Installation, operating and maintenance instructions

High performance solar collector TopSon F3-1 / F3-1Q

Roof top installation with AluPlus installation system

P 9

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Note:

Additional installation instructions are available for the following assembly systems:

- Alu-Flex-U installation frame for flat-roof and wall mounting
- Roof integration set 2-row, or 3-row for interlocking tiles

Specification

Collector	TopSon F3-1	TopSon F3-1Q
Casing	deep-drawn aluminium tray, natural finish, sea-water resistant	
Dimensions (L x W x H) / (external edge)	2099 x 1099 x 110 mm	1099 x 2099 x 110 mm
Weight (dry)	40 kg	41 kg
Content	1.7 l	1.9 l
Absorber	aluminium:copper	aluminium:copper
	style: meander, highly selective coating	
Cover	3.2 mm solar safety glass, hail-proof*	
Thermal insulation - rear	mineral wool	
Thermal insulation - lateral	mineral wool	Melamine resin foam
Connections	flat-packing with union nut G ¾"	
Angle of inclination	15° to 75°	15° bis 75°
Gross surface area	2.3 m²	2.3 m²
Optical efficiency *	70.4 %	70.7 %
Heat loss coefficient a_1 *	3.037 W/(m² K)	3.152 W/(m² K)
Heat loss coefficient a_2 *	0.014 W/(m² K²)	0.010 W/(m² K²)
Irradiation angle correction factor K50 *	95 %	94 %
Thermal capacity C *	5.85 kJ/(m² K)	5.88 kJ/(m² K)
Effective absorber area	2.0 m²	2.0 m²
Optical efficiency *	81.0 %	81.4 %
Heat loss coefficient a_1 *	3.492 W/(m² K)	3.630 W/(m² K)
Heat loss coefficient a_2 *	0.016 W/(m² K²)	0.012 W/(m² K²)
Irradiation angle correction factor K50 *	95 %	94 %
Thermal capacity C *	5.85 kJ/(m² K)	5.88 kJ/(m² K)
Stagnation temp. * (permiss. operating temp.)	194 °C	189 °C
Maximum operating pressure	10 bar	10 bar
Heat transfer medium	ANRO ready-mixed (45 % by vol.)	
Recommended flow rate	30 to 90 l / h x number of collectors	
Solar Keymark registration no.	011-7S260F	011-7S2439F

* Values to DIN EN ISO 9806

Standards and regulations

Observe the locally applicable regulations, rules and guidelines during assembly, installation and operation.

The following standards and regulations must also be observed:

Installation on roofs

Observe all current Health & Safety regulations

- EN 1991 (+NA) Effects on load-bearing structures
  In particular Parts 1-3: Snow loads
  Parts 1-4: Wind loads

Connection of solar heating systems

- EN 12976 Solar heating systems and their components Prefabricated systems (this includes generally applicable information regarding design and implementation)
- EN 12977 Solar heating systems and their components Bespoke systems (this includes generally applicable information regarding design and implementation)

Electrical connection

- VDE 0100 Erection of power installations with rated voltages below 1000 V
- VDE 0105 Cables and lines in buildings
- EN 62305 Parts 1-4 Protection against lightning
- VDE 0100 Part 540 Selection and erection of electrical equipment - earthing arrangements, protective conductors, equipotential bonding conductors

The collectors are tested in accordance with the following standards:

DIN EN ISO 9806 Quality control for solar heating collectors
Performance test for solar heating collectors

Safety instructions / Protection against lightning

Safety instructions

The following symbols are used in conjunction with these important instructions concerning personal safety, as well as operational reliability.

"Safety instructions" are instructions that must be observed exactly, to prevent injury and material losses,

e.g. The potentially very high temperatures inside the collector result in a risk of scalding from the hot heat transfer medium.

CAUTION "CAUTION" indicates technical instructions that you must observe to prevent material losses and equipment malfunctions.

Protection against lightning

The connection of the collector array to an existing or new lightning protection system and the installation of equipotential bonding may only be carried out by an authorised contractor, under consideration of local conditions and in compliance with the following technical rules:

EN 62305 Parts 1-4	Protection against lightning
VDE 0100 Part 540	Selection and erection of electrical equipment - earthing arrangements, protective conductors, equipotential bonding conductors

Notes on installation position

Alignment and shading

Ideally, the collectors should be oriented between south-east and south-west (optimum: south). Please refer to our technical advisers in case of an alternative orientation. Trees, neighbouring structures, chimneys, etc. should throw as little shade over the collectors as possible. Observe the different position of the sun (summer/winter).

The distance between the upper end of the solar collector and the lower edge of the ridge should be at least 3 roof tiles, in order to reduce wind forces and to allow sufficient space for installation.

Snow and wind loads

The load on the collector array is a combination of wind and snow loads which are determined by the dimensions of the building, the roof shape and the location. A precise calculation of the assumed loads must be carried out for each specific installation, in line with EN 1990 (+NA) and EN 1991 (+NA) and under consideration of regional regulations.

F3-1 collectors may be used for pressure and suction loads of up to 2.4 kN/m². By using the snow load extension set, the maximum permissible pressure load may be increased to 4 kN/m².

F3-1Q collectors may be used for suction loads of up to 2.4 kN/m² and pressure loads of up to 4 kN/m².

For safety reasons, the cross battens, rafters and roof tiles under the roof hooks must not show signs of previous damage (cracking, drill holes, ageing), else they will not withstand the loads to which they are subjected. If in doubt, replace the battens and roof tiles in those sections.
We recommend the use of metal tiles below the roof hooks, particularly in areas of high snowfall.
To avoid peaks in wind load we strongly recommend 1 metre minimum clearance between the collector array and the roof edge (or ridge).

Pipework

With single-sided pipework a maximum of 5 F3-1 or F3-1Q collectors may be connected in parallel.

With alternating pipework a maximum of 10 F3-1 or F3-1Q collectors may be connected in parallel.

- Do not use zinc-plated/galvanized pipes, fittings, etc.
- Thermal insulation must be temperature-resistant to >175 °C, in external areas it must also be UV and weather-resistant.
- Only use the gaskets supplied.

CAUTION Pipes close to the collectors may reach temperatures of up to 200 °C when the system is on standby. Beware of potential fire hazard.

- Pipes should be routed to the collector array with a rise. This will enable an 'emptying' of the collector in the event of stagnation. Do not create air locks.

Recommendation:

- Fit an air trap at the highest point.
- Where multiple collectors are fitted, integrate flow regulating valves into the return to enable hydraulic balancing.

CAUTION The solar lines must be laid and connected before the collector casing and thermal insulation are fitted, so that the entire line length and all collector connection points can be checked for tightness.

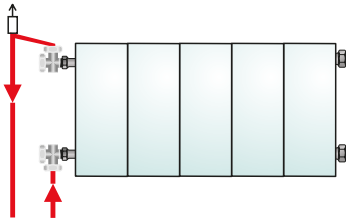
Pipework examples

Recommendation:

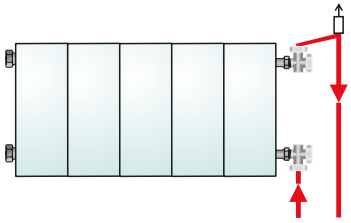
Air vent trap (install at the highest point)

Flow regulation valve for multiple collector arrays

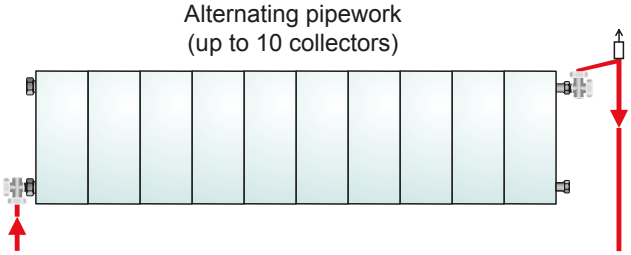
Single sided pipework, to the left (up to 5 collectors)



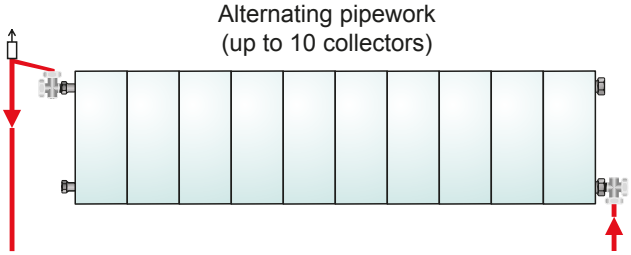
Single sided pipework, to the right (up to 5 collectors)



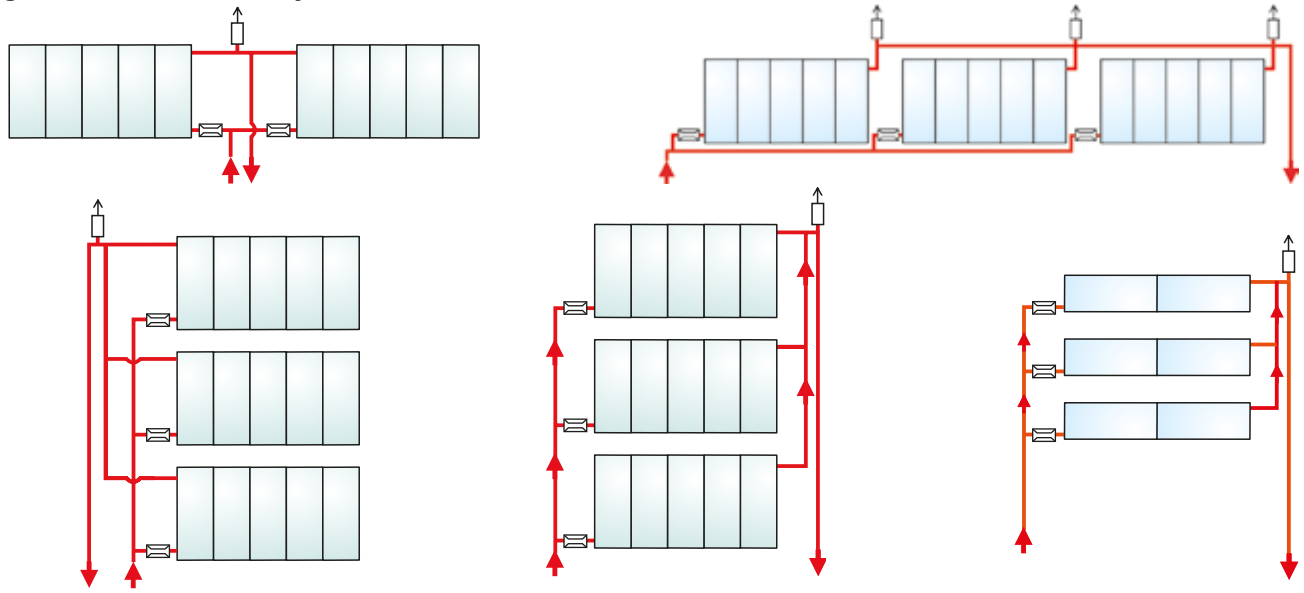
Alternating pipework (up to 10 collectors)



Alternating pipework (up to 10 collectors)



Piping several collector arrays in accordance with Tichelmann



Information regarding the system hydraulics

Information regarding the system hydraulics

- The collectors can be operated with a high specific flow rate (so-called High-Flow). Advantages: The collector is well cooled = high collector efficiency level, low heat losses at the flow line. Disadvantages: High pressure drop = powerful pump, large pipe cross-sections.
- The collectors can be operated with a low specific flow rate (so-called Low-Flow). Here, the advantages and disadvantages are reversed compared to the High-Flow operation. An additional advantage, due to the higher flow temperature, is the effective operation of a stratification cylinder.

Flow data: High-Flow (90 l/h x coll), ANRO 30 °C

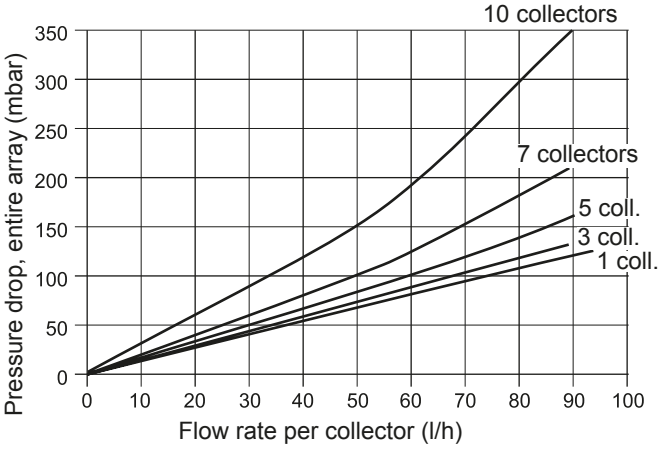
Collector number	Solar line length (m)	Solar pipe Ø (mm)	Pump group	DHW cylinder	Expansion vessel 2.5 bar	
					F3-1	F3-1Q
2	15	15 x 1	10	SEM-2-300	18	18
2	30	18 x 1	10	SEM-2-300	18	18
3	10	15 x 1	10	SEM-2-400	25	35
3	20	18 x 1	10	SEM-2-400	35	35
3	30	15 x 1	20	SEM-2-400	25	35
3	70	18 x 1	20	SEM-2-400	35	35
4	15	18 x 1	10	SEM-1-500	35	50
4	30	22 x 1	10	SEM-1-500	50	50
4	50	18 x 1	20	SEM-1-500	35	50
5	10	18 x 1	10	SEM-1-750	50	50
5	20	22 x 1	10	SEM-1-750	50	50
5	35	18 x 1	20	SEM-1-750	50	50
5	90	22 x 1	20	SEM-1-750	50	50
6	15	22 x 1	10	SEM-1-750	80	80
6	30	18 x 1	20	SEM-1-750	50	80
6	70	18 x 1	20	SEM-1-750	50	80
7	15	28 x 1.5	10	SEM-1-1000	80	80
7	15	18 x 1	20	SEM-1-1000	80	80
7	50	22 x 1	20	SEM-1-1000	80	80
8	50	22 x 1	20	SEM-1-1000	80	80
8	100	28 x 1.5	20	SEM-1-1000	80	105
9	20	22 x 1	20	SEM-1-1000	80	80
9	80	28 x 1.5	20	SEM-1-1000	80	105
10	10	22 x 1	20	SEM-1-1000	80	105
10	50	28 x 1.5	20	SEM-1-1000	105	105

Flow data: Low-Flow (50 l/h x coll), ANRO 30 °C

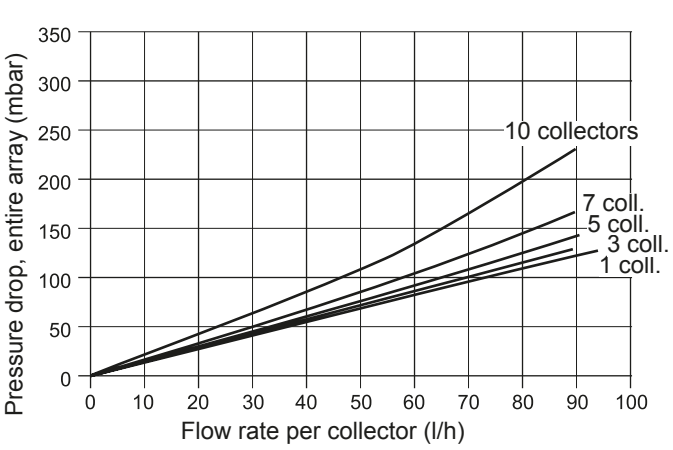
Collector number	Solar line length (m)	Solar pipe Ø (mm)	Pump group	DHW cylinder	Expansion vessel 2.5 bar	
					F3-1	F3-1Q
2	20	12 x 1	10	SEM-2-300	18	18
2	50	15 x 1	10	SEM-2-300	18	18
3	35	15 x 1	10	SEM-2-400	25	35
3	80	18 x 1	10	SEM-2-400	35	35
4	25	15 x 1	10	SEM-1-500	35	35
4	50	18 x 1	10	SEM-2-400	35	50
5	20	15 x 1	10	SEM-1-500	50	50
5	45	18 x 1	10	SEM-1-750	50	50
6	15	15 x 1	10	SEM-1-750	50	80
6	30	15 x 1	20	SEM-1-750	50	80
6	35	18 x 1	10	SEM-1-750	50	80
7	30	18 x 1	10	SEM-1-1000	80	80
7	30	15 x 1	20	SEM-1-1000	80	80
7	60	18 x 1	20	SEM-1-1000	80	80
8	25	18 x 1	10	SEM-1-1000	80	80
8	25	15 x 1	20	SEM-1-1000	80	80
8	50	18 x 1	20	SEM-1-1000	80	80
9	20	18 x 1	10	SEM-1-1000	80	80
9	50	22 x 1	10	SEM-1-1000	80	80
9	50	18 x 1	20	SEM-1-1000	80	80
10	15	18 x 1	10	SEM-1-1000	80	80
10	40	18 x 1	10	SEM-1-1000	80	105
10	40	22 x 1	10	SEM-1-1000	80	105

All details are recommendations and may vary from system to system. The expansion vessel sizes stated are valid for a static head of up to 10 metres only.

Pressure drop, **F3-1Q,** with ANRO 30 °C



Pressure drop, **F3-1** with ANRO 30 °C



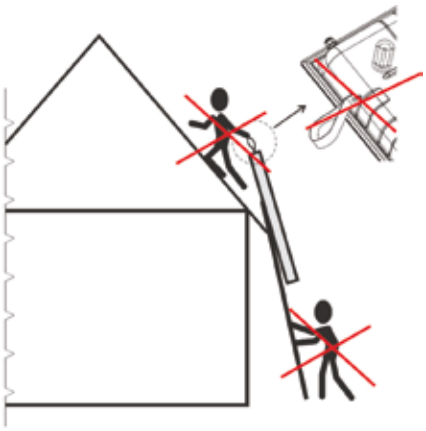
General preparations

Transport and storage

- For handling and storage of the collector pile only use the packing strips and pallets.
- Never move more than 16 collectors in a single pile and never store more than 24 collectors in a single pile.
- Never move collectors with the glass facing down.

CAUTION

- To prevent damage, never carry collectors by the collector connectors or put them down on the connectors.
- Never place the collector back onto uneven surfaces.
- Store collectors only in dry places that are free of dust.
- Cover the glass side of the collectors until the collectors are commissioned.
- We recommend the use of transport handles (available as accessories).



The collector must **not** be pulled onto the roof exclusively by the rivet nuts! Do not step underneath the collector during transport. (see picture)

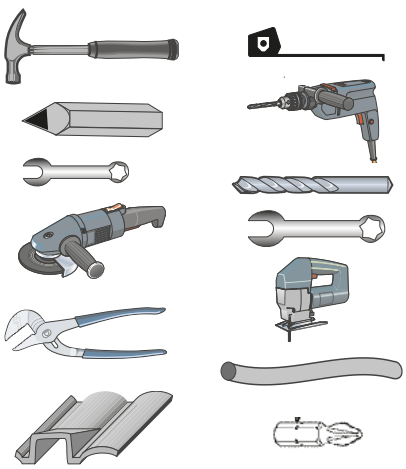
In case of jerky movements the rivet nuts can tear off and the collector can fall.

Installation

The installation and commissioning must only be carried out by authorised contractors. This contractor will be responsible for the correct installation and the commissioning.

The collector connections, even those of dry collectors, can become very hot during the installation. Wear protective gloves as there is a risk of injury from burns.

Required tools



The following materials and tools are required for an easy and safe collector installation:

1 x hammer
1 x tape measure
1 x pencil / chalk
2 x screwdriver / spanner SW 13
1 x wood drill approx. 5 mm (only roof integration)
1 x angle grinder with stone cutting disc
2 x open-ended spanner SW 30
1 x adjustable pliers
1 x hole saw (where the roof is already planked in)
Roof outlets for the solar lines (e.g. ventilation tile; cut to size with an angle grinder)
Protective conduits (sensor lead, pipework)
Anti-falling protection
Crosshead bit

General preparations

Preparations prior to installation

The following tasks should be carried out **prior to the collectors being moved onto the roof**.

Please note: Fit compensators only to the short connectors.

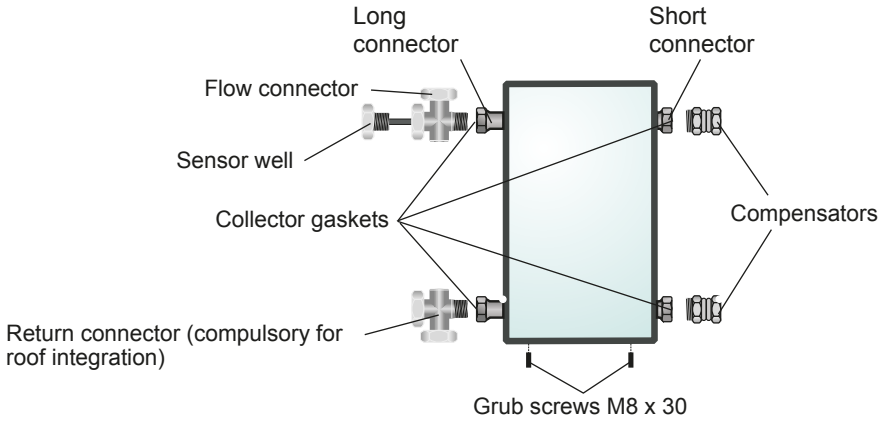
- For **single-sided pipework to the left** (see example diagram) the short connectors are on the right.
- For **single-sided pipework to the right**, rotate the collector through 180°. The short connectors are now to the left.
- For **alternating pipework**, ensure that all short connectors are facing in the same direction.

Prior to joining the connections, check whether the collector gaskets are inside each fitting.

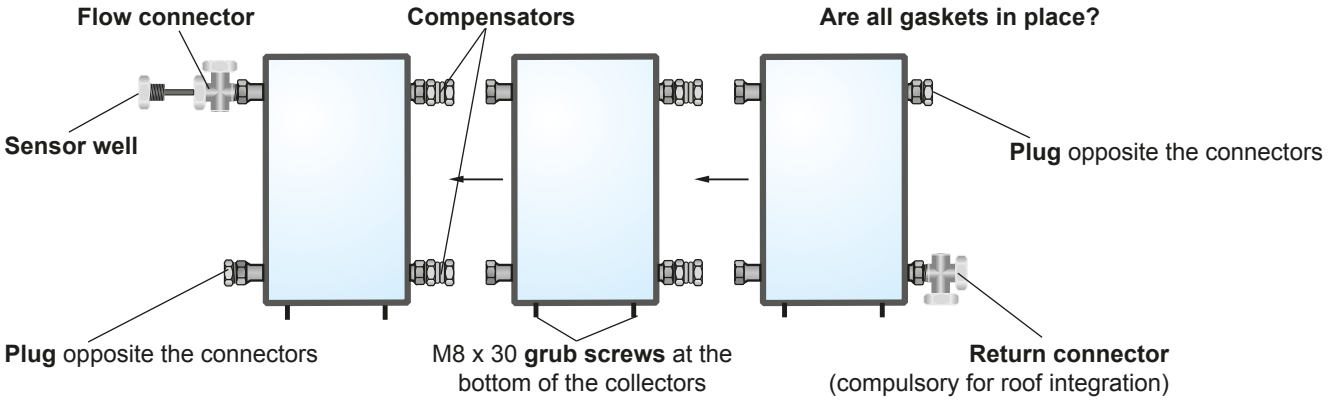
When fitting the connection pieces, compensators and plugs, always **counter hold** the union nut on the collector tightly. Apply a maximum torque of 20 Nm.

Remove the sensor well from the control unit carton and insert it into the flow connector.

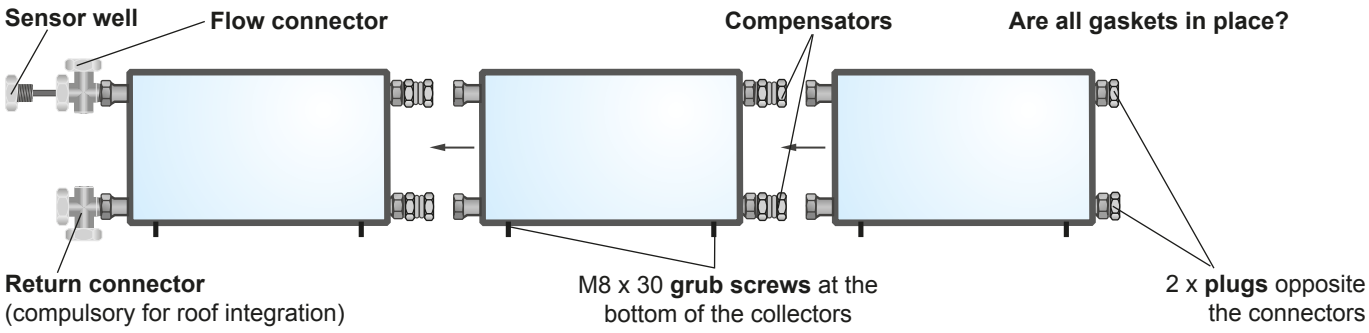
Respectively insert 2 M8 x 30 grub screws fully into the lower tray edge.



Layout example: 3 F3 / F3-1 collectors, on end, alternating pipework (max. 10 collectors)



Layout example: 3 F3-1Q collectors, across, single sided connection on the left (max. 5 collectors)



Rooftop installation - General

Standard dimensions for determining the width of the collector array

The data is provided without consideration to the installation location or the pipe connections.

Installation on end (portrait)

Length of mounting rail Alu + for 1 collector mounted on end	1030 mm
Length of mounting rail Alu + for 2 collectors mounted on end	2160 mm
Length of mounting rail Alu + for 3 collectors mounted on end	3290 mm
Length of mounting rail joiner:	100 mm
Collector width:	1100 mm
Distance between installed collectors:	31 mm

Number of F3-1 collectors	1	2	3	4	5	6	7	8	9	10
Collector array width [m]	1.1	2.23	3.36	4.49	5.62	6.75	7.89	9.02	10.15	11.28
Mounting rail length [m]	1.03	2.16	3.29	4.42	5.55	6.68	7.81	8.94	10.07	11.20

Installation across (landscape)

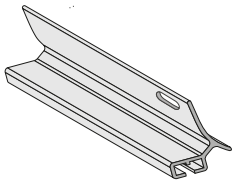
Length of mounting rail Alu + for 1 collector mounted across:	2030 mm
Length of mounting rail joiner:	100 mm
Collector width:	2100 mm
Distance between installed collectors:	31 mm

Number of F3-1Q collectors	1	2	3	4	5	6	7	8	9	10
Collector array width [m]	2.1	4.23	6.36	8.49	10.62	12.75	14.89	17.02	19.15	21.28
Mounting rail length [m]	2.03	4.16	6.29	8.42	10.55	12.68	14.81	16.94	19.07	21.20

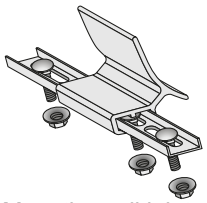
Fixing material

Top roof hooks with fixing bracket

Bottom roof hooks with fixing bracket



Mounting rail



Mounting rail joint set (if required)

Screws, nuts, grub screws, wood screws in a bag

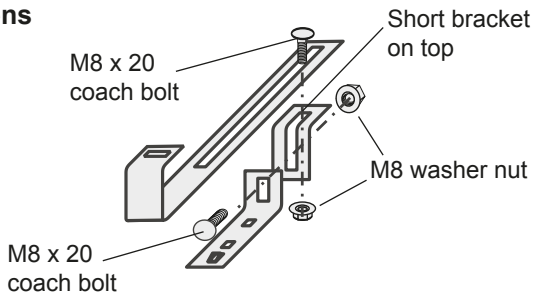
Rafter compensation set with wood screws for rafter mounting (available as an accessory)

CAUTION **Distribute all roof hooks supplied evenly over the width of the collector array to spread the loads applied. For this, position the roof hooks as near to the rafters as possible.**

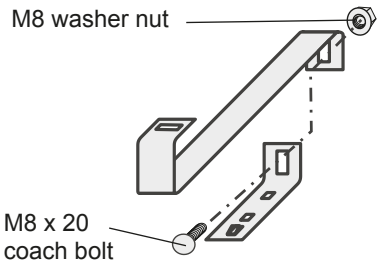
Preparatory installation of roof hooks

Fitting roof hooks to battens
(installed before)

Top roof hooks

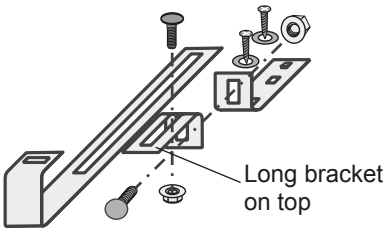


Bottom roof hooks

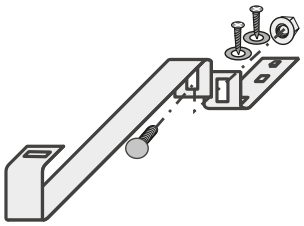


Fitting roof hooks to rafters
(refit)

Top roof hooks



Bottom roof hooks



Initially tighten the roof hooks only by hand.

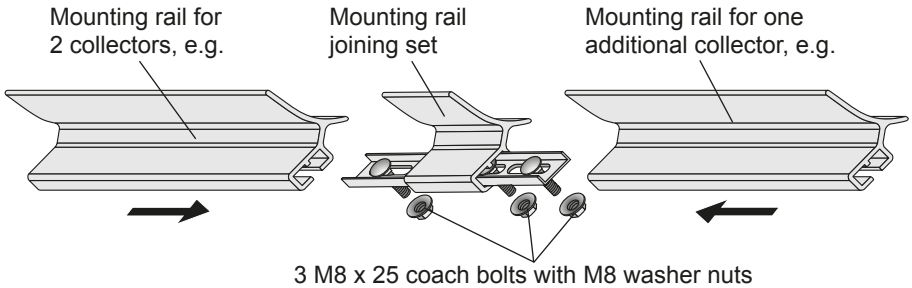
Note:
Some tile shapes (e.g. flat tiles that are profiled at the top and bottom) must be cut out in the area of the roof hooks to enable the fitted roof hooks to lie correctly and to prevent the tile above from lifting up.

Recommendation:
We recommend the use of metal tiles below the roof hooks, particularly in areas of high snowfall.

Joining the mounting rails

The mounting rails can be extended by using mounting rail joiners.

One of the 3 screws of the mounting rail joiner set can also be used for securing to a roof hook. For this, the U-rail remains centrally aligned; the screw can be manoeuvred within the slot to the correct position above the hook.

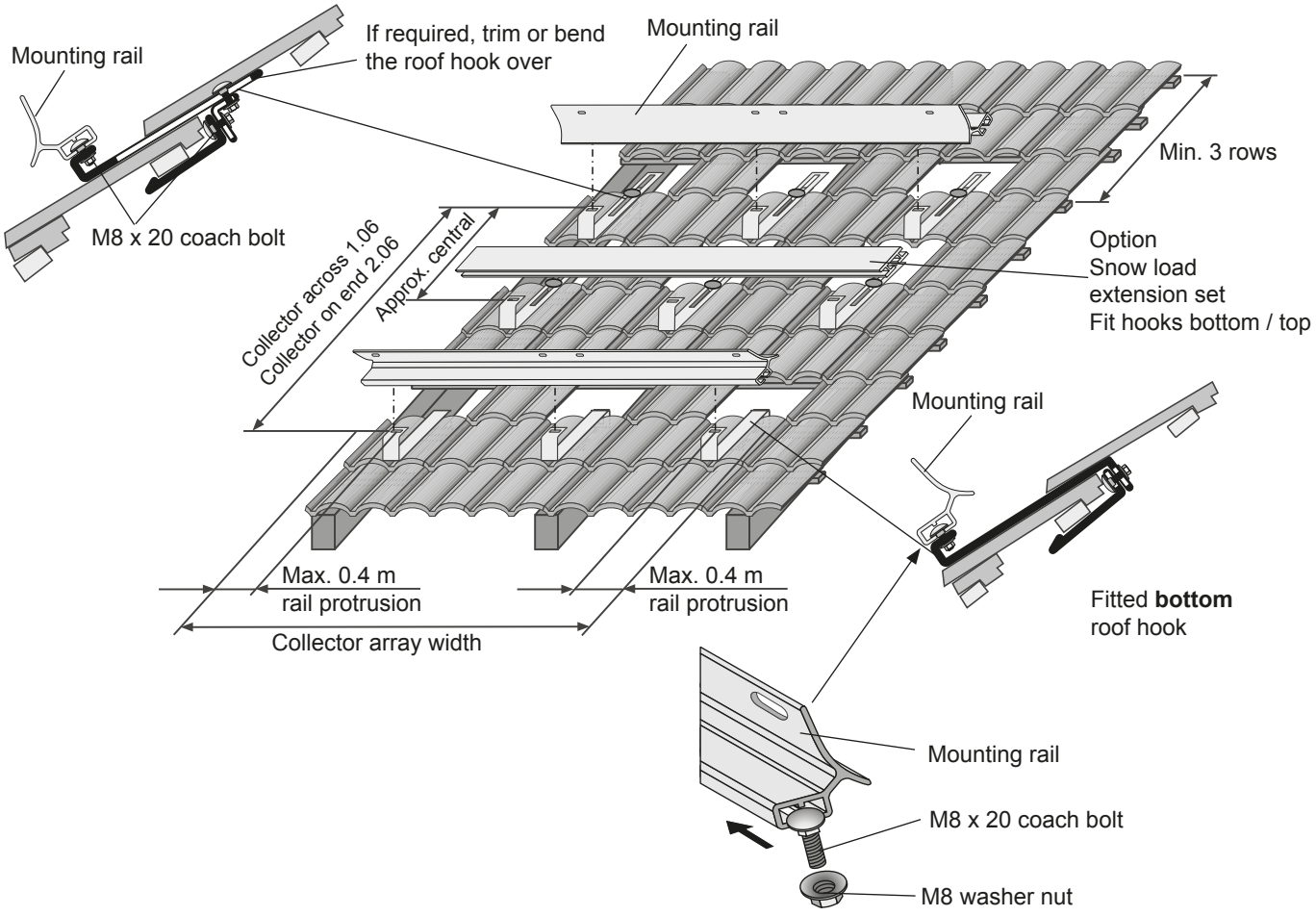


Rooftop installation - Interlocking tiles, plain tiles

Special features for interlocking or plain tile roofs

Roof hook installation on battens (example for 2 collectors)

Fitted **top** roof hook



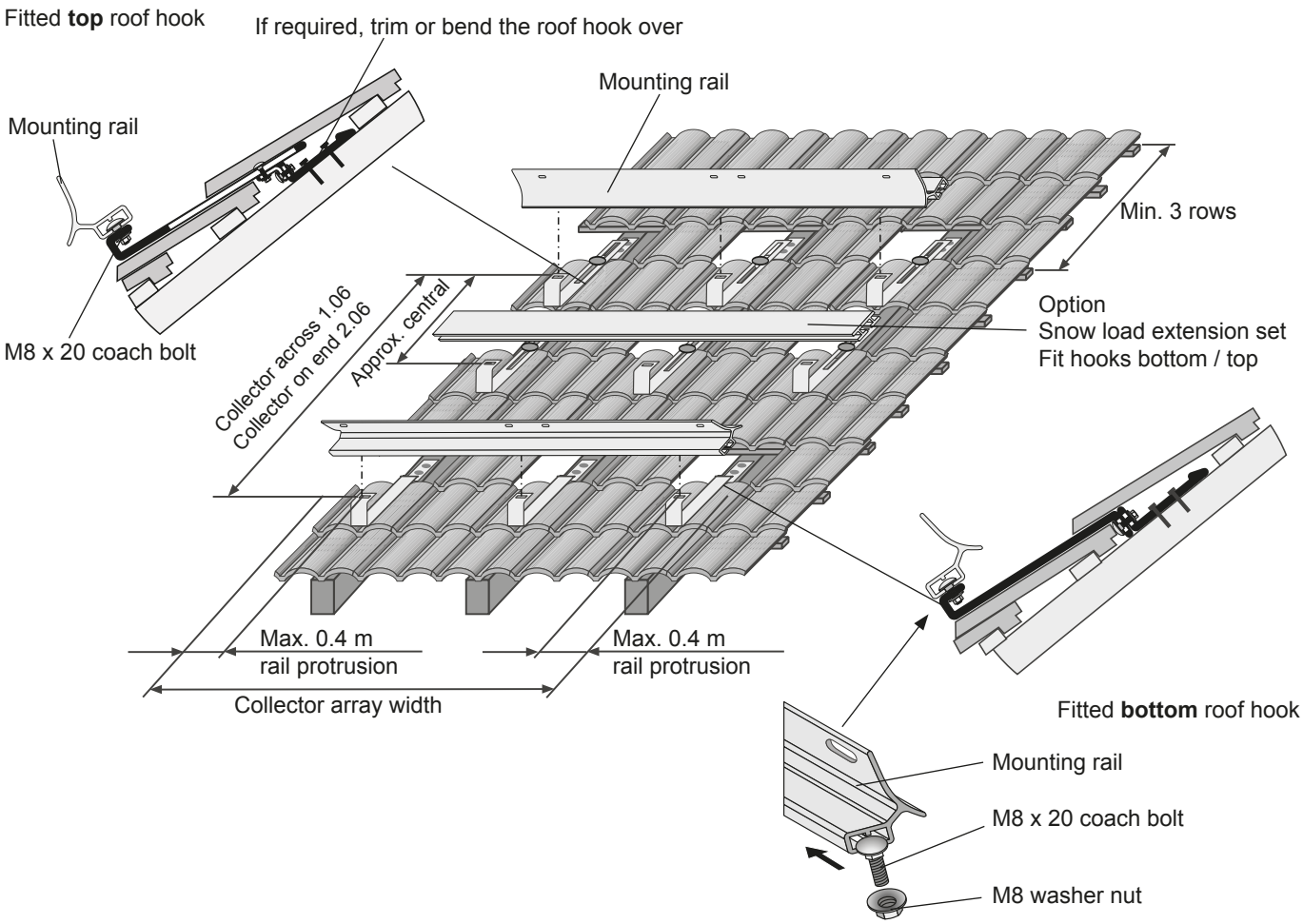
CAUTION **Distribute all roof hooks supplied evenly over the width of the collector array to spread the loads applied. For this, position the roof hooks as near to the rafters as possible.**

1. Assemble the bottom roof hooks in acc. with the diagram and hook them into the batten.
2. Assemble the top roof hooks in acc. with the diagram and hook them into the batten.
   Create the distance between both rails of 2.06 m for collector installation on end or 1.06 m for collector installation across at the top roof hooks using the slot in accordance with the diagram and secure that position with M8 x 20 coach bolts.
3. Adjust the height of the fixing brackets and secure with M8 x 20 coach bolts, ensuring that the pressure is evenly distributed over the roof tiles.
4. Slip the M8 x 20 coach bolts in sufficient numbers into the mounting rails.
5. Fit the mounting rails with washer nuts onto the roof hooks.
6. Cover the roof hook area with tiles.

Rooftop installation - Interlocking tiles, plain tiles

>15°

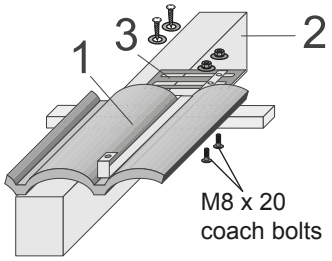
Fitting the roof hooks to the rafters
(Example for 2 collectors)



CAUTION **Distribute all supplied double-ended screws evenly over the width of the collector array to spread the loads applied.**

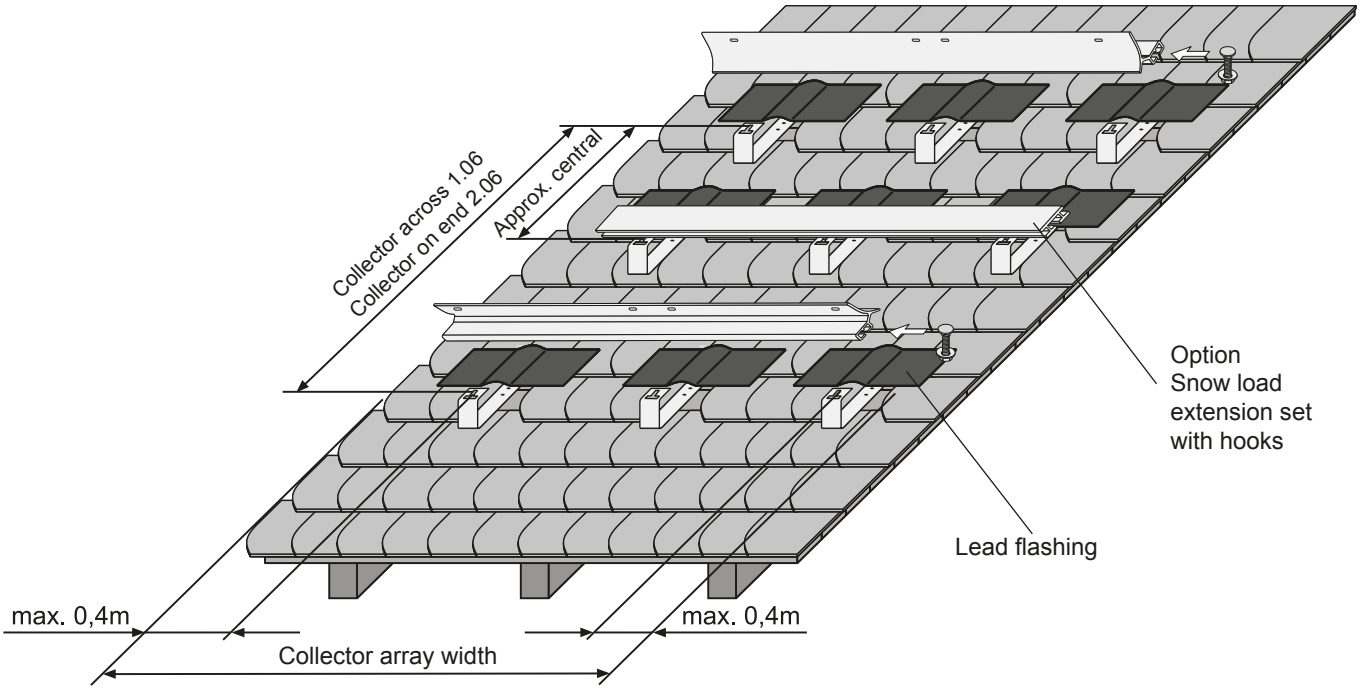
1. Fit the bottom roof hooks in acc. with the diagram and secure them with 6 x 60 wood screws to the rafters.
2. Fit the top roof hooks in acc. with the diagram; adjust the distance between both rails to 2.06 m when installing collectors on end or 1.06 m when installing collectors across using the slot according to the diagram; secure with M8 x 20 coach bolts and with 6 x 60 wood screws to the rafter.
3. Adjust the height of the fixing brackets and secure with M8 x 20 coach bolts, ensuring that the pressure is evenly distributed over the roof tiles.
4. Slip the M8 x 20 coach bolts in sufficient numbers into the mounting rails.
5. Fit the mounting rails onto the roof hooks.
6. Cover the roof hook area with tiles.

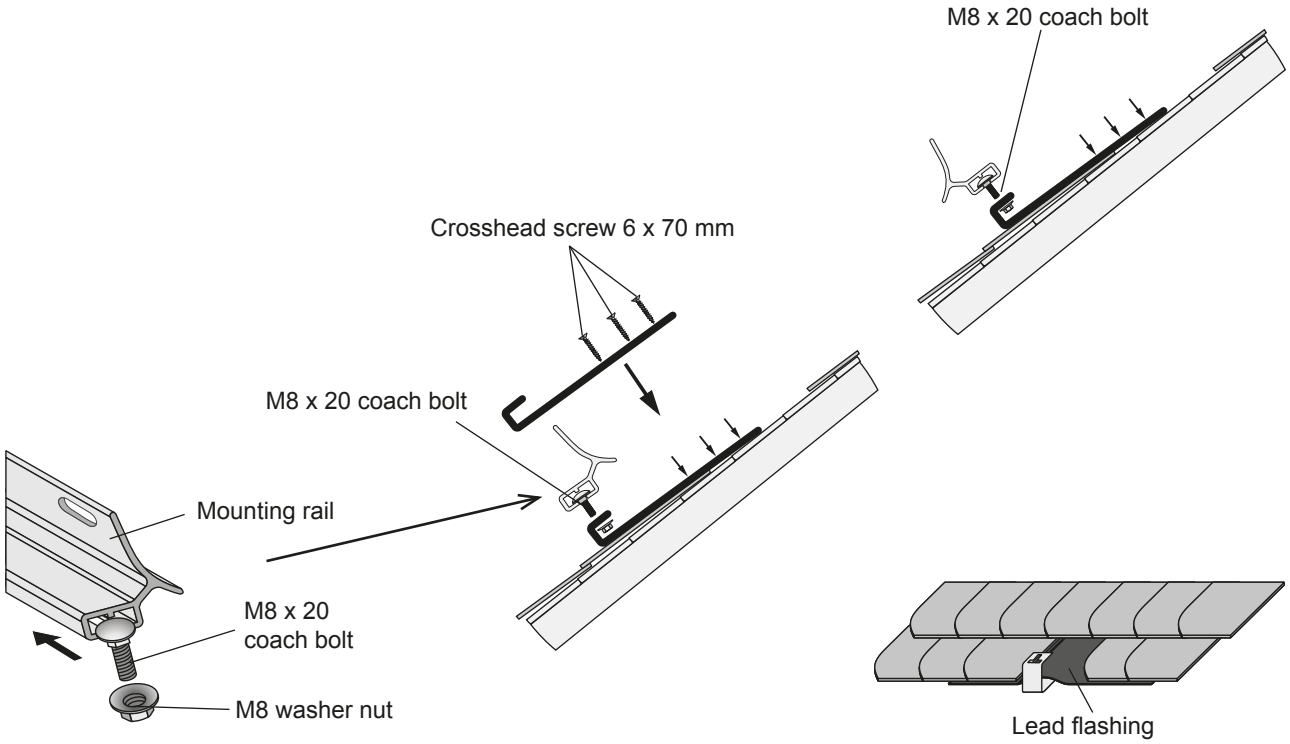
Mounting on rafters with rafter compensating plate



- Where the tile valley is not above a rafter, a separately available rafter compensating plate (3) is fixed above the rafter (2) and the roof hook (1) nestled in the valley is bolted to the compensating plate.
- Secure the compensating plates (3) with 6 x 60 wood screws and washers onto the rafters (2).
- Insert the M8 x 20 coach bolt from below through the compensating rails.
- Position the roof hook and secure tightly with the hexagon nuts.

Special features for rooftop installation on slate roofs with slate hooks

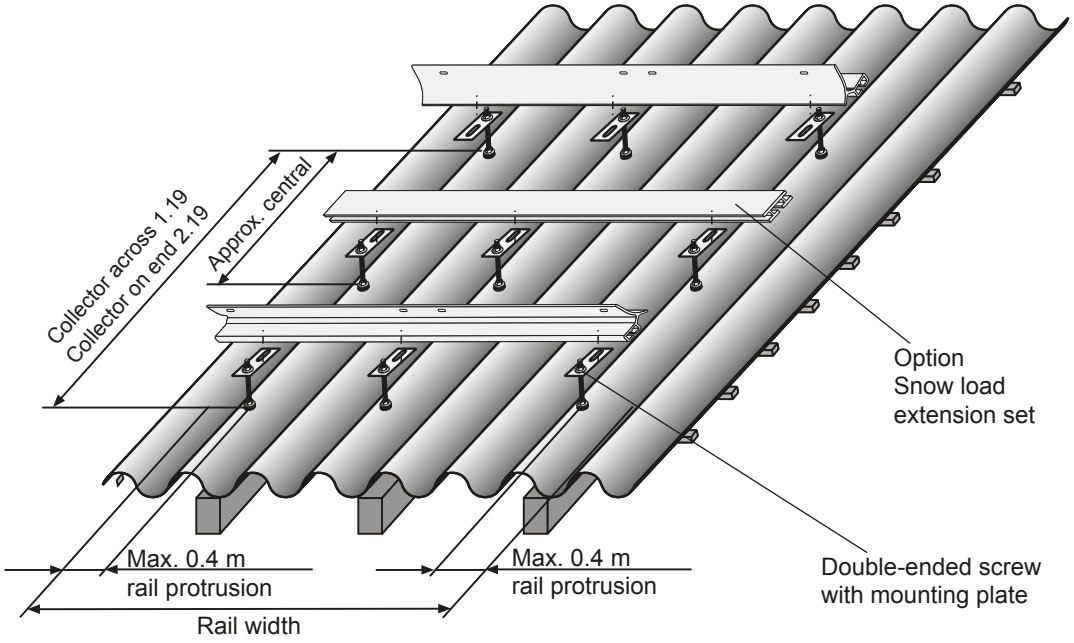




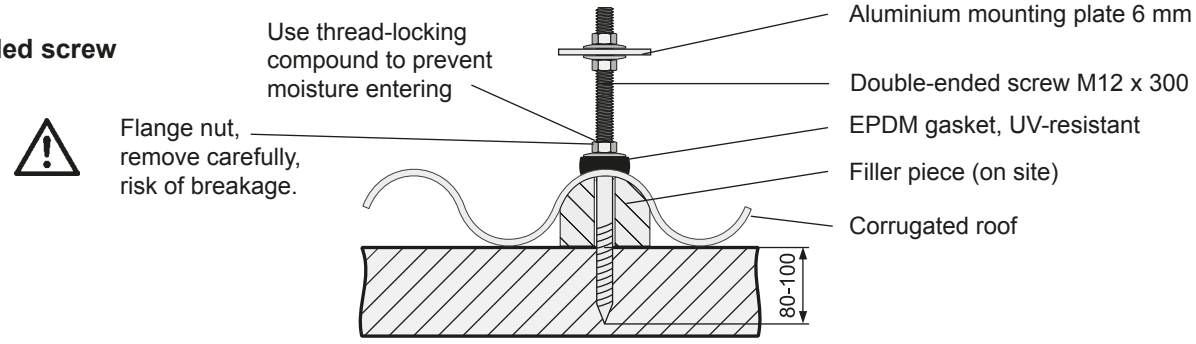
CAUTION **Distribute all supplied double-ended screws evenly over the width of the collector array to spread the loads applied.**

1. Remove the slates where the hooks need to be fitted.
2. Secure the hooks with crosshead screws 6 x 70.
3. Fit mounting rails with coach bolts.
4. Cover the slate hooks with commercially available lead flashing.
5. Cover the roof.

Special features for corrugated/sheet steel roofs with double-ended screws



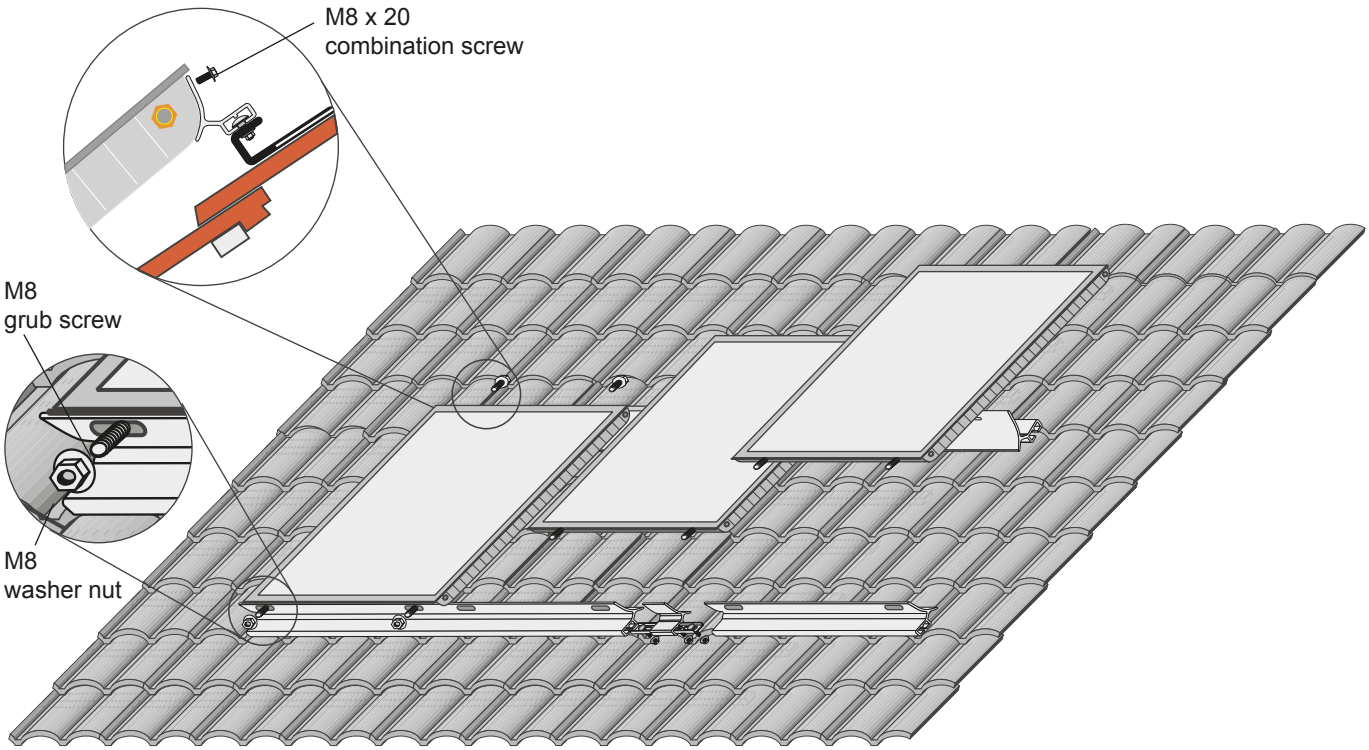
Fitting the double-ended screw

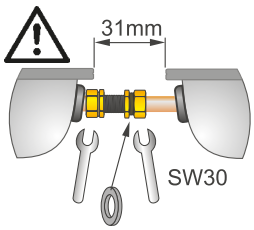


CAUTION **Distribute all supplied double-ended screws evenly over the width of the collector array to spread the loads applied.**

- For roofs covered in corrugated roofing sheets, drill the holes (Ø 14) into the roof skin respectively at the apex of the sheet profile.
- Maintain the vertical clearance between the holes for the double-ended screws to safeguard the rail clearance.
- Ensure the secure fixing on the sub-structure/rafters. Where required, create an additional sub-structure on site.
- Drill the holes for securing the double-ended screws in the rafters (Ø 8.5) before commencing the installation. Insert a suitable rawl plug in case of concrete or brickwork sub-structures.
- The double-ended screws must be inserted to a depth of between 80 and 100 mm. Lubrication makes the insertion easier. The smooth part of the shank acts as sealing seat for the contact gasket. It must be located in the area of the roof skin.
- The upper mounting plates point downwards; the lower mounting plates point upwards. If the snow load extension set is used the double ended screws should be cut off flush with the nut, above the mounting plate. This ensures that the collector housing does not come to rest on the screws.
- The roof skin is sealed by lightly and carefully tightening the flanged nut. Corrugated Eternit roofing sheets may otherwise fracture. Use filler elements (on site) where necessary.
- We recommend the use of a thread-locking compound (e.g. Marston-Domsel 585.243) to prevent moisture entering along the thread and to secure the position of the flange nut.

Collector mounting





- Are all gaskets in place?
- Maintain the necessary distance
- Align all threaded fittings
- Counter hold with a second **open-ended spanner** max. torque 20 Nm

1. Insert the collector with the grub screws in with the lower mounting rail according to the diagram and initially secure it with the M8 washer nut by hand.
2. Push the M8 x 20 combination screws through the top mounting rail and initially tighten by hand into the collector.
3. Fit additional collectors likewise.
4. Secure the fittings for the flow and return. Check gaskets.
5. Tighten all screws and nuts to secure the collector.

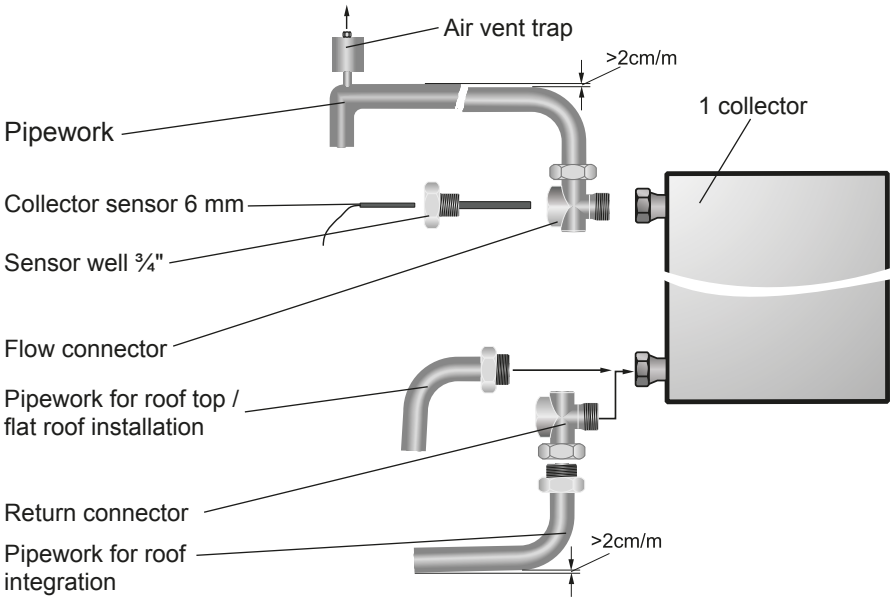
Fitting the sensors

Fitting the sensors

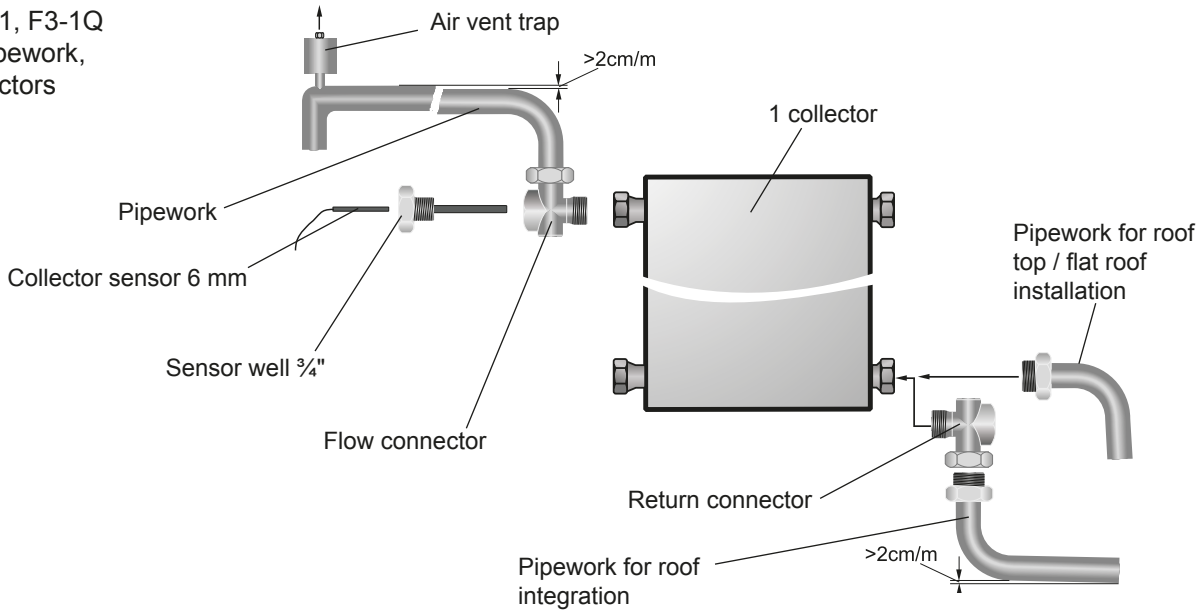
In stagnation the collectors can reach temperatures of up to 200 °C. Therefore only to use the solar-specific flat gaskets supplied and ensure that the mounting and connecting components used are sufficiently temperature-resistant, particularly near the collectors.

Note also the information provided in chapter "Pipework".

Example: F3-1, F3-1Q
single-sided,
up to 5 collectors



Example: F3-1, F3-1Q
alternating pipework,
up to 10 collectors



Filling the system / Safety datasheet / Initial start-up

Filling the system

For flushing and filling the solar heating system, we recommend the use of a fill & flush pump that runs for at least 30 to 60 minutes. This makes manual venting superfluous. Also consult the manufacturer's instructions for the solar pump assembly.

Filling and flushing the system

Do not fill the system or uncover the collectors in strong sunshine. There is a risk of burns. Only use undiluted ANRO to fill the system. Never add water or any other heat transfer medium. There is a risk of flocculation, and frost and corrosion protection can no longer be guaranteed. This may lead to a complete failure of the system.

Extract from the safety datasheet:

Trade name: Company: Emergency information:	ANRO heat transfer medium (ready-mixed, frost protection to -30 °C) Wolf GmbH, Postfach 1380, D-84048 Mainburg; Tel: +49 (0)8751/74-0; Fax: +49 (0)8751/741600 +49 (0)40 -209497-0 (weekdays 08:00 - 17:00 h)
Chemical properties:	1,2-Propylene glycol with corrosion inhibitors, 45.3 % by vol. mixed with 54.7 % by vol. potable water, dyed blue.
Particular safety information for personnel and the environment:	Not required
After contact with eyes: After contact with skin: After ingestion:	Flush with clear running water for 15 minutes whilst holding the eyelids apart. Wash with water and soap. Flush mouth and drink plenty of water.
Transport:	Not dangerous cargo in the sense of the transport regulations.
Water risk category:	WGK1; little risk to water.

The full safety data sheet is available from the "Download Centre" of the Wolf homepage.

Initial start-up

During commissioning the solar circuit is flushed, filled and pressurised. At this stage the collector must not transfer any heat - it should be covered, unless solar radiation levels are very low. Commissioning is generally carried out using only ANRO.

Filling and flushing

If a filler pump is used for filling the system, ensure that air can escape at the highest point/s. Metal manual air-vent valves are ideal for this purpose. In this case, however, a second person will be required to close the air-vent valves as soon as fluid begins to exit.

The solar filler and flushing pump from the Wolf accessories range has proven reliable in practice. With the pump it is no longer necessary to bleed the system at its highest point. The decisive factor is that the flow velocity in horizontal and falling sections of the solar circuit is greater than 0.4 m/s, this will ensure that the air bubbles are pulled along.

To prevent extensive foaming of the ANRO, we recommend that you start filling the pipework slowly with a reduced flow rate and then gradually increase the rate. Care should also be taken that when fluid flows back into the fill vessel, any turbulence is kept as low as possible. The fluid level above the return or flow connector should always be high enough so that the fluid surface in the vessel is calm.

Take care with objects with high static head. A negative pressure may form at high points owing to the falling water column beyond. This causes the boiling point of the fluid to decrease strongly and even at a low temperature steam may form, preventing the system from being filled correctly. Reducing the drain rate at the BDF valve can help prevent this situation. Reduce the drain flow rate until the required system operating pressure is constantly maintained at the pressure gauge.

Pressure testing / Venting the system

Once the entire solar circuit including the collectors is filled with heat transfer medium, the system must be thoroughly flushed (flow velocity > 0.4 m/s) to ensure that all foreign bodies (scale, swarf, etc.) and air pockets are removed. Experience suggests that the flushing should be maintained for at least 20 minutes in order to flush out all foreign bodies and air pockets.

Pressure test

The following procedure has proven reliable for the pressure test:

- Fill the solar circuit (incl. collectors) with ANRO until the pressure reaches 90 % of the maximum system operating pressure (response pressure of the safety valve minus 10 %).
- Maintain this pressure for at least 30 minutes. (Note: Glycol mixtures respond significantly slower to leaks than water.)
- Now conduct the leak check for all screwed fittings and soldered or compression joints.
- DEV and safety valve remain integrated during the pressure test.

If the pressure test is successful, first bleed the system and then discharge ANRO until the pressure is reduced to the charge pressure of the system.

If the test shows leaks, drain the ANRO to a level at which the remedial work can be carried out. Following this, repeat the pressure test.

Venting the system

During commissioning, ensure that the system is carefully vented. The ANRO previously filled into the system usually still contains micro bubbles that may collect at various points and form small air bubbles, for example in the pump, in the heat exchanger or upstream of the gravity brake. Care must be taken to remove these air bubbles.

Signs of adequate ventilation of the system are a steady indication of the required flow rate and a steady pressure during pump operation, i.e. neither the flow meter nor the pressure gauge show fluctuations.

After the first few weeks of operation, we recommend venting the system again at all venting points to release any air that may have collected.

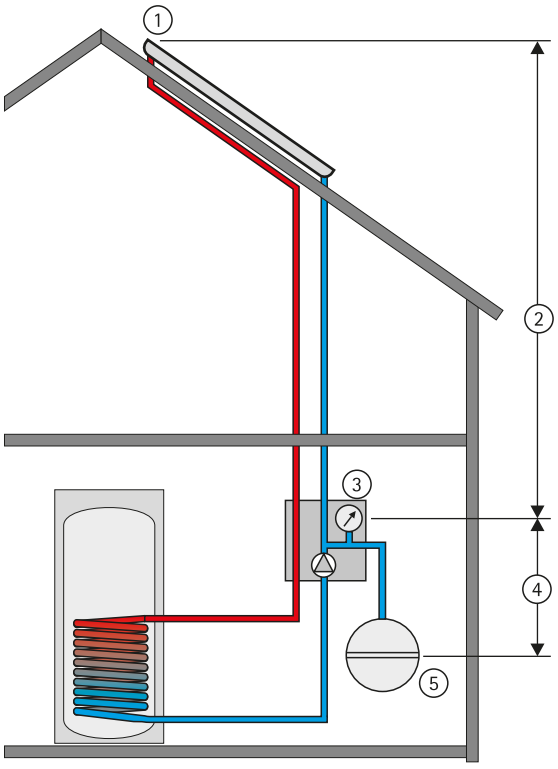
System operating pressure

System operating pressure

An indication of the correct system operating pressure is an overpressure of 1.5 - 2.0 bar at the highest point of the system when cold. The system operating pressure at the solar module is therefore 1.5 - 2.0 bar plus 0.1 bar per metre of static head between the pressure gauge in the solar module and the highest point of the system.

Since some air continues to form after commissioning, the charge pressure should be a little higher (suggestion: +0.1 bar) than the system operating pressure.

The pre-charge pressure in the DEV for the required hydraulic seal is set at least 0.3 bar lower than the system operating pressure. Any difference in height between the pressure gauge and the DEV should be taken into account here. If for example the DEV is installed one metre lower than the pressure gauge, the pre-charge pressure in the DEV must be matched to the system operating pressure effective here (+0.1 bar), thus the pre-charge pressure should be only 0.2 bar lower than what the pressure gauge displays.
This matched pressure ratio between the charge pressure, system operating pressure and pre-charge pressure in the DEV is a requirement for the reliable long-term operation of a solar thermal system.



1	Positive system pressure at highest point	1.5 - 2.0 bar
2	Addition per metre static head	+0.1 bar / m
3	**System operating pressure (pressure gauge)**	**_____bar**

System operating pressure	_____bar
Fill reserve for venting	+ 0.1 bar
Charge pressure	**_____bar**

System operating pressure	_____bar
Deduction for hydraulic seal	-0.3 bar

4	Addition per metre height difference, pressure gauge - DEV	+0.1 bar / m
5	**DEV pre-charge pressure**	**_____bar**

If the system operating pressure is set too low or if it drops a little due to leaks or ventilation, this may result in partial boiling of the solar fluid during system operation. This is particularly harmful to parts with high temperatures, where there is a pressure drop upstream of the collector array, or at the highest point of the solar circuit. A steam bubble at this point will reduce or completely halt the flow. In addition, the formation of steam due to stagnation occurs much more frequently where system operating pressure is low.

Commissioning check list

No.	Installation	
1	Collectors installed safe in case of storms	O
2	Solar line connected to the earthing system	O
3	Blow-off line permanently secured to the safety valve of the solar circuit	O
4	Drip container positioned below the blow-off line (solar circuit)	O
5	Blow-off line fitted to the safety valve and connected to the drain	O
6	Thermostatic mixing valve installed at the DHW outlet or cylinder temperature limited to 60 °C by the control unit	O O
	Commissioning	
7	Expansion vessel inlet pressure (check prior to filling) _____bar	O
8	Solar circuit filled and flushed with heat transfer medium	O
9	Pump, cylinder indirect coil and collector vented (block gravity brake for venting purposes)	O
10	Air vent trap on the collector vented (if installed)	O
11	Solar circuit pressure tested, incl. leak check on all threaded, solder and compression fittings	O
12	All joints (glands on shut-off valves and fill & drain valves) leak tested	O
13	System pressure (cold) _____bar	O
14	Gravity brake function OK	O
16	DHW cylinder filled and vented on the DHW side	O
17	Shading of collectors removed	O
	Control systems	
18	Temperature sensors indicate realistic values	O
19	Solar circuit pump running - circulates heat transfer medium; poss. adj. (flow meter: _____l/min)	O
20	Solar circuit and cylinder are getting warm	O
21	Boiler boosting starts at: _____°C	O
22	Option: DHW circulation pump runtime from _____ h to _____ h	O
	Instruction: The system user has been instructed as follows:	
23	Basic function and operation of the solar control unit incl. DHW circulation pump	O
24	Instruction in the inspection options of the protective cylinder anode	O
25	Service interval	O
26	Handover of documents	O
27	Confirmation of the commissioning by the system user	O

Operation

- A vapour film can appear particularly in the early hours of the morning due to the temperature differential between the outside air and the collector. It will disappear as the collector heats up.
- Where possible avoid switching off the power during solar irradiation. If vapour forms during very high solar yield, the system starts again automatically after it has cooled down.
- The overheating protection function in the control unit does not need to be switched on for flat-plate collectors.
- No special measures are required for times when no hot water is required, i.e. during holidays.
- Ask your local contractor to inspect the system when the system pressure fluctuates severely or the ANRO heat transfer medium has been expelled from the safety valve.

Inspection and service

Have your solar thermal system regularly checked by a specialist contractor to ensure long-term operational reliability and to maintain efficiency. Depending on frequency and extent the checks are classed as inspection (annual) or service (as required, usually every 3-5 years). An inspection and service contract is recommended for all solar thermal systems.

We also recommend an extra inspection after the first few weeks of operation to check the key functions of the system. This post-installation check or initial inspection should be included as a component of the overall service package for the system and can be itemised separately in the quote if required.

The main system parameters are recorded in an inspection and service report to enable any problematic changes (e.g. system operating pressure or pH value) to be detected. For the initial installation, refer to the data provided in the system documentation (charge pressure, system operating pressure, controller and pump settings, etc.).

Scope of inspection

The annual inspection should extend to at least the following (this also applies to the initial inspection):

- Vent all ventilation points in the solar circuit
- Compare the system operating pressure with the set value (initial value if initial inspection)
- Compare frost protection and pH value with their set values and the previous year's values (initial value if initial inspection)
- Switch on pump, manually if necessary
- If a flow meter is installed: Compare flow rate with set value
- Check for fluctuations on the pressure gauge and flow meter (if applicable)
- Check for noises in the pump (air)
- Open and close gravity brake
- Check movement of the thermostatic mixing valve
- Check plausibility of controller (e.g. Tmax collector, Tmax cylinder, total yield, etc.)
- Check plausibility as a function of solar radiation: flow and return temperatures on thermometers - values displayed by the controller
- Document all settings and measured values

The DEV and the safety valve do not need to be checked if the system operating pressure is correct and the safety valve shows no sign of tripping (deposits, drops, increased contents of drip pan).

Scope of service

We further recommend servicing the system at longer intervals (roughly 3-5 years) as an extended inspection. Works to be carried out in addition to the regular inspections are as follows:

- Visual inspection of all valves, joints and connections
- Visual inspection of collectors including fixings
- Visual inspection of insulation, solar circuit and sensor lines

If the cylinder is included in the service contract, the cylinder should be serviced in accordance with the manufacturer's instructions.

If the service or inspection reveal the need for additional work, this should be offered to the customer separately (e.g. collector cleaning, replacement of solar fluid or anode, etc.).

Return

At the end of their useful life the collectors may be returned to Wolf GmbH. These collectors must be clearly identified (e.g. as "scrap") and be delivered expenses paid during business hours.

All collector materials are either correctly recycled or disposed of by Wolf GmbH.

Packaging

For optimum environmental responsibility, recycle the polystyrene packaging via suitable collection points.
If required, dispose of the heat transfer medium via a recycling centre.

Inspection and service checklist

	Date:	Date:
Collector inspection		
- Visual collector inspection	O	O
- Visual inspection of the collector fixings	O	O
- Visual inspection for potential leaks in the roof	O	O
- Visual inspection of the thermal insulation on pipework	O	O
Solar heating circuit		
- Visual inspection for potential leaks in the solar circuit (joints)	O	O
- Colour check of the ANRO heat transfer medium	O	O
- pH value test of ANRO heat transfer medium only in case the medium has turned brown; poss. replacement	pH_____	pH_____
- Frost protection level of the heat transfer medium checked.	_____°C	_____°C
- Safety valve tested	O	O
- Solar expansion vessel inlet pressure tested (for this, release pressure from expansion vessel).	_____bar	_____bar
- In case of noisy pumps or system pressure fluctuations vent the system; for this, block the gravity brake	O	O
- System pressure in a cold system state (see system operating pressure)	_____bar	_____bar
- Reactivate the gravity brake	O	O
Solar cylinder and DHW circuit		
- Protective anode inspection	O	O
- Check for scale build-up in the cylinder and on the thermostatic mixing valve; poss. carry out de-scaling	O	O
- Check the anti-scalding protection (thermostatic mixing valve or via the maximum cylinder temperature limit)	O	O
Control systems		
- Check control parameters and display values for plausibility	O	O
- Solar circuit pump running - circulates (poss. adj. and checking on the flow meter)	_____l/min	_____l/min
- Temperature of boiler boosting tested	_____°C	_____°C
- Option: DHW circulation pump runtime checked	O	O

Inspection and service checklist

	Date:	Date:
Collector inspection		
- Visual collector inspection	O	O
- Visual inspection of the collector fixings	O	O
- Visual inspection for potential leaks in the roof	O	O
- Visual inspection of the thermal insulation on pipework	O	O
Solar heating circuit		
- Visual inspection for potential leaks in the solar circuit (joints)	O	O
- Colour check of the ANRO heat transfer medium	O	O
- pH value test of ANRO heat transfer medium only in case the medium has turned brown; poss. replacement	pH_____	pH_____
- Frost protection level of the heat transfer medium checked.	_____°C	_____°C
- Safety valve tested	O	O
- Solar expansion vessel inlet pressure tested (for this, release pressure from expansion vessel).	_____bar	_____bar
- In case of noisy pumps or system pressure fluctuations vent the system; for this, block the gravity brake	O	O
- System pressure in a cold system state (see system operating pressure)	_____bar	_____bar
- Reactivate the gravity brake	O	O
Solar cylinder and DHW circuit		
- Protective anode inspection	O	O
- Check for scale build-up in the cylinder and on the thermostatic mixing valve; poss. carry out de-scaling	O	O
- Check the anti-scalding protection (thermostatic mixing valve or via the maximum cylinder temperature limit)	O	O
Control systems		
- Check control parameters and display values for plausibility	O	O
- Solar circuit pump running - circulates (poss. adj. and checking on the flow meter)	_____l/min	_____l/min
- Temperature of boiler boosting tested	_____°C	_____°C
- Option: DHW circulation pump runtime checked	O	O

Inspection and service checklist

	Date:	Date:
Collector inspection		
- Visual collector inspection	O	O
- Visual inspection of the collector fixings	O	O
- Visual inspection for potential leaks in the roof	O	O
- Visual inspection of the thermal insulation on pipework	O	O
Solar heating circuit		
- Visual inspection for potential leaks in the solar circuit (joints)	O	O
- Colour check of the ANRO heat transfer medium	O	O
- pH value test of ANRO heat transfer medium only in case the medium has turned brown; poss. replacement	pH_____	pH_____
- Frost protection level of the heat transfer medium checked.	_____°C	_____°C
- Safety valve tested	O	O
- Solar expansion vessel inlet pressure tested (for this, release pressure from expansion vessel)	_____bar	_____bar
- In case of noisy pumps or system pressure fluctuations vent the system; for this, block the gravity brake	O	O
- System pressure in a cold system state (see system operating pressure)	_____bar	_____bar
- Reactivate the gravity brake	O	O
Solar cylinder and DHW circuit		
- Protective anode inspection	O	O
- Check for scale build-up in the cylinder and on the thermostatic mixing valve; poss. carry out de-scaling	O	O
- Check the anti-scalding protection (thermostatic mixing valve or via the maximum cylinder temperature limit)	O	O
Control systems		
- Check control parameters and display values for plausibility	O	O
- Solar circuit pump running - circulates (poss. adj. and checking on the flow meter)	_____l/min	_____l/min
- Temperature of boiler boosting tested	_____°C	_____°C
- Option: DHW circulation pump runtime checked	O	O

Inspection and service checklist

	Date:	Date:
Collector inspection		
- Visual collector inspection	O	O
- Visual inspection of the collector fixings	O	O
- Visual inspection for potential leaks in the roof	O	O
- Visual inspection of the thermal insulation on pipework	O	O
Solar heating circuit		
- Visual inspection for potential leaks in the solar circuit (joints)	O	O
- Colour check of the ANRO heat transfer medium	O	O
- pH value test of ANRO heat transfer medium only in case the medium has turned brown; poss. replacement	pH_____	pH_____
- Frost protection level of the heat transfer medium checked.	_____°C	_____°C
- Safety valve tested	O	O
- Solar expansion vessel inlet pressure tested (for this, release pressure from expansion vessel)	_____bar	_____bar
- In case of noisy pumps or system pressure fluctuations vent the system; for this, block the gravity brake	O	O
- System pressure in a cold system state (see system operating pressure)	_____bar	_____bar
- Reactivate the gravity brake	O	O
Solar cylinder and DHW circuit		
- Protective anode inspection	O	O
- Check for scale build-up in the cylinder and on the thermostatic mixing valve; poss. carry out de-scaling	O	O
- Check the anti-scalding protection (thermostatic mixing valve or via the maximum cylinder temperature limit)	O	O
Control systems		
- Check control parameters and display values for plausibility	O	O
- Solar circuit pump running - circulates (poss. adj. and checking on the flow meter)	_____l/min	_____l/min
- Temperature of boiler boosting tested	_____°C	_____°C
- Option: DHW circulation pump runtime checked	O	O

Faults - Causes - Remedies

Notes to system user:

Please also refer to the instructions provided for the individual components connected. If it is not possible to rectify a fault, please inform your specialist contractor.

Fault	Possible cause	Remedy
Desired flow temperature not achieved	• Flow rate set too high or • No flow • Too little insolation or too little absorber area	• Note the relationship between the flow rate and the temperature spread between flow and return; check and reduce the flow if necessary. • Have a specialist contractor check the sizing of the system.
System pressure too low	• Leakage and loss of fluid • Faulty DEV or incorrect pre-charge pressure • Safety valve has responded	• Check pipework for leaks. • Notify your specialist contractor.
Flow rate not correct	• Faulty pump • Shut-off valve • Flow rate is dependent on temperature (viscosity) • Collector temperature too low/too high • Faulty sensor	• Observe installation instructions for pump and pump assembly. • Check/open all shut-off valves. • At low temperatures the flow rate can fall below the set value and at high temperatures may exceed it. This is not a fault. • Observe the installation instructions for the control unit and check the collector temperature displayed. The pump is only activated if the solar yield is sufficiently high, and switches off when the maximum cylinder temperature is reached.
Safety valve has responded	• Expansion vessel faulty or wrongly sized	• Notify your specialist contractor.

Product fiche according to Regulation (EU) no. 811-812/2013

Product group: Solar

Product fiche according to Regulation (EU) no. 811/2013

Supplier's name or trade mark			Wolf GmbH	Wolf GmbH	Wolf GmbH	Wolf GmbH
Supplier's model identifier			CFK-1	CRK	F3-1	F3-1Q
Collector aperture area	A_{sol}	m²	2.12	1.99	2.11	2.11
Collector efficiency	η_{col}	%	59	61	66	62
Energy efficiency class of the solar hot water storage tank			dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank
Standing loss of the solar hot water storage tank	S	W	dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank
Storage volume of the solar hot water storage tank	V	l	dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank
Annual non-solar heat contribution	Q_{nonsol}		dependent on the DHW storage tank and load profile	dependent on the DHW storage tank and load profile	dependent on the DHW storage tank and load profile	dependent on the DHW storage tank and load profile
Pump power consumption	solpump	W	25	25	25	25
Standby power consumption	solstandby	W	5	5	5	5
Annual auxiliary electricity consumption	Q_{aux}		93.8	93.8	93.8	93.8

Product fiche according to Regulation (EU) no. 812/2013

Supplier's name or trade mark			Wolf GmbH	Wolf GmbH	Wolf GmbH	Wolf GmbH
Supplier's model identifier			CFK-1	CRK	F3-1	F3-1Q
Collector aperture area	A_{sol}	m²	2.12	1.99	2.11	2.11
Zero-loss efficiency	η_0		0.767	0.642	0.768	0.77
First-order coefficient	a_1	W/m²K²	3.67	0.89	3.31	3.43
Second-order coefficient	a_2	W/m²K²	0.018	0.001	0.015	0.011
Incidence angle modifier	IAM		0.95	0.88	0.95	0.94
Storage volume	V	l	dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank
Load profile			dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank	dependent on the DHW storage tank
Annual non-solar heat contribution	Q_{nonsol}	kWh	dependent on the DHW storage tank and load profile	dependent on the DHW storage tank and load profile	dependent on the DHW storage tank and load profile	dependent on the DHW storage tank and load profile
Pump power consumption	solpump	W	25	25	25	25
Standby power consumption	solstandby	W	5	5	5	5
Annual auxiliary electricity consumption	Q_{aux}	kWh	93.8	93.8	93.8	93.8

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Material number: 3021001 07/2017

GB IE

Product fiche according to Regulation (EU) no. 811/2013

Supplier's name or trade mark			Wolf GmbH
Supplier's model identifier			F3-Q
Collector aperture area	A_{sol}	m²	1.99
Collector efficiency	η_{col}	%	63
Energy efficiency class of the solar hot water storage tank			dependent on the DHW storage tank
Standing loss of the solar hot water storage tank	S	W	dependent on the DHW storage tank
Storage volume of the solar hot water storage tank	V	l	dependent on the DHW storage tank
Annual non-solar heat contribution	Q_{nonsol}		dependent on the DHW storage tank and load profile
Pump power consumption	solpump	W	25
Standby power consumption	solstandby	W	5
Annual auxiliary electricity consumption	Q_{aux}		93.8

Product fiche according to Regulation (EU) no. 812/2013

Supplier's name or trade mark			Wolf GmbH
Supplier's model identifier			F3-Q
Collector aperture area	A_{sol}	m²	1.99
Zero-loss efficiency	η_0		0.794
First-order coefficient	a_1	W/m²K²	3.49
Second-order coefficient	a_2	W/m²K²	0.015
Incidence angle modifier	IAM		0.95
Storage volume	V	l	dependent on the DHW storage tank
Load profile			dependent on the DHW storage tank
Annual non-solar heat contribution	Q_{nonsol}	kWh	dependent on the DHW storage tank and load profile
Pump power consumption	solpump	W	25
Standby power consumption	solstandby	W	5
Annual auxiliary electricity consumption	Q_{aux}	kWh	93.8

Declaration of Conformity

in accordance with the Pressure Equipment Directive 97/23/EC
in accordance with appendix VII

Product designation:	Solar collector category I Absorber Type: TopSon F3-1, TopSon F3-1Q
Applied conformity assessment procedure:	Panel A
Applied standards and specifications:	DIN EN ISO 9806

We, Wolf GmbH, Industriestraße 1, D-84048 Mainburg, Germany hereby declare that the above solar collectors comply with the appropriate regulations laid down in the Directive 97/23/EC.

This declaration loses its validity, if the product has been modified without our express permission. Observe the safety instructions in the documentation and the operating instructions.

Gerdewan Jacobs
Director of Technology

pp. Klaus Grabmaier
Product approval