needed for fastening for their load-carrying capacity and screw together with Spax screws with internal stars (Torx) 5 x 60.

D. If necessary, grind the roof tile joints to be flat for the positioning of the roof clamps

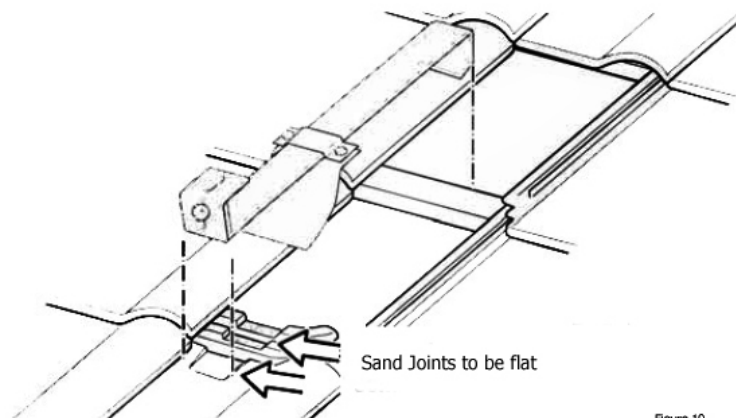


Figure 10.

- The roof clamps must lie flat on the roof tile.

E. Connect the roof clamps and screw down

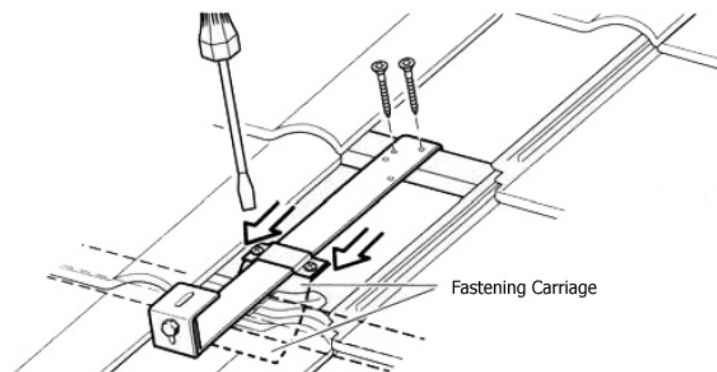


Figure 11.

- Connect the roof clamps and secure with two Spax screws with internal stars (Torx).
- Push the fastening carriage on a block under the lower roof batten and screw down. The fastening carriage will prevent the roof clamp lifting up. In the case of very thick roof tiles, bend back the rim of the fastening carriage so that it reaches under the batten and not just under the roof tile.

F. Cover the roof completely again

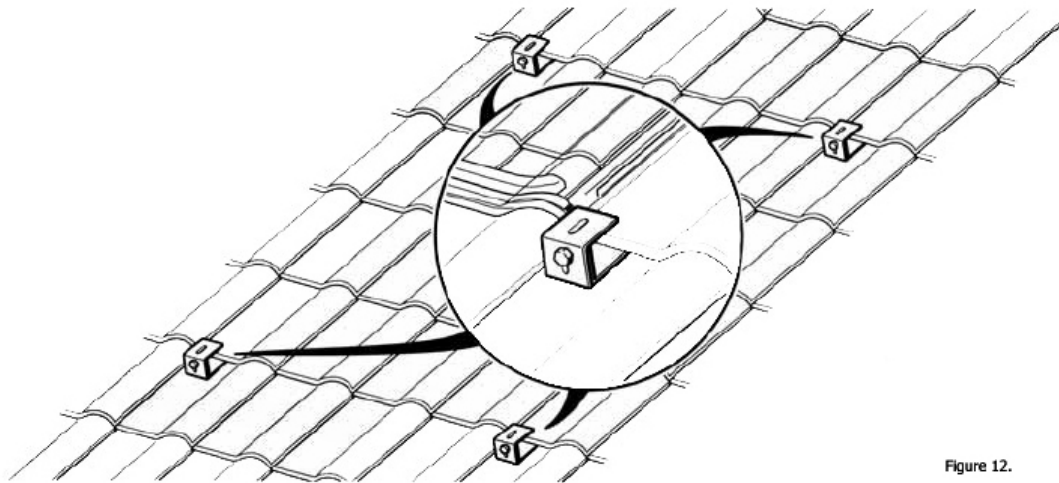
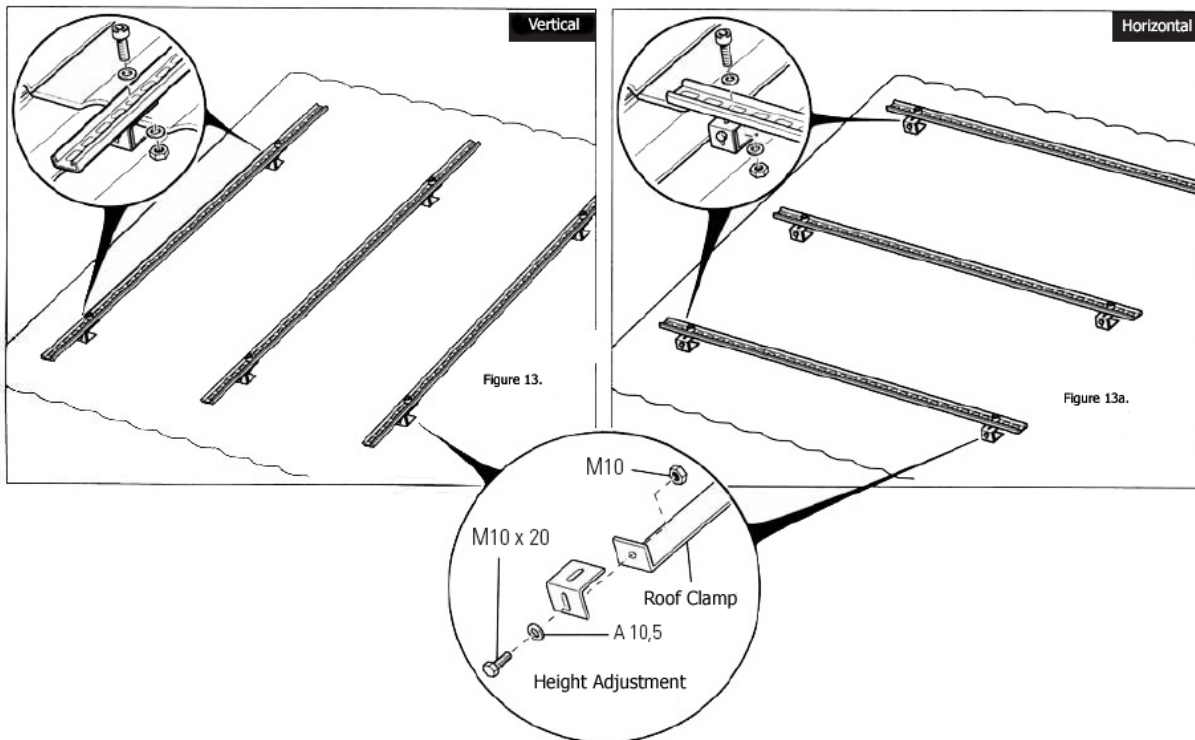


Figure 12.

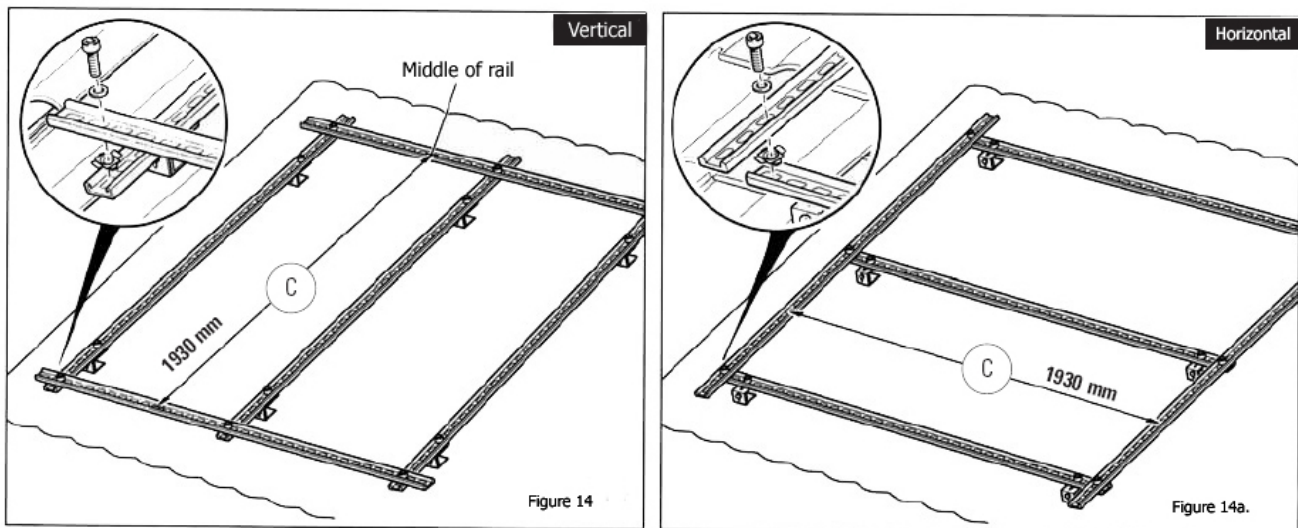
G. Install the guide rails



The guide rails are always parallel to the vacuum tubes.

- Install the guide rails. One Allen screw M10 x 20 with 2 flat washers and stainless steel nuts must be used for each roof clamp.
- If the distance between the guide rails and roof tiles is tight, use the height adjustment on the roof clamps to increase the distance, see detail on figure 13.

H. Install the supporting rails



- Install the supporting rails on the guide rails at distance C (1900 mm). For each rail, use an Allen screw with flat washer and a wing nut to do this.
- **Important! Make sure that measurement C is accurately complied with!**

I. Install the collector

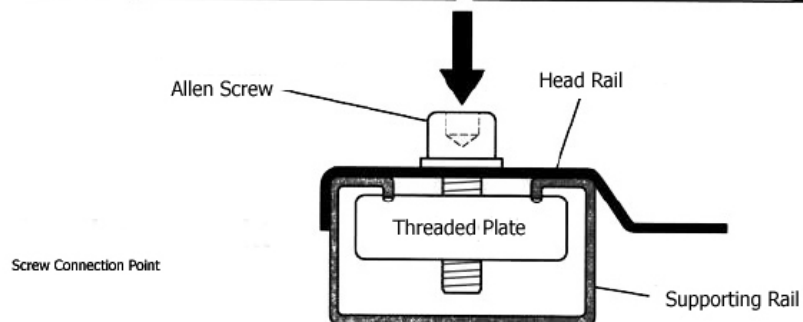
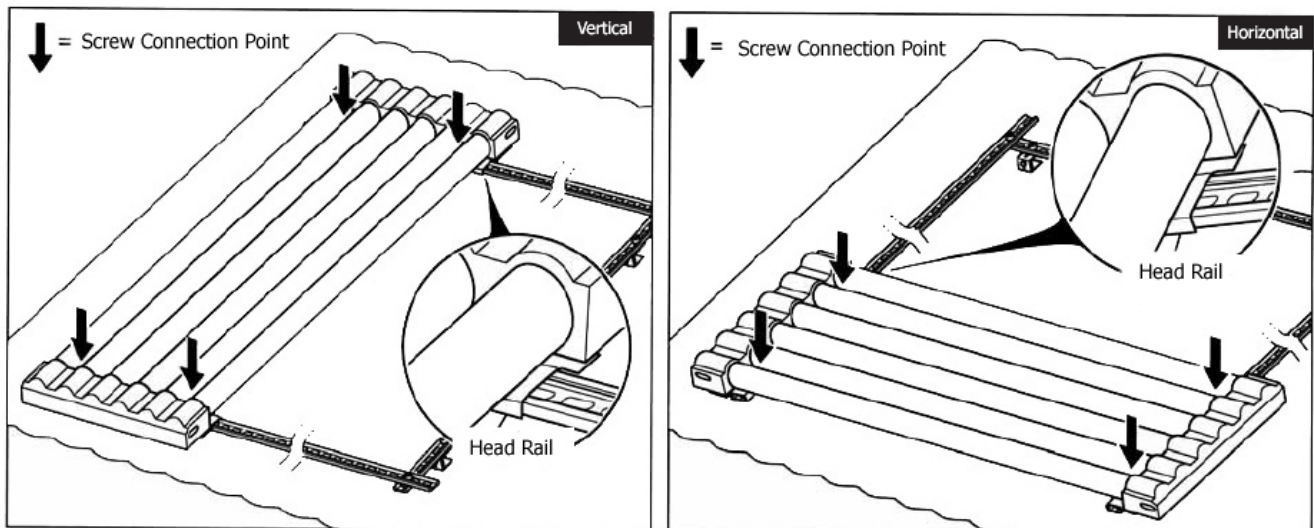


Figure 15.

Important:

- During “vertical” installation, the collector must be installed with the distributor head facing upwards.
- During horizontal installation, the distributor head can be installed to face left or right.

Position the collector with a head rail in each of the two supporting rails. Allen screws with threaded plates are pre-installed on the head rails. These must be locked in place in the supporting rails. (Figure 15 on page 12)

Turn the threaded plates through 90°, position the collector (head rails and supporting rails flush with each other) and tighten the Allen screws.

J. Create a connection

Collector joining kit Part No. 600013	
Description	Qty.
Joining fitting 22mm	2
Self adhesive seal	2

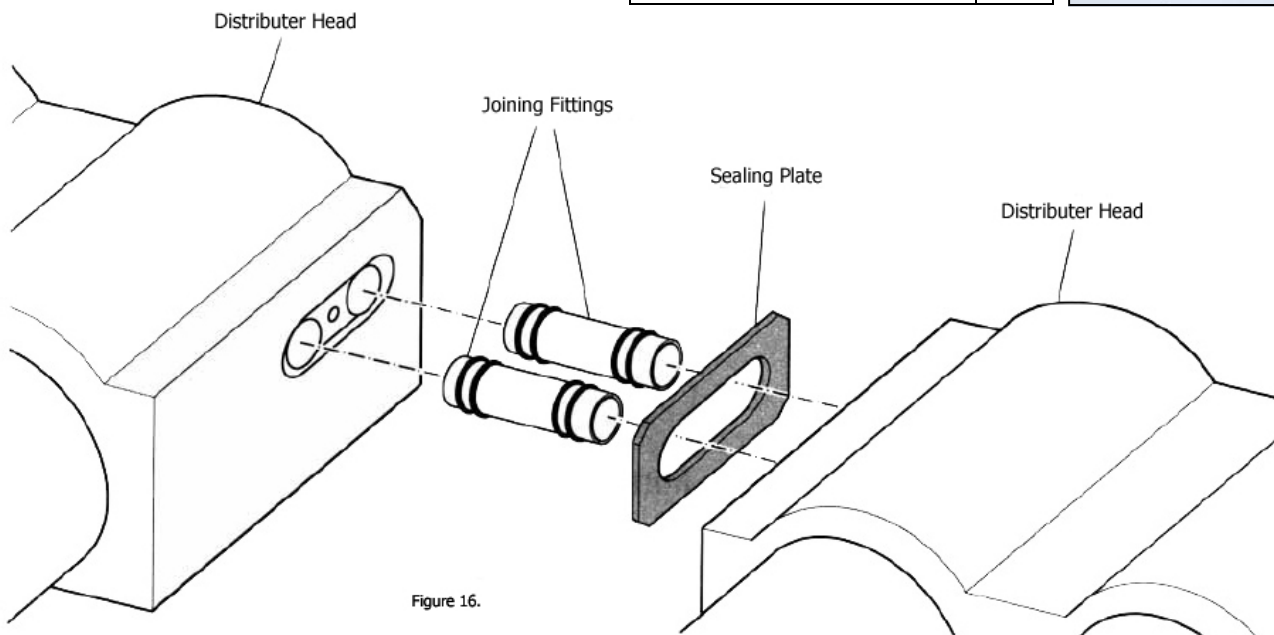
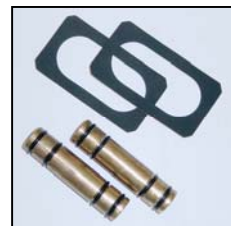


Figure 16.

- Push the joining fittings into the distributor tubes of the first collector. It must be ensured that there is no dirt on either the joining fittings or the connections.
- Stick sealing plates that are adhesive on one side onto the head sections.
- The second collector is placed on the supporting rails as described above and then pushed towards the first collector.
- Push the joining fitting into the distributor tubes of the second collector.
- Secure the collector (figure 15 on page 12).
- The installation of further collectors takes place in the same way.

3.5.3 Special characteristics of plain roof tiles

If the roof is covered in plain tiles, the same roof clamps can be used but there is no need for fastening carriages (see Page 10).

Therefore the fastening carriage must be removed before installation.

Installation of the roof clamps

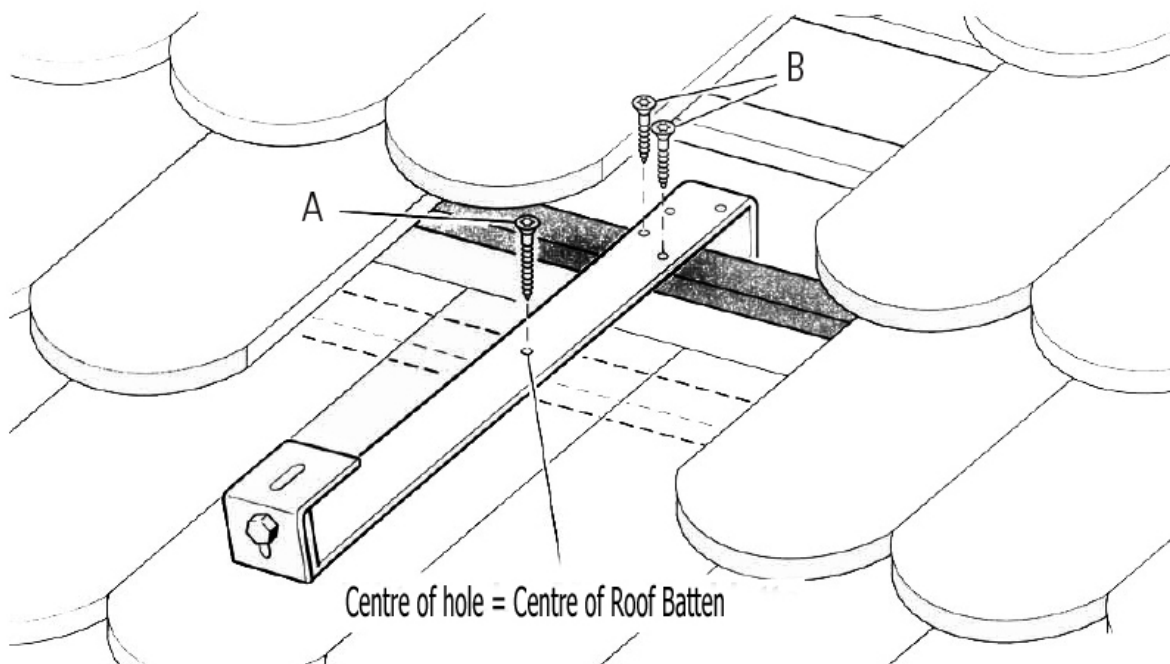


Figure 17.

- Place on the roof clamp and push it upwards until the hole for screw A is in the centre of the roof batten.
- Drill through the roof batten (6 mm diameter) through the hole for screw A in the roof clamp.
- Fasten the roof clamp and roof batten together through this hole with a Spax screw with internal star (A).
- Afterwards, screw in both the Spax screws with internal star (B).

Screw A Spax screw with internal star 5 x 60 1 item

Screw B Spax screw with internal star 5 x 30 2 items

3.5.4 Special characteristics of flat roof installation

Installation of the frame

- If more than 3 collectors are used, the supporting rails must be extended using the rail connector, see figure 7 page 9.
- Concrete slabs (provided by the customer) must be placed on a solid surface to be used as the base for the frames. The concrete slabs are placed on a protective plate so that the roof cladding is not damaged.

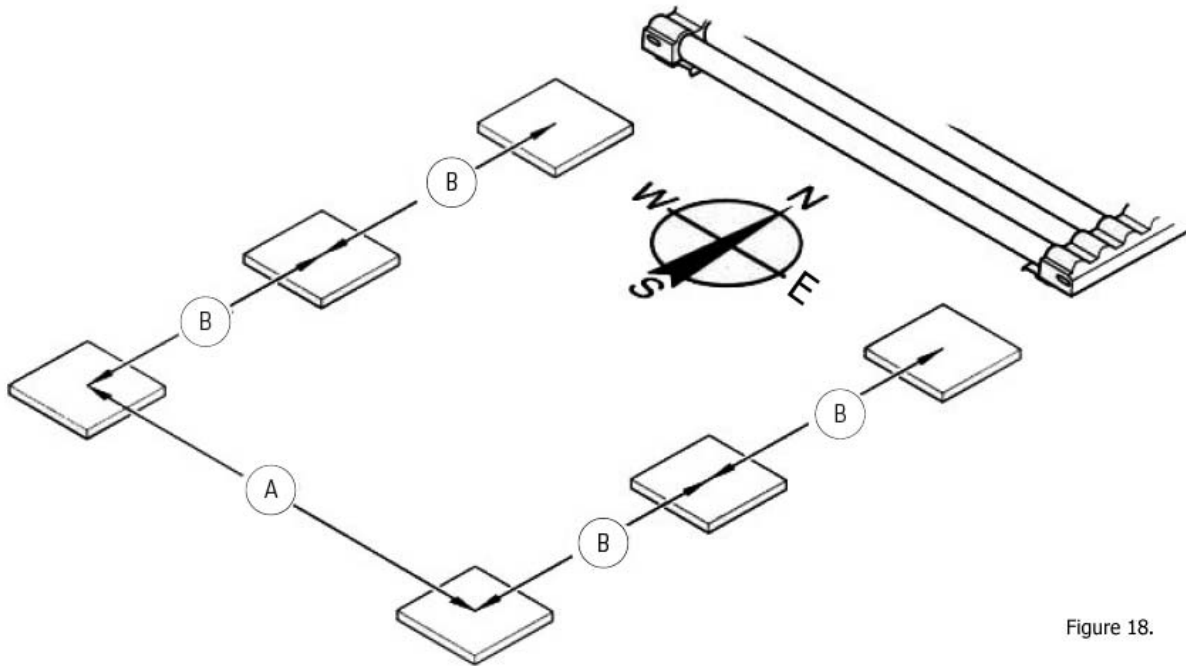


Figure 18.

- Distance A is 1900 mm (centre-centre). Distance B is dependent on the number of collectors.

Collectors	1	2	3	4	5	6
Distance B in mm	600	1000	2x1000	2x1140	3x1140	4x1050

- The individual collectors must be installed so that they are horizontal to each other.
- The alignment of the tube axis takes place from east to west.
- There must be a small slope to the distributor due to the need for venting.
- The absorber gradient must exceed 25°.
- The guide rails are secured onto the concrete slab at distance B with screws and pegs provided by the customer.

3.5.5 Special characteristics of cement asbestos roof installation

If installation is being carried out on a cement asbestos roof, you will need a special fastening screw for the frame instead of roof clamps, see figure 19.

Consider that the fastening screw always has to be attached from above onto the curve of the roof tiles, never in the trough of the roof tile.

Fasten the screw in at the same intervals as those given for "Vertical and horizontal roof installation", see section 3.6.2, figures 8 and 8a, page 9.

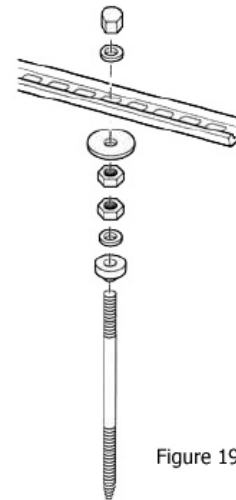


Figure 19.

3.5.6 Special characteristics of welted seam roof cladding installation

When installing onto welted seam roof cladding you will need to use seam clamps instead of roof clamps to fasten on the frame, see figure 20.

Fasten the clamp at the same intervals as those given for "Vertical and horizontal roof installation", see section 3.6.2, figures 8 and 8a, page 9.

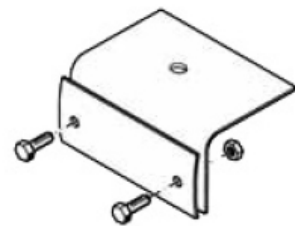


Figure 20.

3.5.7 Special characteristics of façade installation

Important: The collectors may only be installed horizontally on vertical façades. The absorber gradient must be 25° from vertical (for setting see section 3.5, figure 4).

When carrying out hydraulic connection it must be ensured that venting is possible.

The guide rails are screwed on to the façade a number of times throughout their length using the screws and pegs supplied by the customer. They are attached in a horizontal position, see figure 21. Distance B is dependent on the number of collectors. (See table in centre of page 15).

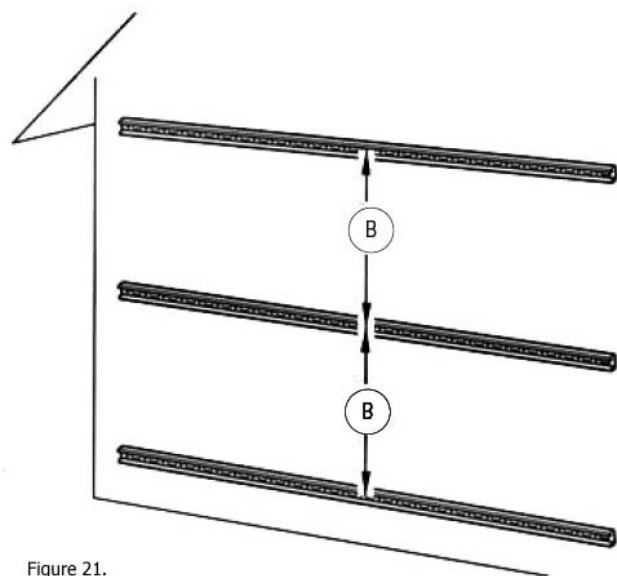


Figure 21.

3.6 Connecting the solar collectors

3.6.1 Connector kit parts

Please ensure that you have all of the parts required prior to attempting installation of the collector/s.

This page details all the parts required for connecting the collector/s to the pipework, and interconnection between collectors.

Connecting kit Part No. 7-AS 100AS		
No.	Description	Qty.
1	Connection fitting 22mm x 18mm	2
2	Sealing plug 22mm	2
3	Retaining bracket	2
4	Cover plate	4
5	Allen screw M6x25	2
6	Lubricant	1
7	Retaining washer	2
8	Allen screw M6x12	2
9	Pipework Connector 18mm x 22mm	2
15	Self adhesive foam seal	2



3.6.2 Collector joining kit parts

For interconnecting two or more collectors, a separate kit utilising two 22mm Joining Fittings, is required.

These fittings are shown on the right.

Collector joining kit Part No. 7-AS 100VS		
No.	Description	Qty.
14	Joining fitting 22mm	2
15	Self adhesive foam seal	2

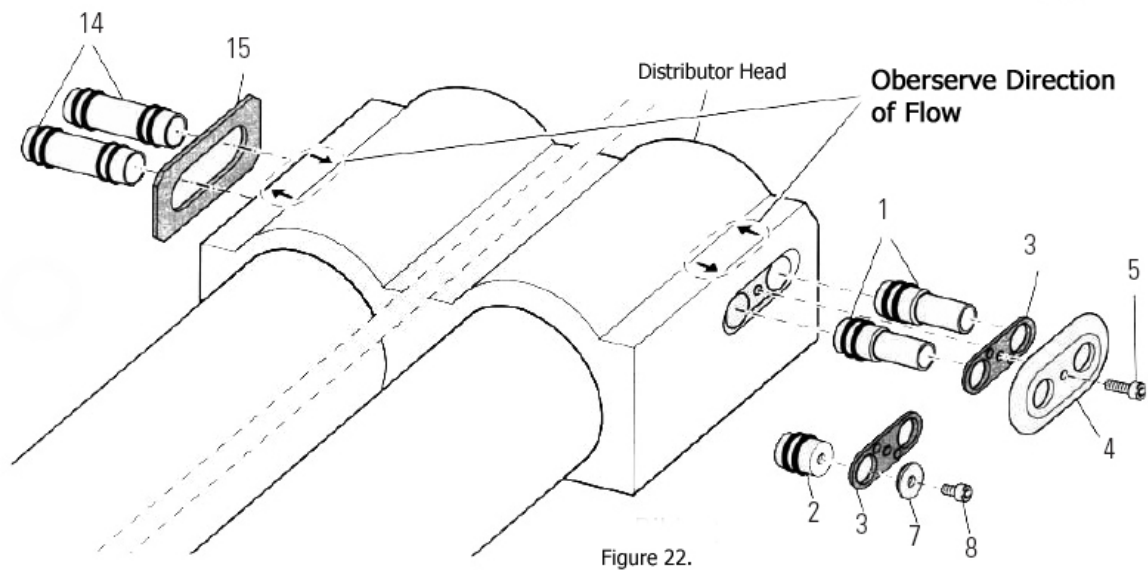


3.6.3 Assembly of the collector field connections

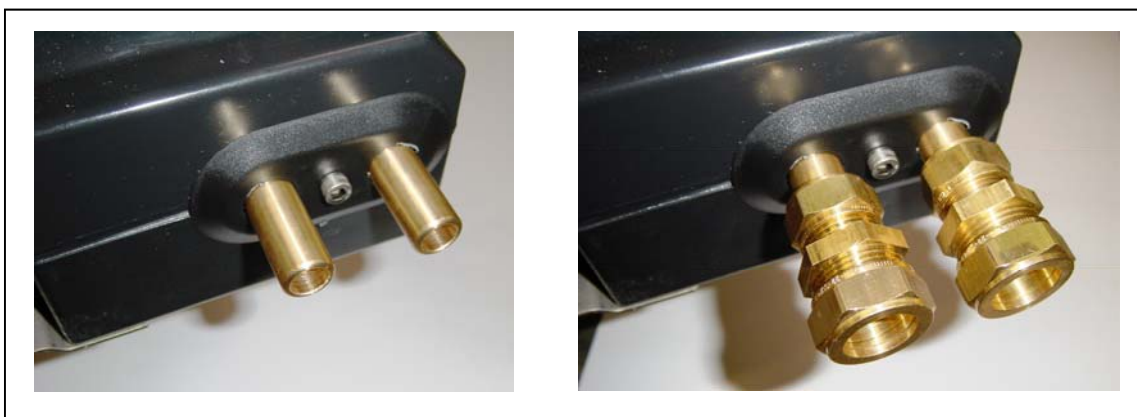
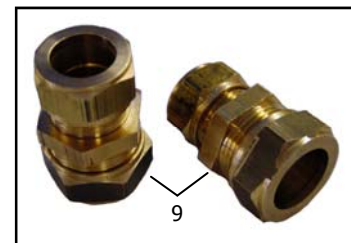
According to requirements of the application, the connections can either be one-sided or alternating.

The connecting tubes must be greased with the special lubricant supplied in the connecting kit.

- Push in the connection fittings, close unused outlets with sealing plugs.
- Push the retaining bracket over the connection fitting/sealing plugs.
- Secure both sealing plugs with retaining washers and Allen screws.
- Separate the required tube outlets from the cover plate, attach the cover plate and secure with Allen screws.



- Fit the Pipework Connectors (Drawing No.9) as shown below.
- When fitted, these provide a 22mm connection to the system hydraulic pipework.



3.6.4 Close lower housing openings

A lower housing is available for applications where a cosmetic fascia is required for aesthetic purposes.

When fitting a lower housing; feed in the counter plate and secure the cover plate to the lower head section using an Allen screw M6 x 25, as shown in Fig.24.

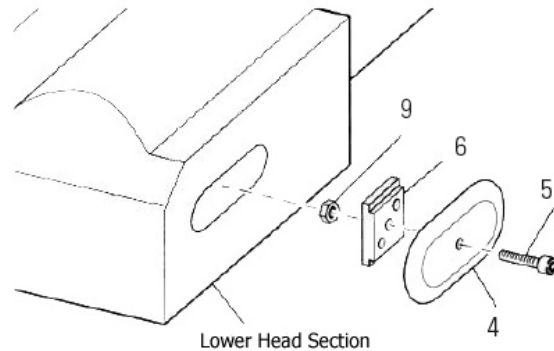


Figure 24.

Assembly notes for the connection and joining set for copper and soft steel tubes

Permitted operating conditions

Max. permitted operating pressure: 14 bar when using water
Max. permitted operating temperature: 200°C (possible due to special O-ring material)

Assembly notes:

The connection kit is suitable for copper tubes and soft steel tubes. Copper tubes must comply with DIN EN 1057 (issue 1996-05) or DIN 1754. The following simple rules must be adhered to in order to obtain a quick and reliable connection:

- Cut the pipework at right angles to its axis using a rotating tube cutter. Before assembly, the tube end must be trimmed so that it is rounded (calibrate if necessary) and clean.
- Carry out the leak test in accordance with the recognised technical rules.
- Only original O-rings may be used, for all connection fittings, even when carrying out replacements. This is due to the high temperature capabilities of the original O-rings.

Important:

A manual Air-Vent MUST be fitted to the highest point of the system, to allow for venting of the collectors. Automatic Air Vents are not permitted.

3.7 Notes on installation

All installation work must be carried out by an authorised specialist. The tubing of the flow and return lines must be carried out using copper tubes (as per DIN 1786) or approved systems. When using copper tubes, soldering must be carried out in accordance with the Pressure Equipment Directive. Use only metal, manual, Air Vents that have been locked under normal operating conditions. The fitting material must meet pressure level PN10.

Optional sequencing of the collectors can be used to connect groups of collectors in series. For reasons related to fluidics a maximum of 6 collectors can be connected in 1 group. Several groups can be connected in parallel in a reverse return system or can be balanced using control valves.

The pressure loss of tubing, pumps and other tube fixtures must be calculated according to the system design and the pump capacity must be adjusted accordingly.

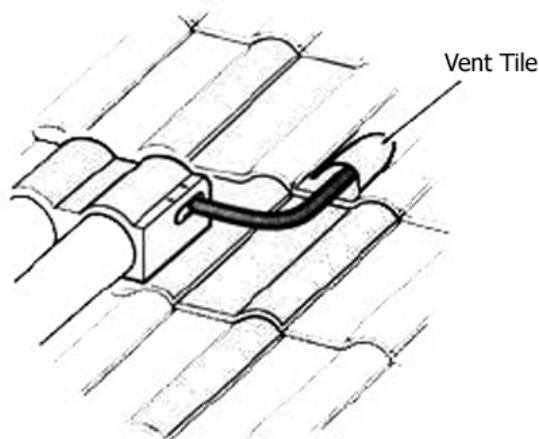
The heat insulation materials must be able to withstand temperatures of up to 160°C. It is recommended that mineral fibre/fibre glass shells with aluminium lamination or other suitable materials should be used.

A sheet jacket made of aluminium or galvanised steel plating, which has longitudinal and horizontal seams sealed with silicon, protects heat insulation from becoming wet when installed outside.

The insulating cover must comply with the Heating Installations Ordinance (3/3-Energy Saving Act), i.e. all tubing must have 100% insulation. The suitability and processing are based on the information from the insulating material manufacturer.

Warning: Tubing without insulation will result in significant heat loss.

Pipework Insertion into the Roof



Please see the respective operating instructions for information on filling the system, putting the solar assembly block into operation and regulation.

4. Electrical installation, potential equalisation and lightning protection

For general electric shock protection:

Link the collectors together so that they are electrically equal. Also connect the solar tubing (flow and return) with the building earth potential equalisation, using a short line. If there is lightning protection in place in the building, large metal parts (e.g. the collector housing) must be connected to it. Please also observe the regulations applicable on site and the assembly instructions issued by the control system manufacture.

Work must always be carried out by an authorised specialist.

5. Operating instructions

The system should be filled using Strebel approved solar solution. A pre-mixed Glycol Solution is available from Strebel Ltd. Please contact Strebel for further information and prices.

Depending on the system, solar fluid can sometimes leak out via the pressure relief valve when the collector overheats (e.g. idle operation). Do not direct this into the sewer system, it should be collected and fed back into the system. To do this, use a positive displacement pump that is attached to the filling and emptying taps using a hose connection fitting. Open the valve; do not pump in any air!

The safety valve, expansion tank and the heat transfer liquid must be tested regularly according to the manufacturer's information.

The heat transfer liquid must be tested for its frost resistance $-27^{\circ}\text{C} \pm 3^{\circ}\text{C}$ using a special frost protection tester both after filling and in subsequent recurrent tests. This must be documented.

Important:

The solar fluid must be replaced every 5 years. Failure to do so will result in a less efficient system and potentially damage the installation. **No liability can be accepted for damage caused by poor quality solar fluid.**

Maintenance notes:

Frost protection must be tested annually and corrosion protection must be tested every 2 years. The pH value must be greater than 7. The heat transfer medium must be replaced if it has turned brown, gone cloudy or started to smell. **No liability can be accepted for possible frost damage.**

Important:

The collectors must be covered if the solar system is not put into operation immediately. This will protect the sealing material used and will prevent the heat transfer liquid already in the system from overheating. **Damage caused by overheating is not subject to a manufacturer's guarantee.**

Warning:

Oversizing, and system downtime, when there is high solar radiation can lead to overheating and steam formation in the system.

Heat transfer liquid and sealing material can be damaged after repeated or prolonged overheating. We recommend that suitable shading measures or heat appliances should be provided.

6. Acceptance test record

Date: _____

Construction project: _____

Address: _____

Installation Company: _____ Technician: _____

Solar system design (items): DF6 _____

Type of installation: On roof Free display

Collector alignment:

Direction: South SouthWest SouthEast East West

Roof gradient: (°) _____

Collectors are in shade (%): Yes No

Type/make of accumulator: _____ Content (I): _____

Heat exchanger size m2 area: _____ Content (II): _____

Installation Date: _____ Company: _____

Tube length from collector to accumulator, basic (m): _____

Tube type: _____ DIN: _____

Electrical connections according to IEE (BS7671) Wiring Regulations Health & Safety Document 635 and Local Regulations.

Company performing task: _____

Solar regulator Make _____ Type _____

Regulator settings
According to instructions Yes No ΔT : ____ K Max. T: ____ °C

Solar regulator temperature sensors show realistic values: Yes No

Regulator put into operation according to operating instructions on: _____

Acceptance test record – page 2

Corrosion protection anode installed in accumulator : Yes No
 Magnesium anode Electronic Anode
 Electronic Anode Installed & Tested

Processing water mixer installed Yes No
 Store filled and ventilated from drinking water side Yes No
 Cut-off device on the store opened Yes No
 Safety valve installed on the drinking water side _____ bar
 Safety valve blow off line installed in discharge funnel Yes No
 Solar circuit pressure tested with 10 bar when system cold Yes No
 Leak inspection carried out for screw connections, soldering points and shut-off devices Yes No
 System pressure transferred (when cold) Yes No
 System filled with heat transfer medium without air Yes No
 Pumps set to level 1 2 3 4
 Tubing insulated (according to Heating Installations Ordinance) Yes No
 Insulating material make _____ Insulating thickness _____ mm
 Set value temperature difference "diff" ACTUAL value _____
 Set the flow rate (nominal) _____ Set value (actual) _____
 Frost resistance tested up to _____ °C Yes No

Note: The system is designed so that no safety measures need to be taken in the summer when the system operator is away for long periods of time. **The system (regulator) may not be switched off.**

Date: _____ Stamp/Signature: _____

7. Most frequent sources of error in solar systems

- There are no Air Vents in the roof at the points where air pockets form.
- The tube insulation in the solar area is not heat and UV resistant.
- The collecting vessel beneath the solar safety valve blow off is missing.
- The solar circuit potential equalisation (equal potential earthing) is not in place.
- The circulating pump is too powerful and runs for too long (destroys the heat layer in the accumulator).
- There is no processing water mixer for temperature limitation.
- Only tighten connections in the cold condition.
- Arrangement of the solar sensors in the accumulator.
- Arrangement of flow/return.
- The use of plastic/galvanised parts should be avoided throughout the solar circulation.
- Incorrect expansion tank size.
- The system had not been completely vented.
- The tubing had not been tested.
- Occurrence of intrinsic circulation.
- Regulator incorrectly set or connected.

Notes:



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We are pleased to inform you that additional information and literature is also available on our website.