

OPERATING AND INSTALLATION INSTRUCTIONS

FLAT PLATE SOLAR COLLECTOR

» SOL 25 PLUS



STIEBEL ELTRON

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2. SAFETY INSTRUCTIONS

General Information

Read this entire manual. Failure to follow all the guides, instructions and rules could cause personal injury or property damage. Improper installation, adjustment, alteration, service and use of this unit can result in serious injury.

This unit must be installed by a professional installer. The installation must comply with all national, state and local plumbing and electric codes. Proper installation is the responsibility of the installer. Failure to comply with the installation and operating instructions or improper use voids the warranty.

Save these instructions for future reference. Installer should leave these instructions with the consumer.

If you have any questions regarding the installation, use or operation of this water heater, or if you need any additional installation manuals, please call our technical service line at 800-582-8423 (USA and Canada only). If you are calling from outside the USA or Canada, please call USA 413-247-3380 and we will refer you to a qualified Stiebel Eltron service representative in your area.

Safety Instructions



THIS IS THE SAFETY ALERT SYMBOL. IT IS USED TO ALERT YOU TO POTENTIAL PERSONAL INJURY HAZARD. OBEY ALL SAFETY MESSAGES THAT FOLLOW THIS SYMBOL TO AVOID POSSIBLE INJURY OR DEATH.



COLLECTOR WARNING: A SOLAR COLLECTOR GENERATES HEAT FROM SUNLIGHT AND ALL OTHER TYPES OF LIGHT. THIS LEADS TO COLLECTOR CONNECTORS GETTING VERY HOT, EVEN WHEN THEY ARE NOT FILLED, WHICH CREATES A RISK OF BURN INJURY. COVER THE COLLECTORS WITH OPAQUE MATERIAL UNTIL THE INSTALLATION HAS BEEN COMPLETED. IT IS RECOMMENDED THAT YOU LEAVE THE COLLECTOR INSIDE ITS PACKAGING UNTIL IT IS INSTALLED.



SAFETY VALVE WARNING: NEVER INSTALL ANY VALVES OR SHUT-OFF DEVICES IN THE PIPING BETWEEN THE COLLECTORS AND THE SAFETY VALVE. THE SAFETY VALVE IS ACTUATED AT 87 PSI PRESSURE.

NEVER SET THE SOLAR LOOP PRESSURE GREATER THAN POTABLE (DOMESTIC) WATER SUPPLY PRESSURE. IF THE POTABLE WATER PRESSURE IS TOO LOW, A BOOSTER PUMP MAY BE NEEDED TO ASSURE THAT IT EXCEEDS THE REQUIRED SOLAR LOOP PRESSURE.

The solar system must not bypass auxiliary system safety devices.

Check Valve

The Flowstar pump station is equipped with two check valves to prevent heat loss from thermo-siphoning between the storage tanks and the solar loop and collectors.

Drain Facility

Install a drain valve at the lowest point of the system.

Expansion Tanks

The diaphragm-type expansion tanks are designed for an operating pressure of 87 psi and are resistant to deterioration from propylene glycol mixtures.

The air-side inlet pressure should be set to 5-7 psi less than the system start-up (cold) pressure; check it when the system has not been filled. This pressure must not be reduced.

2. SAFETY INSTRUCTIONS (CONT.)



WARNING: NEITHER DROP THE COLLECTOR NOR ANYTHING ONTO THE COLLECTOR.

NEVER STEP ONTO OR STAND ON THE COLLECTOR.

NEVER LEAVE THE COLLECTOR UNSUPPORTED OR UNSECURED. THE GLASS COULD BREAK IF THE COLLECTOR FALLS OVER CAUSING SERIOUS INJURY OR DEATH.



WARNING: SETTING THE MAXIMUM TANK TEMPERATURE HIGHER THAN 140°F AT THE CONTROL UNIT IS PERMISSIBLE ONLY IN CONJUNCTION WITH A THERMOSTATICALLY-CONTROLLED DHW MIXING VALVE. OTHERWISE THERE CAN BE A RISK OF SCALDING AT THE DRAWOFF POINT.



IMPORTANT: ALL SENSOR WIRING SHOULD BE RATED FOR EXPECTED TEMPERATURES AND MUST BE PROTECTED FROM DEGRADATION AND ELECTRICAL INTERFERENCE.

Solar Loop

Use only a mixture of 50% GRAS (food grade) Propylene Glycol and de-ionized water. (Heat Exchanger type SW, AWWA Fluid Class II - see MSDS for handling instructions.)



WARNING: FLUID MAY BE DISCHARGED AT HIGH TEMPERATURE AND/OR PRESSURE.

NO OTHER FLUID SHALL BE USED THAT WOULD CHANGE THE ORIGINAL CLASSIFICATION OF THIS SYSTEM. UNAUTHORIZED ALTERATIONS TO THIS SYSTEM COULD RESULT IN A HAZARDOUS CONDITION.

Shut-Down

Use only a mixture of 50% GRAS (food grade) Propylene Glycol and de-ionized water. (Heat Exchanger type SW, AWWA Fluid Class II - see MSDS for handling instructions.)

Except for repair and/or emergency, the control unit and the pump must remain powered and activated in order to avoid overheating the collectors. Prior to shutting down the system for repairs, cover the solar collectors or work at night.

If EMERGENCY SHUT-DOWN is needed, the system should be placed in manual operating mode (set HND: OFF - see SOM controller manual), then call for service. There are three isolation valves on the Flowstar pump unit (see Flowstar manual).

3. ASSEMBLY INSTRUCTIONS FOR THE PROFESSIONAL



3.1 Equipment Description

The SOL 25 Plus flat-plate collector converts sunlight (radiation) into heat. Light penetrates the glass cover, which is pre-stressed, highly transparent single pane safety glass. As the light strikes the absorber plate, it is converted into heat. The highly selective vacuum coating of the absorber and the thermal insulation on the back of the absorber reduce heat losses to the environment to a minimum.

The thermal energy produced by the collector is transported by the heat transfer medium (solar loop fluid), via a circulating pump, to the storage tank(s). The inside of the collector can mist up under certain operating conditions (e.g., large tank with low temperature compared to the outdoor temperature and/or high relative humidity). Vent holes are provided in the collectors for venting humidity and equalizing air pressure.

3.2 Important Information



WARNING: RISK OF SCALDING. TO PREVENT THE SOLAR FLUID FROM BOILING IN THE COLLECTORS, THE SYSTEM SHOULD NOT BE FLUSHED OR FILLED DURING PERIODS OF STRONG SUNSHINE.

System Pressure

Regularly check the pressure gauge of the heat transfer circuit at the SE Flowstar pump station; it should indicate 50 psi when the system is cold (below 86°F).

A 2-tank system should include bypass valves to bypass the solar storage tanks. All valves should be labeled with operating position indicated.

After-heating Backup

The backup heater should be of adequate capacity to provide sufficient hot water. The backup water heater must be certified, listed, and labeled by an accredited safety certification organization.

Expansion Tank

The standard, 1.5-gallon expansion tank for the solar loop is sized for up to 10 gallons of total system fluid volume and up to 60 feet in overall system height.

3.3 Technical Data & Specifications

Model	SOL 25 Plus			
Part no.	185541			
	English Units	Unit Dim.	SI Units	Unit Dim.
Height	87-15/16	inches	2233	mm
Width	48-1/8	inches	1223	mm
Depth	3-1/16	inches	78	mm
Grid dimension (incl. fitting)	48-1/8 x 91.46	inches	1223 x 2327	mm
Weight, empty	108	lbs	49	kg
Standing temperature (at 1000 W/m ²)	410	°F	210	°C
Operating pressure, min.	50	psi	3.5	bar
Permissible operating overpressure	87	psi	6.0	bar
Tested pressure (absorber, ex factory)	160	psi	11.0	bar
Test medium (ex factory)	water			
Pressure test of complete solar system (with Tyfocor LS)	115	psi	7.8	bar
Flow rate - rated capacity	13 - 80	gal/hr	50 - 300	l/hr
Pressure drop of collector (@26 gal/hr and 68°F fluid temp.)	~0.029	psi	~2.0	mbar
Pressure drop of collector (@52 gal/hr and 68°F fluid temp.)	~0.087	psi	~6.0	mbar
Connection	G 3/4" male BSPP (British Standard Pipe Parallel Thread)			
Heat-transfer medium	Propylene Glycol, ready-mixed			
Heat-transfer medium (fluid) content, incl. manifold	0.43	gal	1.6	l
Total area	29	sq ft	2.7	m ²
Effective collector (aperture) area	27	sq ft	2.5	m ²
Absorber area	27	sq ft	2.5	m ²
Installation angle	20° - 90°			
Housing	aluminum (saltwater-proof)			
Cover	low-iron, tempered, 0.16" safety glass; super-transparent			
Absorber	copper, highly-selectively vacuum-coated			
Pipe	copper, header pipe Ø 3/4, pot pipe Ø 5/16			
Thermal insulation, rear wall	mineral wool, 1.57 inches / 40 mm thick			
Thermal insulation, side wall	mineral wool, 0.39 inches / 10mm thick			
Seal	EPDM			
Connection fittings	pipe bend (stainless steel) with union nut (brass) G 3/4"			
Thermal power generated (per collector)*	0 to 6830	BTU/hr	0 to 2000	W
Conversion factor h ₀	0.781			
Heat loss value a ₀	0.500	BTU/(hr•ft ² •°F)	2.838	W/(m ² •K ²)
Heat loss value a ₁	0.0027	BTU/(hr•ft ² •°F)	0.0154	W/(m ² •K ²)

4. INSTALLATION INSTRUCTIONS FOR THE PROFESSIONAL

Table 4.1.1 shows some typical components available for several common arrangements of SOL 27 Premium collectors.

Item	Part No.
Collector Clamps for SOL 27 Premium	S267510
SE Flowstar Pump Station kit, including: circulator, expansion tank, pressure relief valve, 2 boiler drains, temperature/pressure gauge, flowmeter, check valve, return line thermometer, air vent	221339
SOM 6 Plus differential temperature controller for one control function and 4 sensor inputs; V-bus ready; (2) FKP6 temperature sensors included	230141
SOM 7 Plus differential temperature controller for two control functions and 4 sensor inputs; V-bus ready; (4) FKP6 temperature sensors included	230142
SOM 9 SI, temperature differential controller ; V-bus; (6) FKP6 temperature sensors included	11566327
Data logger DL2	18000710
VBUS to USB adapter	18000860
Small solar system display	18000777
Pt1000 (1K RTD type) temperature sensor for SOM controllers	165818
Flow meter Max. 5.2 GPM	28001107
Flow meter Max. 13.2 GPM	28001117
Interconnecting stainless steel tube for SOL 27 Premium panels	230185
Inlet and outlet tube set with temperature sensor	230913
Inlet or outlet tube (single) without temperature sensor	231683
Dowfrost™ 50 ready-mixed propylene glycol heat transfer medium, (5.0 U.S. gallons, 19 liters, contains 50% propylene glycol) - jug	074200
Expansion tank, diaphragm-type (2.0 gal.)	ST116
SB 150 S (150 liter, 40-gal.) solar storage tank, single HX	221220
SB 200 S (200 liter, 52-gal.) solar storage tank, single HX	221221
SBB 300 S (300 liter, 82-gal.) solar storage tank, single HX; includes STAK-003 connection kit	221219
SBB 400 S (400 liter, 110-gal.) solar storage tank, single HX; includes STAK-003 connection kit	221222
SBB 300 Plus (300 liter, 82-gal.) solar storage tank, double HX; includes STAK-002 connection kit	187873
SBB 400 Plus (400 liter, 110-gal.) solar storage tank, double HX; includes STAK-002 connection kit	187874
SBB 600 Plus (600 liter, 163-gal.) solar storage tank, double HX; includes STAK-002 connection kit	187875
Red indicator for SBB anode rods	140919
Anode rod for SBB 300-400 tanks	249041
Anode rod for SBB 600 tank	249042
Segmented (flexible) replacement anode for SBB tanks	143499
Gasket for anode rod	036770
Thermometer for SBB Tanks	165967

4.2 Planning and Installation

System Schematic

A schematic diagram of components and pipe arrangements for a typical Stiebel Eltron SOLKIT system is shown in Figure 1.

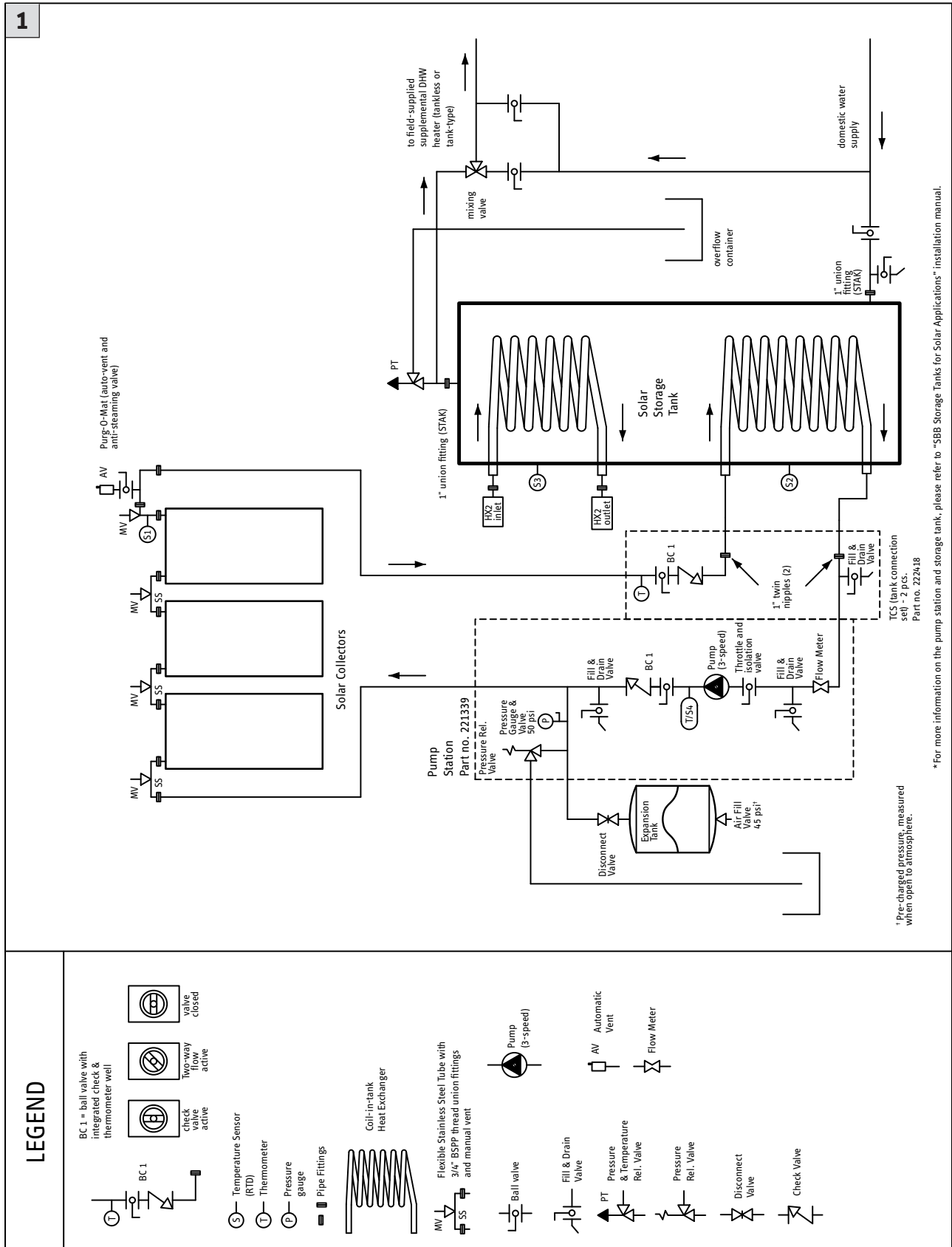


Figure 1: SOLKIT System Schematic Diagram



IMPORTANT: TO PROTECT THE SYSTEM AGAINST FROST AND CORROSION, FILL THE SOLAR HEATING SYSTEM EXCLUSIVELY WITH THE RECOMMENDED PROPYLENE GLYCOL MIXTURE (SECTION 2.1.2). THESE INSTRUCTIONS ARE APPLICABLE ONLY TO SINGLE HYDRAULIC ASSEMBLIES OF NO MORE THAN 30 INDIVIDUAL COLLECTORS. LARGER SYSTEMS REQUIRE INDIVIDUAL APPROVAL. COMMERCIAL SYSTEMS MUST ADHERE TO LOCAL REGULATIONS.

Pipework Installation

Use copper or stainless steel pipes or corrugated stainless steel hoses for the supply and return lines. Pipe diameter is dependent on length of run and expected flow rates. Recommended pipe diameter for systems of up to 10 collectors is 3/4". If the pipe run is longer than 60 feet, a larger pipe diameter may be needed.

All pipe runs to the building interior shall be supplied by the installer. Vent tiles are recommended for the roof penetrations on steeply pitched tile roofs; for flat roofs, corrugated sheet roofs, and roofs with shallow pitch, passing the pipes through an external wall is recommended to avoid water leaks. Pipe hangers must provide correct support and pitch and must meet building codes. Hangers must not compress insulation and should allow for thermal contraction and expansion of the pipework. Installers must comply with all Local, State and National Codes.

We recommend trimming pipes with pipe cutters to avoid creating metal filings. Electrically ground the pipework in accordance with electrical codes. Connect all pipework to the building's ground over the shortest possible distance.

Soldered Pipe

Soldered pipe must be hard-soldered using 95/5 lead-free solder.

Alternative Piping

Piping made with locking ring fittings, press fittings, and corrugated hoses must be sealed using suitable sealants. Seals must be resistant to propylene glycol and temperatures up to 356°F.

Rated Volumetric Flow Rate

The rated volumetric flow rate for a collector array (max. 5 collectors) is 27-80 gallons/hour or 0.45-1.33 GPM. All collector arrays must be connected in parallel. The flow rate for every additional collector array is added to the total, so in a system with 3 x 3 collectors, the flow rate would be 80-240 gallons/hour.

Thermal Insulation

All hot water (and final 5 feet of cold water) piping requires insulation of at least R-2.6. All exterior piping also requires UV and moisture protection. Insulation must be resistant to temperatures up to 356°F.

Use the following recommended temperature and UV-resistant thermal insulation to insulate the external pipework:

- Polyisocyanurate, PVC cover
- Armaflex®
- Mineral wool backed by aluminum mesh foil
- Flexible EPDM hose (e.g. type Aeroflex®)

A rigid aluminum sheath is recommended as protection for the mineral wool. The EPDM hose can be finished with UV-resistant paint. Where required, protect the thermal insulation against bird or rodent attack. Insulate all lines of the solar loop. Apply the thermal insulation after pressure testing and checking the system for leaks (see Section 8).

Extremely cold climates that experience nighttime winter temperatures below -30°F may need thicker-than-standard pipe insulation to prevent freeze-ups or slushing of the anti-freeze mixture.

Minimum Insulation Thickness

Normal Diameter of Pipes	Min. thickness of insulation layer, based on thermal conductivity of 0.035 W/(m·K)
Less than 3/4"	3/4"
3/4" to 1-1/4"	1"
1-1/4" to 4"	identical to pipe diameter
Greater than 4"	4"

Collector Temperature Sensor Well

The collector sensor well is threaded onto the outlet pipe of the collector array (i.e., positioned at the hot side). The outlet can be the upper left or right side of the collector, depending on how the array is plumbed to the pump station. After installing the sensor well on the collector, coat the sensor probe with heat-conducting paste and insert it into the sensor well until it bottoms out. Secure the lead to the outside of the insulation (to avoid melting under high temperature operation) and under a protective cover.

Cover the collector sensor well and the roof outlet with thermal insulation, which must be tightly sealed and must be temperature- and UV-resistant. Also protect the thermal insulation against bird attack. See Figure 2 for details.

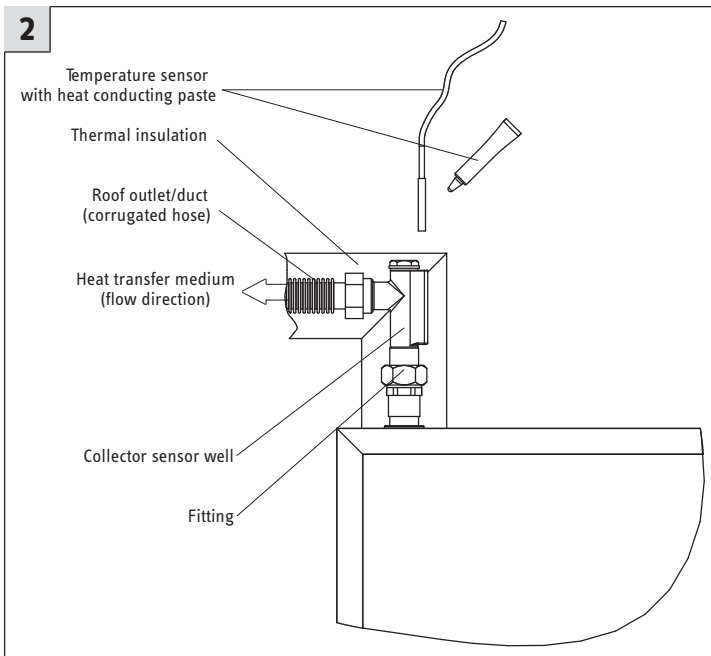


Figure 2: Collector Temperature Sensor Well

Storage Tank

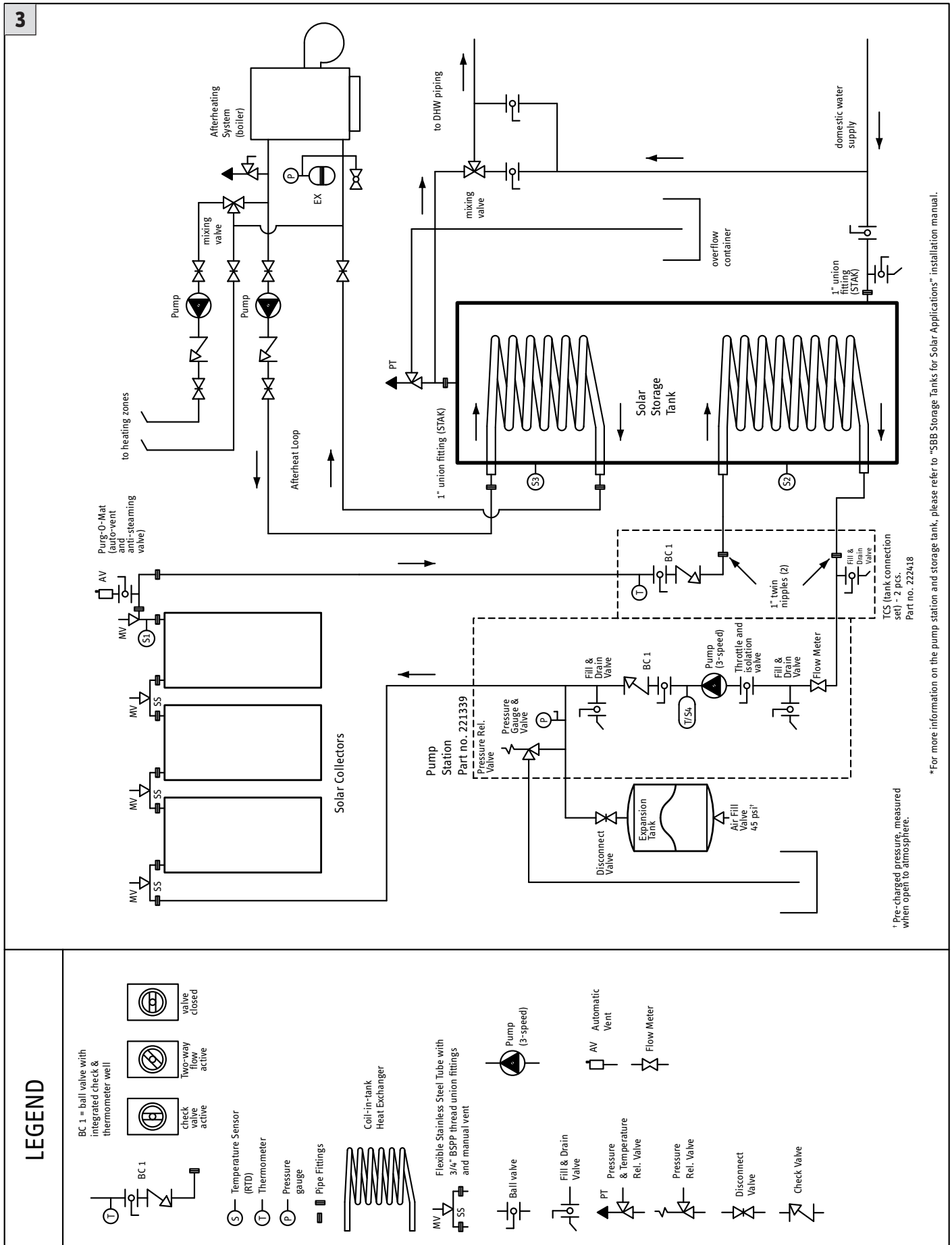
In a standard residential solar heating system, one to three collectors are connected in series to a solar storage tank of 80-163 gallons capacity. Refer to the tank installation instructions for details.

Storage Tank Temperature Sensor

The temperature sensor for the SBB tanks is inserted into the sensor well of the lower internal smooth-tube heat exchanger (only the SBB Plus tanks have an upper heat exchanger). Coat the collector sensor with heat-conducting paste and insert it into the sensor well until it bottoms out. It is very important that the sensor make full contact (without gaps or voids) to the inside of the sensor well's walls. Secure the sensor and its lead (e.g. cable tie).

Installation Example

A general system schematic diagram of components and pipe arrangements for a typical Stiebel Eltron SOLKIT domestic hot water (DHW) heating system with both solar heating and alternative afterheating (or reheating) with a boiler is shown in **Figure 3**.



LEGEND

- BC 1 = ball valve with integrated check & thermometer well
- check valve active
- two-way flow active
- valve closed
- Temperature Sensor (RTD)
- Thermometer
- Pressure gauge
- Pipe Fittings
- Coil-in-tank Heat Exchanger
- Flexible Stainless Steel Tube with 3/4" BSP thread union fittings and manual vent
- Ball valve
- Fill & Drain Valve
- Pressure & Temperature Rel. Valve
- Pressure Rel. Valve
- Disconnect Valve
- Check Valve
- Pump (3-speed)
- AV Automatic Vent
- Flow Meter

* Pre-charged pressure, measured when open to atmosphere.

* For more information on the pump station and storage tank, please refer to "SBB Storage Tanks for Solar Applications" installation manual. Part no. 222418

Figure 3: Collector Temperature Sensor Well

5. MOUNTING SYSTEMS

5.1 General Mounting System Information

Mounting hardware for Stiebel Eltron SOL 25 Plus solar collectors is available in the following configurations:

- 45° fixed mount, vertical orientation
- 45° fixed mount, horizontal orientation
- 30/45/60° fixed mount, vertical orientation
- 30/45/60° fixed mount, horizontal orientation
- Flush mount, vertical orientation
- Flush mount, horizontal orientation

Select the collector mounting kit that is capable of providing the required tilt and azimuth in a mounting location that is not subject to excessive shading of the solar collectors. The mounting kit must be securely attached to a structure capable of supporting and maintaining its integrity under the static and dynamic (e.g., high wind) loading conditions.

The type of mounting system that is best-suited to the installation must be determined by the designer, and must take into consideration the details of the roof, wall, or ground upon which the collectors are to be placed, the latitude and orientation of the site, the space available for the collectors, possible shading from nearby structures or vegetation, etc. The intended use of the system should also be an important consideration. For example, if the house is a summer residence that requires only domestic hot water during summer months, and it is located near 45° north latitude, the best performance can be gained by mounting the collectors at 30° from horizontal, as the best solar gain will be obtained for summertime use¹. In contrast, if most of the water heating (and some space heating) is required during winter months, the best angle for collectors would be approximately 60° from horizontal, thus maximizing wintertime solar gain.

Stiebel Eltron furnishes mounting kits for each of the above arrangements and for each SOLKIT system. Table 5.1, below, gives details of the kits and their components:

Table 5.1 Required hardware for typical mounting situations.

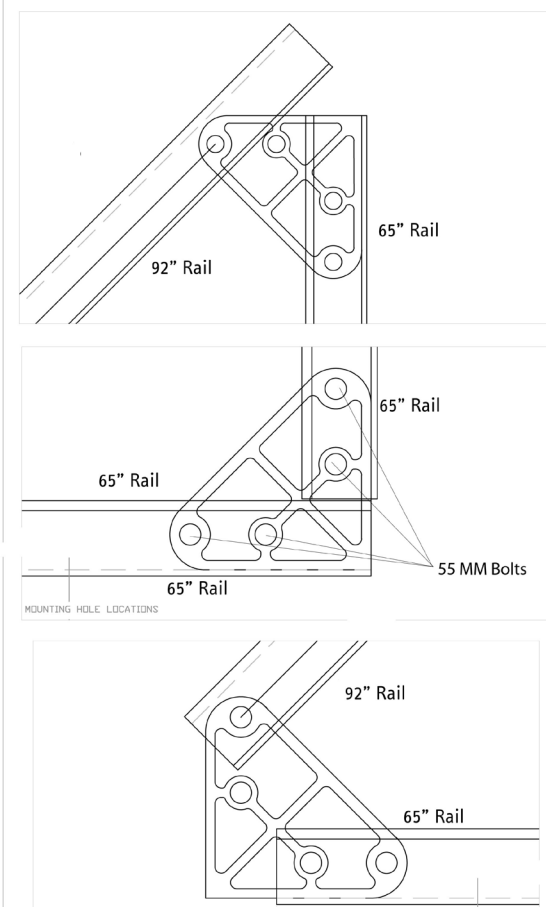
No. of Panels in Array	Orientation	Flush Mount	45° Mount	30/60/45° Mount	Tilt Kit
1	Vertical	(1) 185545 (1) 230913 (2) 560104-25 (4) 560105(L or Z)	(1) 185545 (1) 230913 (2) 560101 (1) 560106 (4) 560105SQ	(1) 185545 (1) 230913 (2) 560102 (1) 560106 (4) 560105SQ	(1) 185545 (1) 230913 (2) SFT-004 (4) 560105L
1	Horizontal	(1) 185546 (2) 560107-25 (1) 230913 (4) 560105(L or Z)	(1) 185546 (1) 230913 (2) 560201 (1) 560206 (4) 560105SQ	(1) 185546 (1) 230913 (2) 560203 (1) 560206 (4) 560105SQ	
2	Vertical	(1) 185546 (2) 560104-25 (1) 230185 (4) 560105(L or Z) (1) 230913	(1) 185546 (1) 230913 (2) 560101 (1) 230185 (1) 560106 (4) 560105SQ	(1) 185546 (1) 230913 (2) 560102 (1) 230185 (1) 560106 (4) 560105SQ	
2	Horizontal	(2) 185546 (2) 560107-25 (1) SFC001* (4) 560105(L or Z) (1) 230185* (1) 230913	(2) 185546 (1) 230913 (1) SFC001* (1) 230185* (4) 560201 (2) 560206 (8) 560105SQ	(2) 185546 (1) 230913 (1) SFC001* (1) 230185* (4) 560203 (2) 560206 (8) 560105SQ	
3	Vertical	(1) 185546 (1) 230913 (1) 185545 (3) 560104-25 (1) SFC001 (6) 560105(L or Z) (2) 230185	(1) 185546 (1) 230913 (1) 185545 (2) 560106 (1) SFC001 (3) 560101 (2) 230185 (6) 560105SQ	(1) 185546 (1) 230913 (1) 185545 (2) 560106 (1) SFC001 (3) 560101 (2) 230185 (6) 560105SQ	
3	Horizontal	(3) 185546 (2) 560107-25 (2) SFC001* (6) 560105(L or Z) (1) 230913 (2) 230185*	(3) 185546 (1) 230913 (2) SFC001* (2) 230185* (6) 560201 (3) 560206 (12) 560105SQ	(3) 185546 (1) 230913 (2) SFC001* (2) 230185* (6) 560203 (3) 560206 (12) 560105SQ	
4		No kit available; requires custom design.			

* If mounting horizontally in one row.

¹ Peak altitude angle of the sun at noon, at 45° north latitude, at summer solstice, is about 68°. Maximum gain occurs with panels normal (perpendicular) to this angle, or tilted 22° from horizontal, facing true south. Overall gain is not reduced significantly if collectors are within ±10° of the optimum tilt angle and within ±15° of true south.

Assembly of 45° SOL 25 Plus Mounting Systems

5.2 45° Industrial Mounting System for SOL 25 Plus (Vertical/Portrait Installation)



560101		Bill of Materials -- 45 Degree Industrial				
Component			Fasteners			
Part	Drawing	Qty	Type	Material	Size	Qty
Bracket	M-101	3	Flange Head Bolt	316 - Stainless Steel	M10X1.5X55mm	10
92" Rail	M-102	1	Flange Head Nut Serrated	316 - Stainless Steel	M10X1.5mm	10
65" Rail - Industrial	M-103	2	Flange Head Bolt	316 - Stainless Steel	M10X1.5X20mm	2
			Flange Head Nut Serrated	316 - Stainless Steel	M10X1.5mm	2

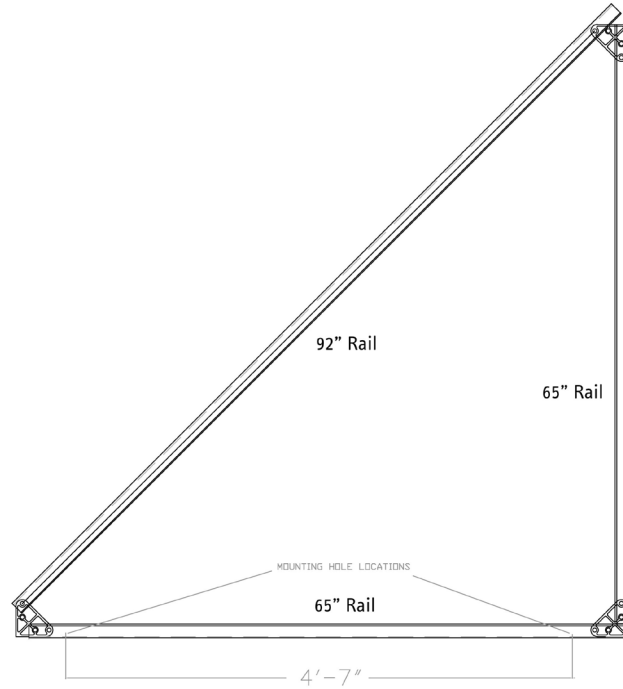
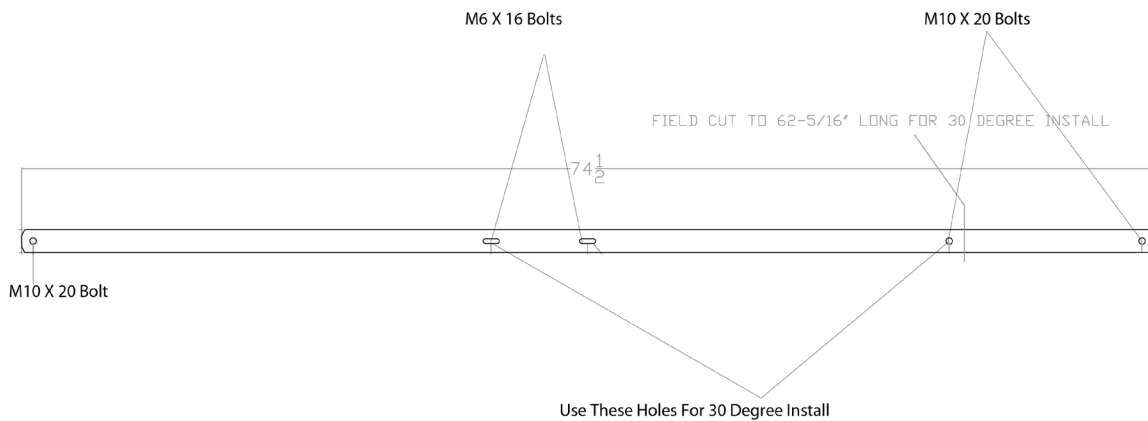


Figure 5.2.1: 45° Vertical Mounting Kit (Part # 560101) Component Listing and Assembly Example



560106		Bill of Materials -- Diagonal Vertical				
Component			Fasteners			
Part	Drawing	Qty	Type	Material	Size	Qty
Diagonal	M-106	2	Flange Head Bolt	316 - Stainless Steel	M10X1.5X20mm	4
			Flange Head Nut Serrated	316 - Stainless Steel	M10X1.5mm	4
			Flange Head Bolt	316 - Stainless Steel	M6X1.0X16mm	1
			Flange Head Nut Serrated	316 - Stainless Steel	M6X1.0mm	1

Figure 5.2.2: SOL 25 Plus Cross Braces

5.2.0 Installation of 45° Mounts on Roofs, Walls, or Ground



IMPORTANT: INSTALLED HEIGHT MUST NOT EXCEED 60 FEET.

CHECK THE ROOF STRUCTURE TO ENSURE PROPER SUPPORT FOR COLLECTORS, MOUNTING HARDWARE, WIND LOADS, ETC. (STATIC CALCULATION REQUIRED; IF NECESSARY, CONTACT THE BUILDER).

ALL ROOFING WORK MUST BE CARRIED OUT BY A PROFESSIONAL ROOFING CONTRACTOR. WHEN WORKING ON ROOFS, OBSERVE ALL RELEVANT SAFETY REGULATIONS, IN PARTICULAR: “SAFETY REGULATIONS FOR WORK ON ROOFS” AND “SAFETY AND RECOVERY HARNESSES”V (OR LOCAL REGULATIONS).

INSTALLERS MUST COMPLY WITH ALL LOCAL, STATE, AND NATIONAL CODES.

ROPE MAY BE USED TO HOIST COLLECTORS, BUT MUST NEVER BE ATTACHED TO THE COLLECTORS’ PIPES.

WHEN WORKING ON ROOFS, ALL RELEVANT SAFETY REGULATIONS MUST BE OBSERVED.

Designers and installers should consider how rainwater, snow, and ice accumulation is affected by the installation of the collectors and mounting hardware. Collectors affect the flow of rainwater around them, so appropriate means for conducting the water away from the vicinity of the collectors must be provided. Collectors and mounting hardware are also subject to accumulation of snow and ice in cold climates. Installations must provide protection to people and structures below the solar collectors to avoid hazards due to falling snow and ice as it melts (or is blown off by winds). Installers must also consider the possibility of snow and ice falling onto collectors from any structures located above them and provide appropriate means of protecting them.

Building materials adjacent to solar components must not be exposed to the elevated temperatures that the collectors can generate. Exposed components (that can readily be reached) must be maintained below 140°F or otherwise be insulated/isolated. All other exposed surfaces that can exceed 140°F should be labeled with appropriate burn hazard warnings.



NOTICE: TO PREVENT EXCESSIVE PRESSURE DROP IN THE SOLAR LOOP, NEVER LINK UP MORE THAN 5 COLLECTORS IN SERIES. ARRANGE THE INDIVIDUAL LINEAR ARRAYS PARALLEL TO EACH OTHER.

Building penetrations for plumbing and mounting must not impair enclosure integrity or functionality and must not allow rodent or vermin intrusion. They must meet applicable codes and National Roofing Contractors Assoc. practices. Structural members penetrated by solar system components must not be compromised and penetrations must meet code, particularly penetrations through fire-rated construction. Do not reduce fire resistance below code. Protect control sensor wiring.

Multiple Rows of Collectors:

If multiple arrays of collectors are being installed on a flat roof, one behind another, the recommended spacing between them should be:

- at least 25 ft. (7.6 m) for vertical installation, as shown in **Figure 5.2.10**; or
- at least 14 ft. (4.0 m) for horizontal installation, as shown in **Figure 5.2.11**.

This spacing prevents excessive shading from adjacent rows for latitudes of up to 50°. For latitudes significantly higher than 50°, multiple rows of collectors may not be practical due to low sun altitude angles.

Fastening To Structures

The type of roof or wall is a crucial factor in the choice of fasteners. Remember to take the static and dynamic (live load) forces into account.

The 45° vertical mounting racks can develop significant pull-out forces under heavy wind conditions; therefore it is important to take wind loads into account.

Force data for each collector:

Mounting Ht.	Shear Force	Tensile Force
Up to 26 ft. (8m)	470 lbs. (2.1 kN)	250 lbs. (1.1 kN)
Up to 65 ft. (20m)	790 lbs. (3.5 kN)	700 lbs. (3.1 kN)

Depending on the hardware, installers should consider distributing the shear and tensile forces over the fastening surface with six fasteners.

For anchoring in concrete, use six M8 UPAT Multicones or SM M10 anchors, both of stainless steel, per collector.

For anchoring in wood, use six wood screws in accordance with DIN 571, at least 10 x 80, of stainless steel, per collector.

5.2.1 Vertical 45° Mounting on a Flat Roof

(Please review section 5.2.0)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Assemble 2 triangular trusses using the 65" rails (M-103), the 92" rails (M-102), the brackets (M-101), and the 55 mm bolts as shown in Figure 5.2.1.

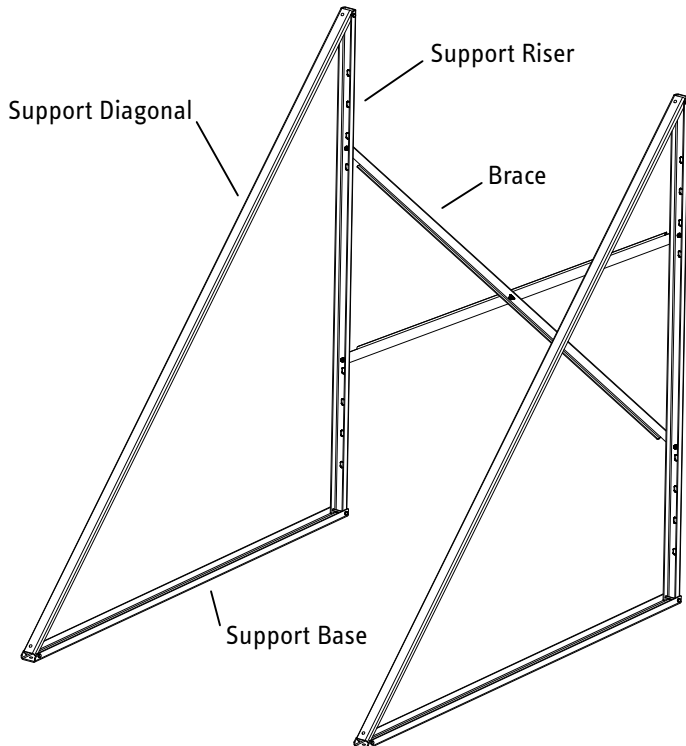


Figure 5.2.3: Assembled triangle trusses with cross-braces.

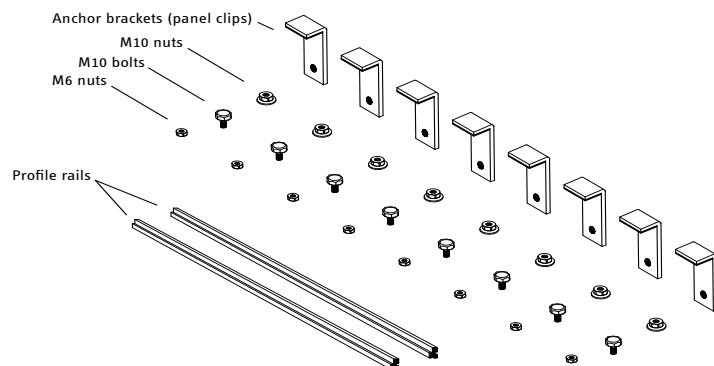


Figure 5.2.4: R1 Mounting Frame for Vertical Collector Arrangement

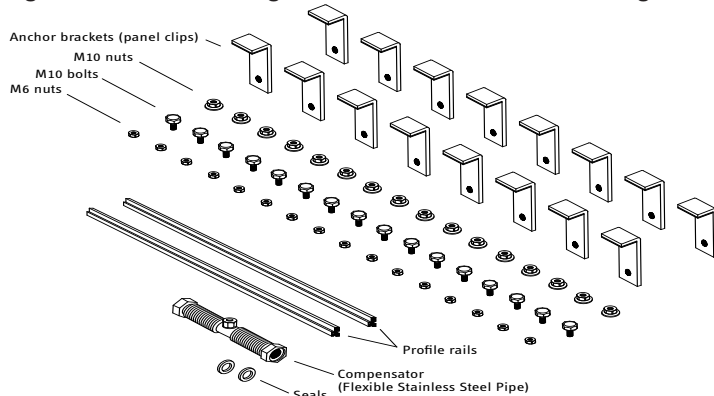


Figure 5.2.5: R2 Mounting Frame for Vertical Collector Arrangement

3. Bolt the trusses to the cross braces connecting the bolts as shown in Figure 5.2.2. The resulting assembly should look similar to Figure 5.2.3. The collector frames may then be bolted to the holes in the 92" rails using the 20 mm bolts. The collector frames, as well as the number of trusses used, depends upon the number of collectors being installed (see Table 5.1). If multiple flat-roof mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.2.7 and 5.2.8.

4. If installing one collector, the triangular trusses with cross braces must be set up at intervals of ≤ 43 in. (110 cm). If installing two or more collectors, the triangle trusses with their attached cross braces are to be positioned at the midpoint, behind the collectors. With a 3 collector system the 3 triangular trusses should be equidistant with 2 sets of cross braces interconnecting them. The resulting assembly should then be centered to support the R1/R2/SFC001 frame assembly.

5. When installing four or five trusses, brace both end spans with crossbraces, as shown in 5.2.8. For six or more trusses, cross-braces should also be placed in an inside span.

6. Fasten the flat-roof mounting racks to the roof in an appropriate manner, or weight them down with at least 400 lbs. (180 kg) of solid, dead weight (e.g. concrete slab) per collector if the installed height is less than 25 ft (8 m). Remember to take the static and dynamic (e.g., wind) loading into account for the roof structure.

7. For installed heights above 25 ft. (8 m), weighting is not advisable due to the higher wind loading conditions. In this case, the holes in the 65" rail at the base (M-103) should be used to fasten the mounting hardware to the roof (six M6 bolts per horizontal support).

5.2.2 Vertical 45° Mounting on a Wall

Procedures described above for mounting of collectors upon a flat roof apply to wall mounting, except for the following:

1. Cross braces should be attached to the 65" rail at the base of the trusses rather than the ones at the rear.
2. Fasten the rear 65" rail of the trusses to the wall using the mounting holes in a suitable manner.
3. Low elevation mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.

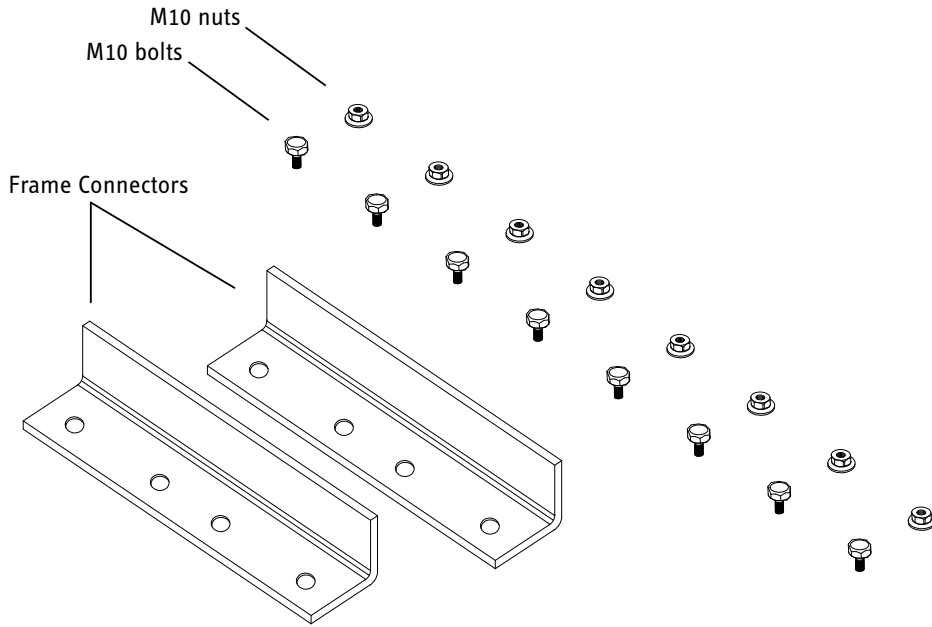


Figure 5.2.6: SFC001 Frame Connector Kit.

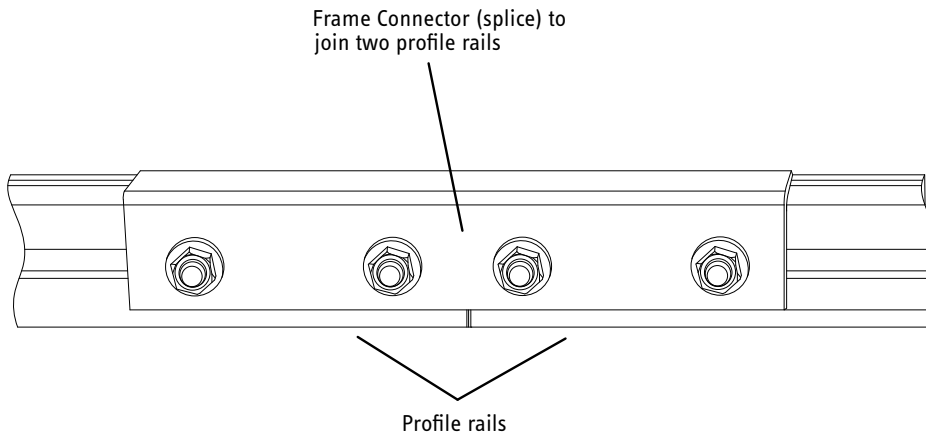


Figure 5.2.7: SFC001 Frame Connector (Splice) Kit.

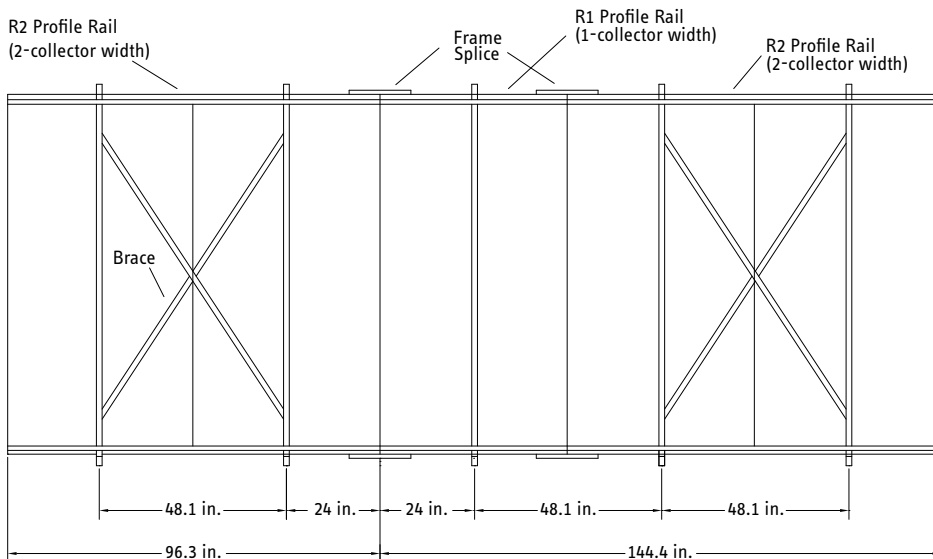


Figure 5.2.8: Multiple-collector framing arrangement, with frame connectors and cross-bracing.

5.2.3 Vertical 45° Mounting On The Ground

Procedures described above for mounting of collectors upon a flat roof apply to ground mounting, except for the following:

1. Installer must ensure that the mounting foundation for the system is not subject to movement, such as frost heaves. Therefore, it is necessary to install footings below the frost line in locations subject to freezing weather. If it is not possible or practicable to avoid movement due to frost, etc., it will be necessary to provide a floating frame that does not flex or warp the collectors' mounting frames if the ground shifts or heaves.
2. Ground mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.
3. Ground mounting often requires longer outside piping runs, so proper insulation and protection of collector piping essential. Installers should consider laying pipe runs below grade to avoid damage and to mark the location of these runs to avoid damage from digging operations.

5.2.4 Vertical 45° Mounting On A Pitched Roof

Procedures described above for mounting of collectors upon a flat roof apply to mounting on a pitched (sloped) roof, except for the following:

1. Use of weights to secure collectors and mounting hardware is not advisable. Collector mounting frames should be fastened to all pitched roofs in an appropriate manner.
2. The 45° mounting kits add 45° to an existing roof pitch, as shown in table 5.2.9. Roofs with pitches above 9-in-12 generally should not use this mounting kit, as the resulting collector tilt angle will be too steep for almost any location.

Roof Pitch (rise-to-run)	Roof Pitch Angle	Resulting Collector Tilt Angle with 45° Mount
1-in-12	4.8°	49.8°
2-in-12	9.5°	54.5°
3-in-12	14.0°	59.0°
4-in-12	18.4°	63.4°
5-in-12	22.6°	67.6°
6-in-12	26.6°	71.6°
7-in-12	30.3°	75.3°
8-in-12	33.7°	78.7°
9-in-12	36.9°	not recommended
10-in-12	39.8°	not recommended
11-in-12	42.5°	not recommended
12-in-12	45.0°	not recommended

Table 5.2.9: Resulting Inclination Angle When Mounting a 45° Kit to Various Roof Pitches

Array spacing for 45° Vertical Mounting
on a flat roof or ground.

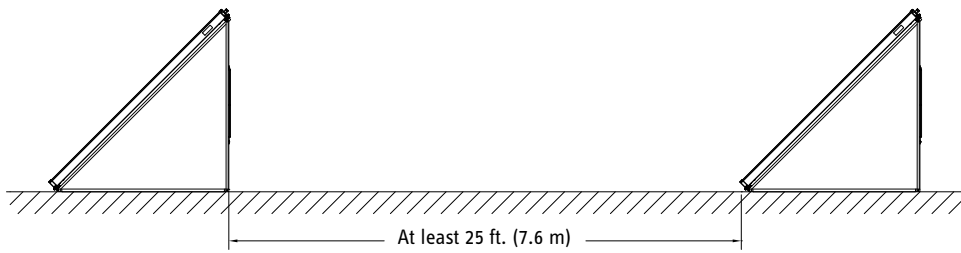


Figure 5.2.10: Recommended row spacing for 45° vertical arrays for latitudes up to 50°.

Array spacing for 45° Horizontal Mounting
on a flat roof or ground.

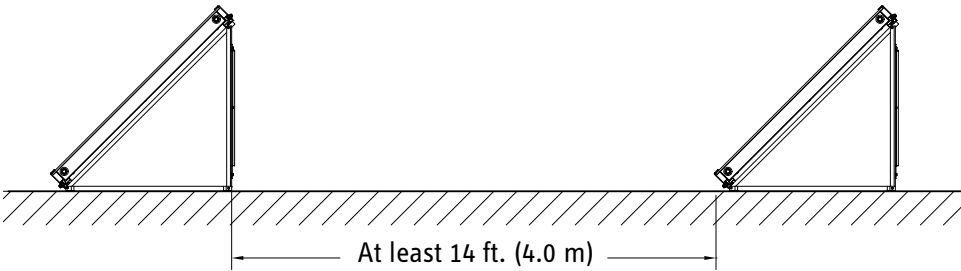


Figure 5.2.11: Recommended row spacing for 45° horizontal arrays for latitudes up to 50°.

5.3 45° Industrial Mounting System for SOL 25 Plus (Horizontal/Landscape Installation)

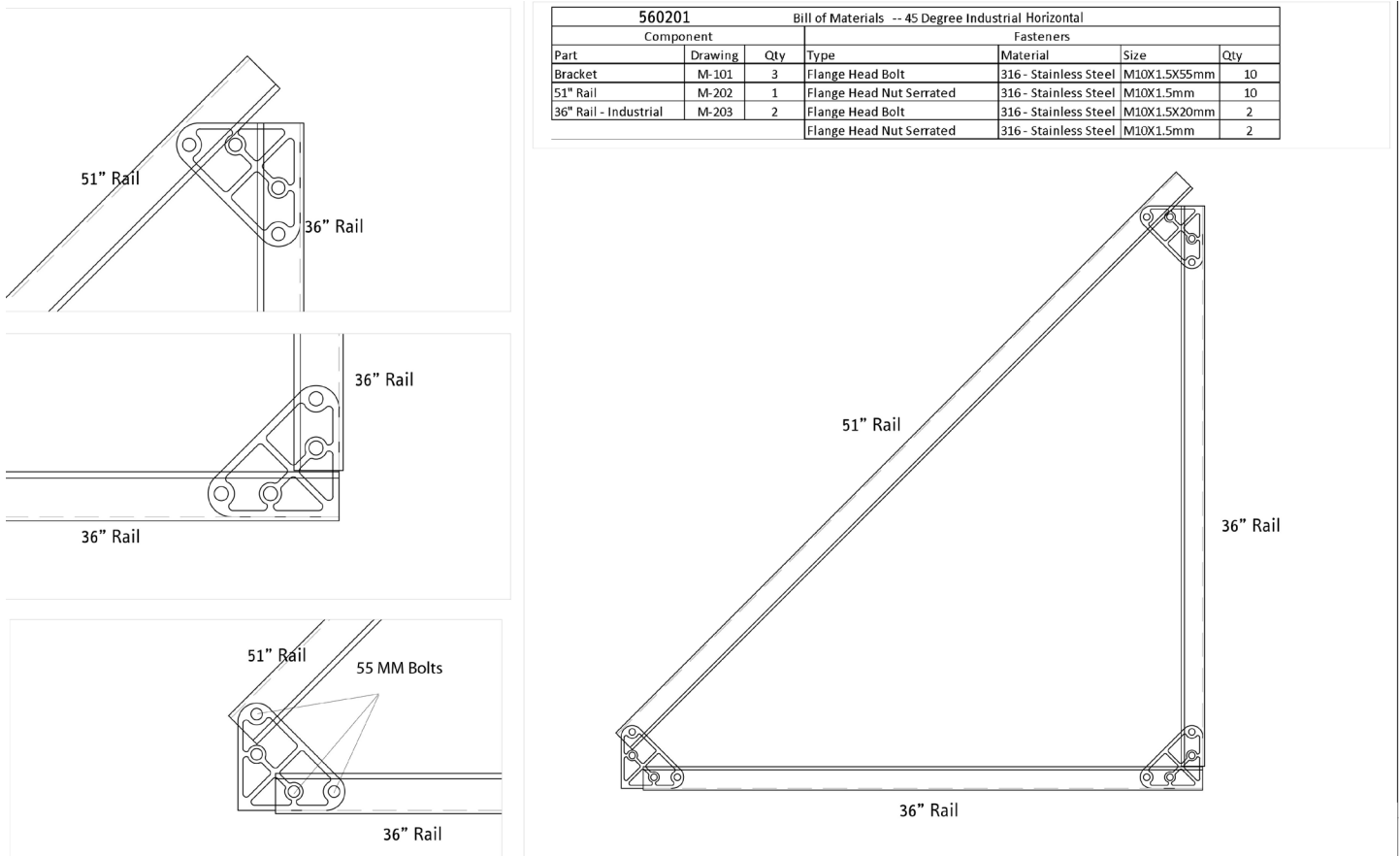


Figure 5.3.1: 45° Horizontal Mounting Kit (Part # 560101) Component Listing and Assembly Example

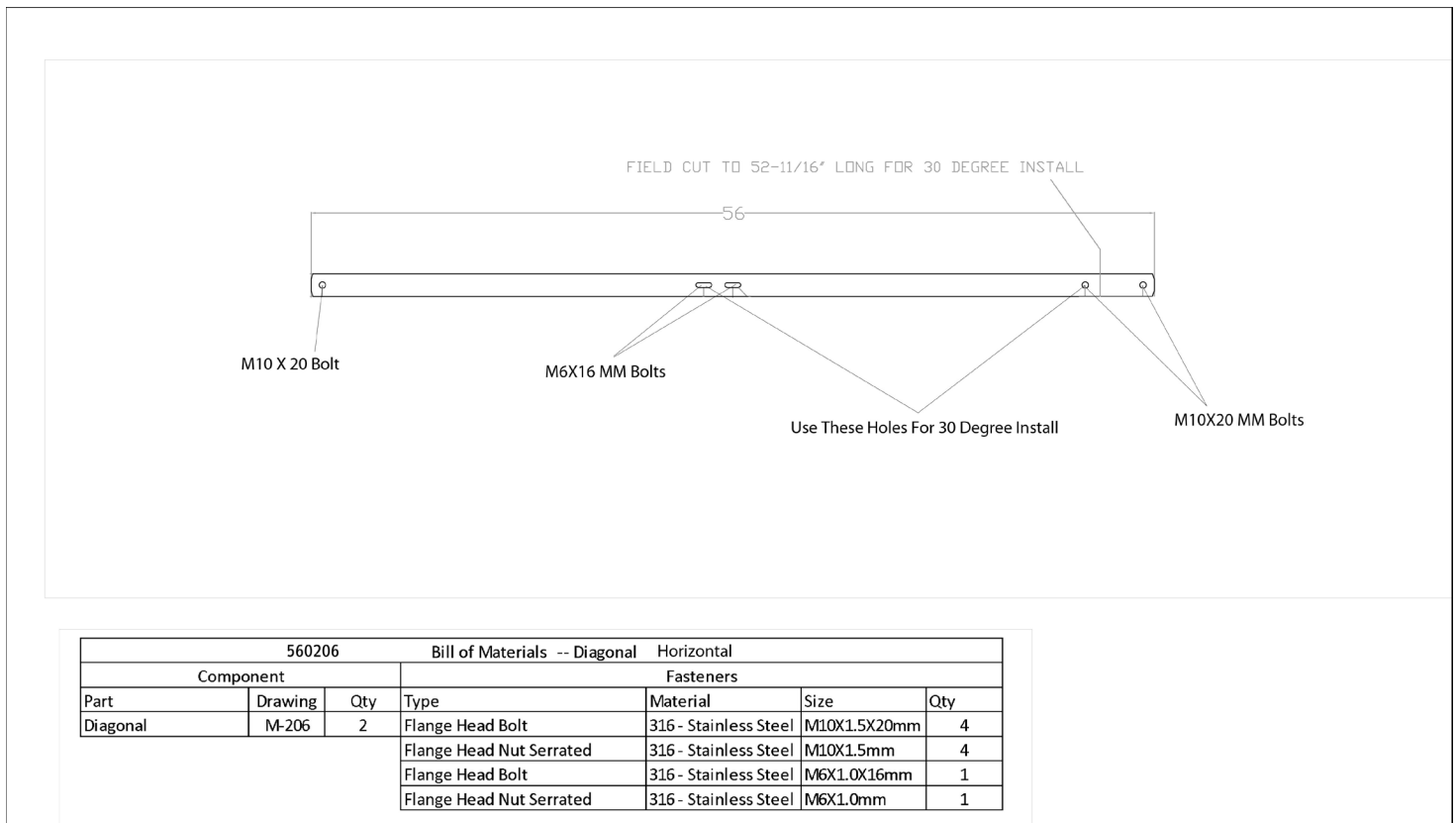


Figure 5.3.2: SOL 25 Plus W Cross Braces

5.3.1 Horizontal 45° Mounting on a Flat Roof

(Please review section 5.2.0)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Assemble 2 triangular trusses using the 36" rails (M-203), the 51" rails (M-202), the brackets (M-101), and the 55 mm bolts as shown in Figure 5.3.1.
3. Bolt the trusses to the cross braces connecting the bolts as shown in Figure 5.3.2. The resulting assembly should look similar to Figure 5.2.3. The collector frames may then be bolted to the holes in the 51" rails using the 20 mm bolts. The triangular truss assemblies with cross braces should be attached to the center of the R2 collector frames (Figure 5.2.5) i.e. there should be an equal amount of the profile rail to the right and left hand sides of each of the triangular trusses. If multiple flat-roof mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.2.7 and 5.2.8.
4. Fasten the flat-roof mounting racks to the roof in an appropriate manner, or weight them down with at least 400 lbs. (180 kg) of solid, dead weight (e.g. concrete slab) per collector if the installed height is less than 25 ft (8 m). Remember to take the static and dynamic (e.g., wind) loading into account for the roof structure.
5. For installed heights above 25 ft. (8 m), weighting is not advisable due to the higher wind loading conditions. In this case, the holes in the 36" rail at the base (M-203) should be used to fasten the mounting hardware to the roof (six M6 bolts per horizontal support).

5.3.2 Horizontal 45° Mounting on a Wall

Procedures described above for mounting of collectors upon a flat roof apply to wall mounting, except for the following:

1. Cross braces should be attached to the 36" rail at the base of the trusses rather than the ones at the rear.
2. Fasten the rear 36" rail of the trusses to the wall using the mounting holes in a suitable manner.
3. Low elevation mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.

5.3.3 Vertical 45° Mounting On The Ground

Procedures described above for mounting of collectors upon a flat roof apply to ground mounting, except for the following:

1. Installer must ensure that the mounting foundation for the system is not subject to movement, such as frost heaves. Therefore, it is necessary to install footings below the frost line in locations subject to freezing weather. If it is not possible or practicable to avoid movement due to frost, etc., it will be necessary to provide a floating frame that does not flex or warp the collectors' mounting

frames if the ground shifts or heaves.

2. Ground mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.
3. Ground mounting often requires longer outside piping runs, so proper insulation and protection of collector piping essential. Installers should consider laying pipe runs below grade to avoid damage and to mark the location of these runs to avoid damage from digging operations.

5.3.4 Horizontal 45° Mounting On A Pitched Roof

Procedures described above for mounting of collectors upon a flat roof apply to mounting on a pitched (sloped) roof, except for the following:

1. Use of weights to secure collectors and mounting hardware is not advisable. Collector mounting frames should be fastened to all pitched roofs in an appropriate manner.
2. The 45° mounting kits add 45° to an existing roof pitch, as shown in table 5.2.9. Roofs with pitches above 9-in-12 generally should not use this mounting kit, as the resulting collector tilt angle will be too steep for almost any location.

Assembly of 30/45/60° SOL 25 Plus Mounting Systems

5.4 30/60/45° Mounting System for SOL 25 Plus (Vertical/Portrait Installation)

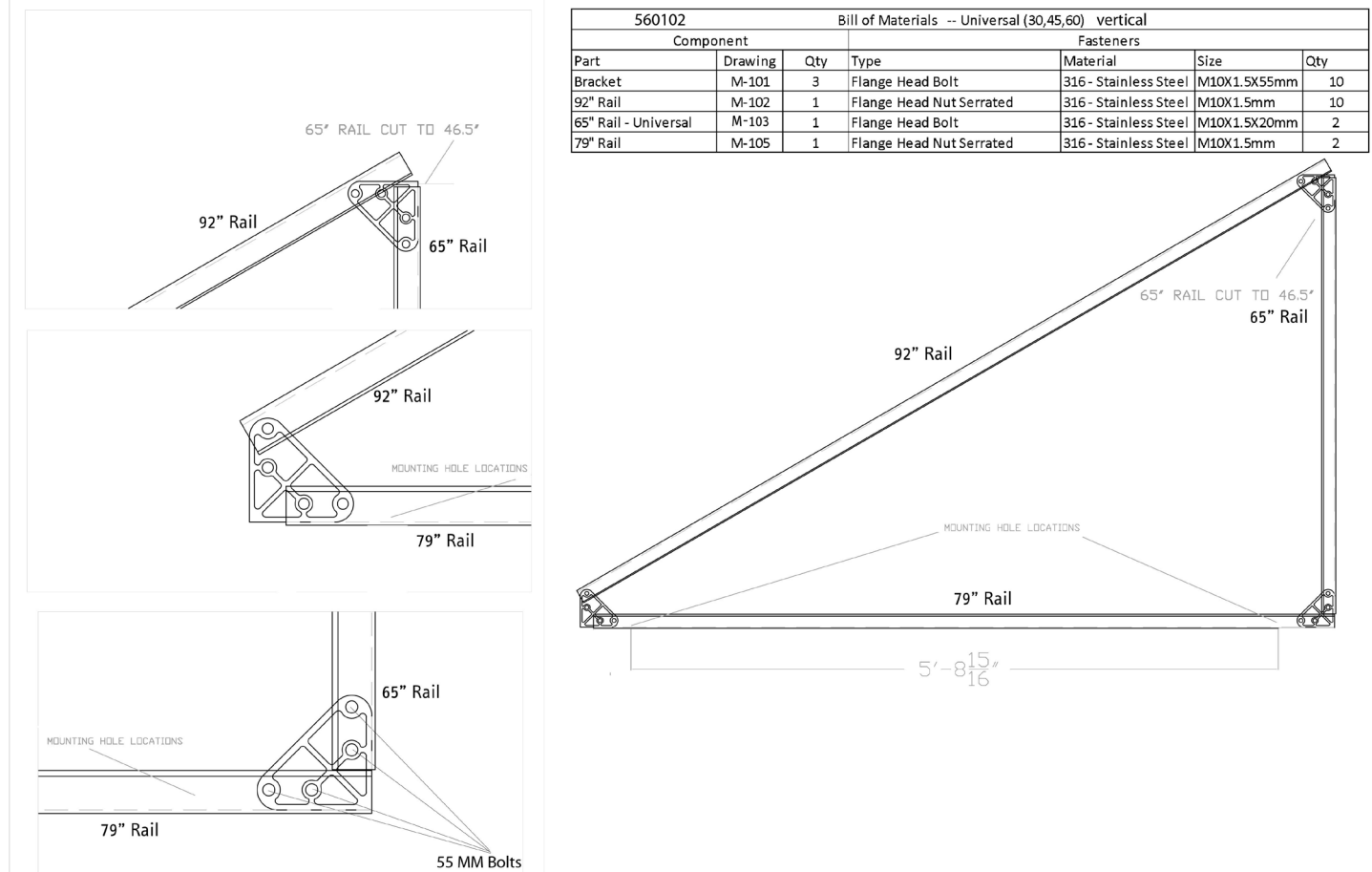


Figure 5.4.1: 30/60/45° Vertical Mounting Kit (Part # 560102) Component Listing and Assembly Example, 30° Mode

5.4.0 Installation of 30/60° Mounts on Roofs, Walls, or Ground



IMPORTANT: INSTALLED HEIGHT MUST NOT EXCEED 60 FEET.

CHECK THE ROOF STRUCTURE TO ENSURE PROPER SUPPORT FOR COLLECTORS, MOUNTING HARDWARE, WIND LOADS, ETC. (STATIC CALCULATION REQUIRED; IF NECESSARY, CONTACT THE BUILDER).

ALL ROOFING WORK MUST BE CARRIED OUT BY A PROFESSIONAL ROOFING CONTRACTOR. WHEN WORKING ON ROOFS, OBSERVE ALL RELEVANT SAFETY REGULATIONS, IN PARTICULAR: "SAFETY REGULATIONS FOR WORK ON ROOFS" AND "SAFETY AND RECOVERY HARNESSES" (OR LOCAL REGULATIONS).

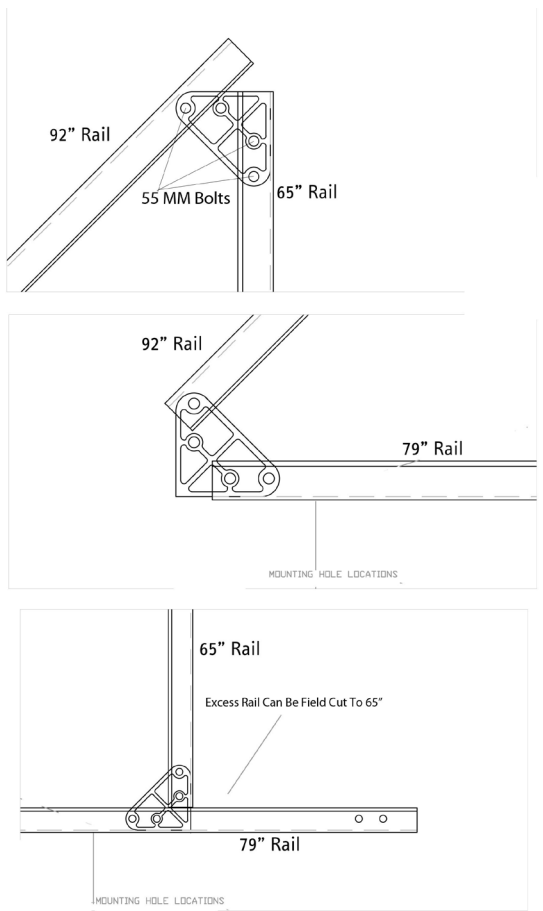
INSTALLERS MUST COMPLY WITH ALL LOCAL, STATE, AND NATIONAL CODES.

ROPE MAY BE USED TO HOIST COLLECTORS, BUT MUST NEVER BE ATTACHED TO THE COLLECTORS' PIPES.

WHEN WORKING ON ROOFS, ALL RELEVANT SAFETY REGULATIONS MUST BE OBSERVED.

Designers and installers should consider how rainwater, snow, and ice accumulation is affected by the installation of the collectors and mounting hardware. Collectors affect the flow of rainwater around them, so appropriate means for conducting the water away from the vicinity of the collectors must be provided. Collectors and mounting hardware are also subject to accumulation of snow and ice in cold climates. Installations must provide protection to people and structures below the solar collectors to avoid hazards due to falling snow and ice as it melts (or is blown off by winds). Installers must also consider the possibility of snow and ice falling onto collectors from any structures located above them and provide appropriate means of protecting them.

Building materials adjacent to solar components must not be exposed to the elevated temperatures that the collectors can generate. Exposed components (that can readily be reached) must be maintained below 140°F or otherwise be insulated/isolated. All other exposed surfaces that can exceed 140°F should be labeled with appropriate burn hazard warnings.



560102 Bill of Materials -- Universal (30,45,60) vertical						
Component			Fasteners			
Part	Drawing	Qty	Type	Material	Size	Qty
Bracket	M-101	3	Flange Head Bolt	316 - Stainless Steel	M10X1.5X55mm	10
92" Rail	M-102	1	Flange Head Nut Serrated	316 - Stainless Steel	M10X1.5mm	10
65" Rail - Universal	M-103	1	Flange Head Bolt	316 - Stainless Steel	M10X1.5X20mm	2
79" Rail	M-105	1	Flange Head Nut Serrated	316 - Stainless Steel	M10X1.5mm	2

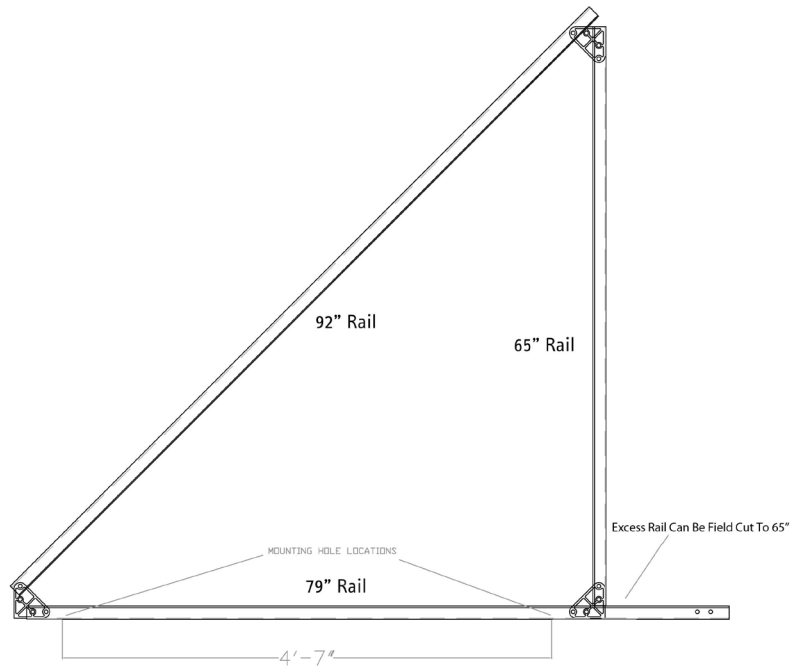


Figure 5.4.2: 30/60/45° Vertical Mounting Kit (Part # 560102) Component Listing and Assembly Example, 45° Mode Fastening To Structures

NOTICE: TO PREVENT EXCESSIVE PRESSURE DROP IN THE SOLAR LOOP, NEVER LINK UP MORE THAN 5 COLLECTORS IN SERIES. ARRANGE THE INDIVIDUAL LINEAR ARRAYS PARALLEL TO EACH OTHER.

Building penetrations for plumbing and mounting must not impair enclosure integrity or functionality and must not allow rodent or vermin intrusion. They must meet applicable codes and National Roofing Contractors Assoc. practices. Structural members penetrated by solar system components must not be compromised and penetrations must meet code, particularly penetrations through fire-rated construction. Do not reduce fire resistance below code. Protect control sensor wiring.

If multiple arrays of collectors are being installed on a flat roof, one behind another, the recommended spacing between them should be:

- at least 30 ft. (9.3 m) for 60° vertical installation, as shown in Figure 21; or
- at least 18 ft. (5.3 m) for 30° vertical installation, as shown in Figure 22.

This spacing prevents excessive shading from adjacent rows for latitudes of up to 50°. For latitudes significantly higher than 50°, multiple rows of collectors may not be practical due to low sun altitude angles.

The type of roof or wall is a crucial factor in the choice of fasteners. Remember to take the static and dynamic (live load) forces into account.

The 30/60° vertical mounting racks can develop significant pull-out forces under heavy wind conditions, particularly in the 60° tilt orientation; therefore it is important to take wind loads into account.

Mounting Ht.	Shear Force	Tensile Force
Up to 26 ft. (8m)	470 lbs. (2.1 kN)	250 lbs. (1.1 kN)
Up to 65 ft. (20m)	790 lbs. (3.5 kN)	700 lbs. (3.1 kN)

To handle shear forces along the fastening surface, 6 fasteners over which the shear force is distributed are recommended.

To handle tensile forces perpendicular to the fastening surface, 6 fasteners over which the tensile force is distributed are recommended.

For anchoring in concrete, use six M8 UPAT Multicones or SM M10 anchors, both of stainless steel, per collector.

For anchoring in wood, use six wood screws in accordance with DIN 571, at least 10 x 80, of stainless steel, per collector.

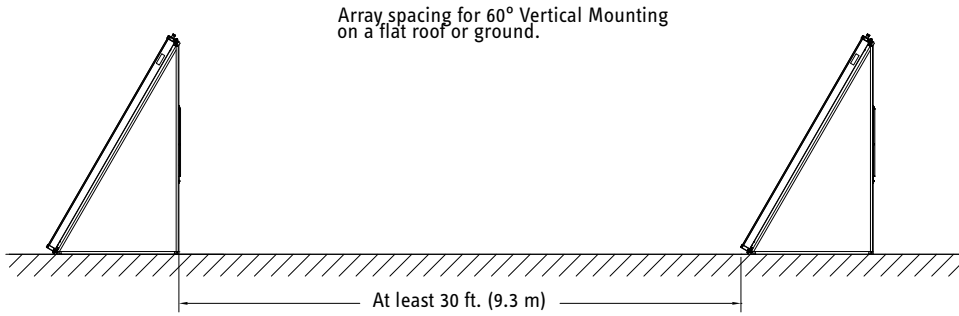


Figure 5.4.3: Recommended row spacing for 60° vertical arrays for latitudes up to 50°.

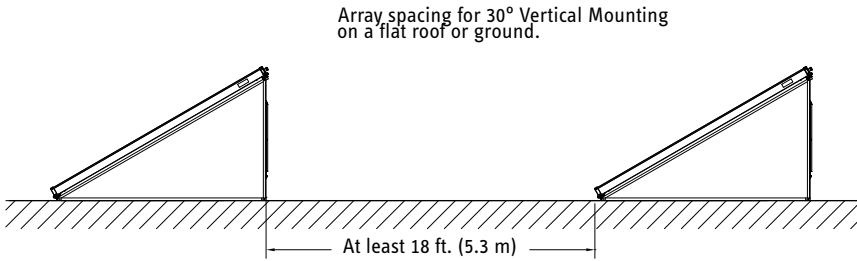


Figure 5.4.4: Recommended row spacing for 30° vertical arrays for latitudes up to 50°.

5.4.1 Vertical 30° Mounting on a Flat Roof

(Please review section 5.2.0)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Assemble 2 triangular trusses using the 65” rails (M-103), the 92” rails (M-102), the 79” rails (M-105), the brackets (M-101), and the 55 mm bolts as shown in Figure 5.4.1. Note that the 65” rails are cut to 46.5”.
3. Bolt the trusses to the cross braces connecting the bolts as shown in Figure 5.2.2. The resulting assembly should look similar to Figure 5.2.3. The collector frames may then be bolted to the holes in the 92” rails using the 20 mm bolts. The collector frames, as well as the number of trusses used, depends upon the number of collectors being installed (see Table 5.1). If multiple mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.2.7 and 5.2.8.
4. If installing one collector, the triangular trusses with cross braces must be set up at intervals of ≤ 43 in. (110 cm). If installing two or more collectors, the triangle trusses with their attached cross braces are to be positioned at the midpoint, behind the collectors. With a 3 collector system the 3 triangular trusses should be equidistant with 2 sets of cross braces interconnecting them. The resulting assembly should then be centered to support the R1/R2/SFC001 frame assembly.
5. When installing four or five trusses, brace both end spans with crossbraces, as shown in 5.2.8. For six or more trusses, cross-braces should also be placed in an inside span.
6. Fasten the flat-roof mounting racks to the roof in an appropriate manner, or weight them down with at least 400 lbs. (180 kg) of solid, dead weight (e.g. concrete slab) per collector if the installed height is less than 25 ft (8 m). Remember to take the static and dynamic (e.g., wind) loading into account for the roof structure.
7. For installed heights above 25 ft. (8 m), weighting is not advisable due to the higher wind loading conditions. In this case, the holes in the 79” rail at the base (M-105) should be used to fasten the mounting hardware to the roof (six M6 bolts per horizontal support).



Figure 5.4.5: Typical wall-mount installation of a 60° collector array.

5.4.2 Vertical 30° Mounting on a Wall

Mounting the vertical 30° system on a wall is not recommended.

5.4.3 Vertical 30° Mounting On A Pitched Roof

Procedures described above for mounting of collectors on a flat roof apply to mounting on a pitched (sloped) roof, except for the following:

1. The 30° mounting kits add 30° to an existing roof pitch, as shown in table 5.2.9.

5.4.4 Vertical 60° Mounting on a Flat Roof

(Please review section 5.4.0)

1. Choose attachment site, allowing for subsequent pipe penetration.

2. Assemble 2 triangular trusses using the 65" rails (M-103), the 92" rails (M-102), the 79" rails (M-105), the brackets (M-101), and the 55 mm bolts similar to the manner shown in Figure 5.4.1 with the following change: the 92" rails should be reversed such that the 65" rail connects to the end with the holes closest, and the 79" rail connects to the end with the holes further away. If desired, the 65" rails can be cut to 46.5".

3. Bolt the trusses to the cross braces connecting the bolts as shown in Figure 5.2.2. The resulting assembly should look similar to Figure 5.2.3. The collector frames may then be bolted to the holes in the 92" rails using the 20 mm bolts. The collector frames, as well as the number of trusses used, depends on the number of collectors being installed (see Table 5.1). If multiple mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.1.1, 5.2.7 and 5.2.8.

4. If installing two or more collectors, the triangle trusses with their attached cross braces are to be positioned at the midpoint, behind the collectors. With a 3 collector system the 3 triangular trusses should be equidistant with 2 sets of cross braces interconnecting them. The resulting assembly should then be centered to support the R1/R2/SFC001 frame assembly as shown in Figure 5.1.1.

5. When installing four or five trusses, brace both end spans with crossbraces, as shown in 5.2.8. For six or more trusses, cross-braces should also be placed in an inside span.

6. Fasten the base of the flat-roof mounting racks to the solar roof mount flashing kit (560105SQ). Remember to take the static and dynamic (e.g., wind) loading into account for the roof structure. Nominal distance is 36 1/2" between the front and back mounting holes and 48" between the bases.

5.4.5 Vertical 60° Mounting on a Wall

Procedures described above for mounting of collectors on a flat roof apply to wall mounting, except for the following:

1. Cross braces should be attached to the 65" (cut down to 46.5")

rail at the base of the trusses rather than the ones at the rear (as pictured in figure 5.4.5).

2. Fasten the rear 79" rail of the trusses to the wall using the mounting holes in a suitable manner.

3. Low elevation mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.

5.4.6 Vertical 60° Mounting On A Pitched Roof

Procedures described above for mounting of collectors on a flat roof apply to mounting on a pitched (sloped) roof, except for the following:

1. The 60° mounting kits add 60° to an existing roof pitch, as shown in table 5.2.9. Roofs with pitches above 4-in-12 generally should not use this mounting kit, as the resulting collector tilt angle will be too steep for almost any location.

5.4.7 Vertical 45° Mounting on a Flat Roof

(Please review section 5.4.0)

1. Choose attachment site, allowing for subsequent pipe penetration.

2. Assemble 2 triangular trusses using the 65" rails (M-103), the 92" rails (M-102), the 79" rails (M-105), the brackets (M-101), and the 55 mm bolts as shown in Figure 5.4.2. If desired, the 79" rails can be cut to 65".

3. Bolt the trusses to the cross braces connecting the bolts as shown in Figure 5.2.2. The resulting assembly should look similar to Figure 5.2.3. The collector frames may then be bolted to the holes in the 92" rails using the 20 mm bolts. The collector frames, as well as the number of trusses used, depends on the number of collectors being installed (see Table 5.1). If multiple mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.2.7 and 5.2.8.

4. If installing two or more collectors, the triangle trusses with their attached cross braces are to be positioned at the midpoint, behind the collectors. With a 3 collector system the 3 triangular trusses should be equidistant with 2 sets of cross braces interconnecting them. The resulting assembly should then be centered to support the R1/R2/SFC001 frame assembly as shown in Figure 5.1.1.

5. When installing four or five trusses, brace both end spans with crossbraces, as shown in 5.2.8. For six or more trusses, cross-braces should also be placed in an inside span.

6. Fasten the base of the flat-roof mounting racks to the solar roof mount flashing kit (560105SQ). Remember to take the static and dynamic (e.g., wind) loading into account for the roof structure. Nominal distance is 4' 7" between the front and back mounting holes and 48" between the bases.

5.4.8 Vertical 45° Mounting on a Wall

Procedures described above for mounting of collectors on a flat roof apply to wall mounting, except for the following:

1. Cross braces should be attached to the 79" (cut down to 65") rail at the base of the trusses rather than the ones at the rear (as pictured in figure 5.4.5).
2. Fasten the rear 65" rail of the trusses to the wall using the mounting holes in a suitable manner.
3. Low elevation mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.

5.4.9 Vertical 30/45/60° Mounting On The Ground

Procedures described above for mounting of collectors on a flat roof apply to ground mounting, except for the following:

1. Installer must ensure that the mounting foundation for the system is not subject to movement, such as frost heaves. Therefore, it is necessary to install footings below the frost line in locations subject to freezing weather. If it is not possible or practicable to avoid movement due to frost, etc., it will be necessary to provide a floating frame that does not flex or warp the collectors' mounting frames if the ground shifts or heaves.
2. Ground mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.
3. Ground mounting often requires longer outside piping runs, so proper insulation and protection of collector piping essential. Installers should consider laying pipe runs below grade to avoid damage and to mark the location of these runs to avoid damage from digging operations.

5.4.10 Vertical 45° Mounting On A Pitched Roof

Procedures described above for mounting of collectors on a flat roof apply to mounting on a pitched (sloped) roof, except for the following:

1. The 45° mounting kits add 45° to an existing roof pitch, as shown in table 5.2.9. Roofs with pitches above 9-in-12 generally should not use this mounting kit, as the resulting collector tilt angle will be too steep for almost any location.

5.5 30/45/60° Mounting System for SOL 25 Plus (Horizontal/Landscape Installation)

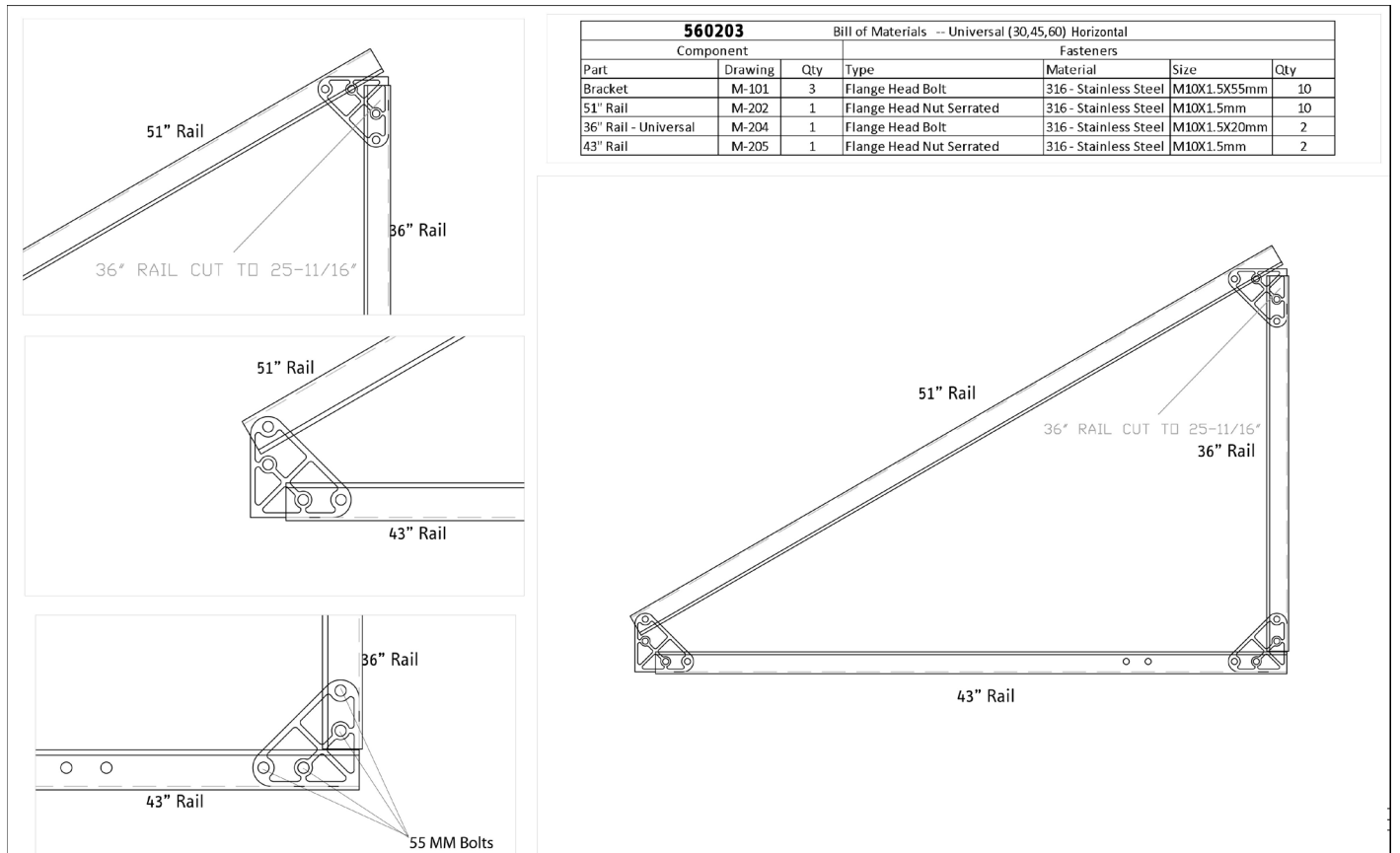


Figure 5.5.1: 30/45/60° Horizontal Mounting Kit (Part # 560203) Component Listing and Truss Assembly Example, 30° Mode

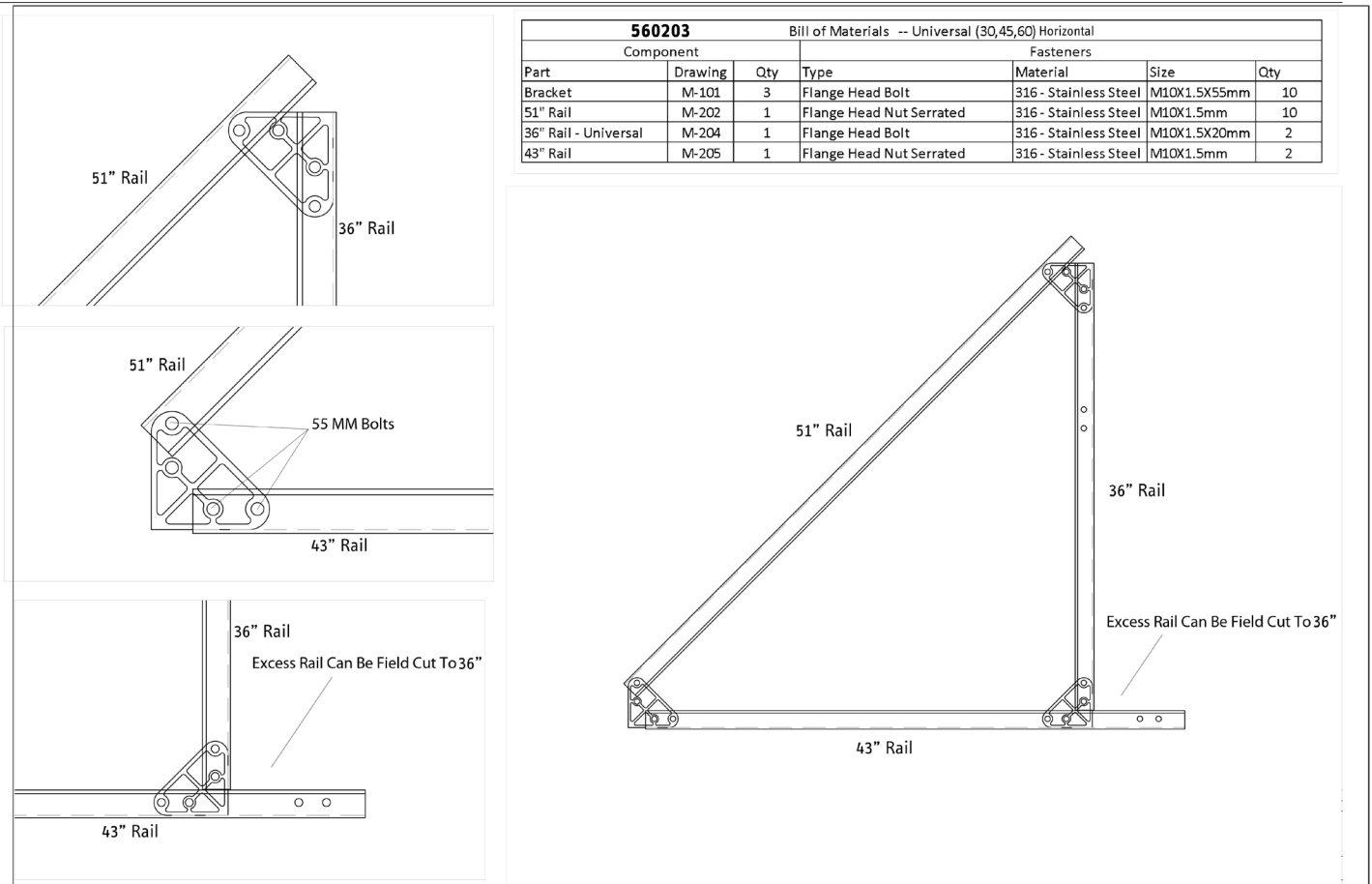


Figure 5.5.2: 30/45/60° Horizontal Mounting Kit (Part # 560203) Component Listing and Truss Assembly Example, 45° Mode

5.5.1 Horizontal 30° Mounting on a Flat Roof

(Please review section 5.4.0)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Assemble 2 triangular trusses using the 36" rails (M-204), the 51" rails (M-202), the 43" rails (M-205), the brackets (M-101), and the 55 mm bolts as shown in Figure 5.5.1. Note that the 36" rail is cut to 25 11/16".
3. Bolt the trusses to the cross braces connecting the bolts as shown in Figure 5.3.2. The resulting assembly should look similar to Figure 5.2.3. The collector frames may then be bolted to the holes in the 51" rails using the 20 mm bolts. The triangular truss assemblies with cross braces should be attached to the center of the R2 collector frames (Figure 5.2.5) i.e. there should be an equal amount of the profile rail to the right and left hand sides of each of the triangular trusses. If multiple flat-roof mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.1.2, 5.2.7 and 5.2.8. Note that there is an additional cross brace between the collectors.
4. Fasten the base of the flat-roof mounting racks to the solar roof mount flashing kit (560105SQ). Remember to take the static and dynamic (e.g., wind) loading into account for the roof structure. Nominal distance is 33 15/64" between the front and back mounting holes and 48" between the bases.

5.5.2 Horizontal 30° Mounting on a Wall

Mounting the horizontal 30° system on a wall is not recommended.

5.5.3 Horizontal 30° Mounting On A Pitched Roof

Procedures described above for mounting of collectors on a flat roof apply to mounting on a pitched (sloped) roof, except for the following:

1. The 30° mounting kits add 30° to an existing roof pitch, as shown in table 5.2.9.

5.5.4 Horizontal 60° Mounting on a Flat Roof

(Please review section 5.4.0)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Assemble 2 triangular trusses using the 36" rails (M-204), the 51" rails (M-202), the 43" rails (M-205), the brackets (M-101), and the 55 mm bolts similar to the manner shown in Figure 5.4.1 with the following change: the 51" rails should be reversed such that the 36" rail connects to the end with the holes closest, and the 43" rail connects to the end with the holes further away. If desired, the 36" rail can be cut to 25 11/16".
3. Bolt the trusses to the cross braces connecting the bolts as shown in Figure 5.3.2. The resulting assembly should look similar to Figure 5.2.3. The collector frames may then be bolted to the holes in the 51" rails using the 20 mm bolts. The triangular truss assemblies with cross braces should be attached to the center of the R2 collector

frames (Figure 5.2.5) i.e. there should be an equal amount of the profile rail to the right and left hand sides of each of the triangular trusses. If multiple flat-roof mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.1.2, 5.2.7 and 5.2.8. Note that there is an additional cross brace between the collectors.

4. Fasten the base of the flat-roof mounting racks to the solar roof mount flashing kit (560105SQ). Remember to take the static and dynamic (e.g., wind) loading into account for the roof structure. Nominal distance is 16 11/64" between the front and back mounting holes and 48" between the bases.

5.5.5 Horizontal 60° Mounting on a Wall

Procedures described above for mounting of collectors on a flat roof apply to wall mounting, except for the following:

1. Cross braces should be attached to the 36" (cut down to 25 11/16") rail at the base of the trusses rather than the ones at the rear (as pictured in figure 5.4.5).
2. Fasten the rear 43" rail of the trusses to the wall using the mounting holes in a suitable manner.
3. Low elevation mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.

5.5.6 Horizontal 60° Mounting On A Pitched Roof

Procedures described above for mounting of collectors on a flat roof apply to mounting on a pitched (sloped) roof, except for the following:

1. The 60° mounting kits add 60° to an existing roof pitch, as shown in table 5.2.9. Roofs with pitches above 4-in-12 generally should not use this mounting kit, as the resulting collector tilt angle will be too steep for almost any location.

5.5.7 Horizontal 45° Mounting on a Flat Roof

(Please review section 5.4.0)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Assemble 2 triangular trusses using the 36" rails (M-204), the 51" rails (M-202), the 43" rails (M-205), the brackets (M-101), and the 55 mm bolts as shown in Figure 5.5.2. If desired, the 43" rails can be cut to 36".
3. Bolt the trusses to the cross braces connecting the bolts as shown in Figure 5.3.2. The resulting assembly should look similar to Figure 5.2.3. The collector frames may then be bolted to the holes in the 51" rails using the 20 mm bolts. The collector frames, as well as the number of trusses used, depends on the number of collectors being installed (see Table 5.1). If multiple mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.1.2, 5.2.7 and 5.2.8. Note that there is an additional cross brace between the collectors.

4. Fasten the base of the flat-roof mounting racks to the solar roof mount flashing kit (560105SQ). Remember to take the static and dynamic (e.g., wind) loading into account for the roof structure. Nominal distance is 25 53/64" between the front and back mounting holes and 48" between the bases.

5.5.8 Horizontal 45° Mounting on a Wall

Procedures described above for mounting of collectors on a flat roof apply to wall mounting, except for the following:

1. Cross braces should be attached to the 43" (cut down to 36") rail at the base of the trusses rather than the ones at the rear (as pictured in figure 5.4.5).
2. Fasten the rear 36" rail of the trusses to the wall using the mounting holes in a suitable manner.
3. Low elevation mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.

5.5.9 Horizontal 30/45/60° Mounting On The Ground

Procedures described above for mounting of collectors on a flat roof apply to ground mounting, except for the following:

1. Installer must ensure that the mounting foundation for the system is not subject to movement, such as frost heaves. Therefore, it is necessary to install footings below the frost line in locations subject to freezing weather. If it is not possible or practicable to avoid movement due to frost, etc., it will be necessary to provide a floating frame that does not flex or warp the collectors' mounting frames if the ground shifts or heaves.

2. Ground mounting configurations may be prone to damage from falling ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.

3. Ground mounting often requires longer outside piping runs, so proper insulation and protection of collector piping essential. Installers should consider laying pipe runs below grade to avoid damage and to mark the location of these runs to avoid damage from digging operations.

5.5.10 Horizontal 45° Mounting On A Pitched Roof

Procedures described above for mounting of collectors on a flat roof apply to mounting on a pitched (sloped) roof, except for the following:

1. The 45° mounting kits add 45° to an existing roof pitch, as shown in table 5.2.9. Roofs with pitches above 9-in-12 generally should not use this mounting kit, as the resulting collector tilt angle will be too steep for almost any location.

5.6 SOL 25 Plus Flush Mounting Systems

5.6.1 Vertical Flush Mounting on a Pitched Roof Using L Brackets (560105L)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Bolt the collector frames to the vertical flush mount rails using the M10 nuts and bolts. The collector frames, as well as the number of flush mount rails used, depends on the number of collectors being installed (see Table 5.1). If multiple flush mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.1.1, 5.2.7 and 5.2.8, except no cross braces are used.
3. Attach the top and bottom collector frames of the assembled flush mounting system to the roof mount flashing kits' L brackets using the supplied hardware. The nominal distance between the top and bottom attachment points is 89 1/2 inches.

5.6.2 Vertical Flush Mounting on a Pitched Roof Using Z Brackets (560105Z)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Bolt the collector frames to the vertical flush mount rails using the M10 nuts and bolts. The collector frames, as well as the number of flush mount rails used, depends on the number of collectors being installed (see Table 5.1). If multiple flush mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.1.1, 5.2.7 and 5.2.8, except no cross braces are used.
3. Attach each Z bracket to the points at which each vertical flush mount rail is attached to the collector frame(s) using the supplied hardware. The nominal distance between the top and bottom attachment points is 85 1/2 inches.

5.6.3 Horizontal Flush Mounting on a Pitched Roof Using L Brackets (560105L)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Bolt the collector frames to the vertical flush mount rails using the M10 nuts and bolts. The collector frames, as well as the number of flush mount rails used, depends on the number of collectors being installed (see Table 5.1). If multiple flush mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.1.2, 5.2.7 and 5.2.8, except no cross braces are used.
3. Attach the top and bottom collector frames of the assembled flush mounting system to the roof mount flashing kits' L brackets using the supplied hardware. The nominal distance between the top and bottom attachment points is 50 1/8 inches.

5.6.4 Vertical Flush Mounting on a Pitched Roof Using Z Brackets (560105Z)

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Bolt the collector frames to the vertical flush mount rails using the M10 nuts and bolts. The collector frames, as well as the number of flush mount rails used, depends on the number of collectors being installed (see Table 5.1). If multiple flush mounting frames are being set up next to one another, use frame connector kits (SFC001, shown in Figure 5.2.6) to join them, as shown in Figures 5.1.2, 5.2.7 and 5.2.8, except no cross braces are used.
3. Attach each Z bracket to the points at which each vertical flush mount rail is attached to the collector frame(s) using the supplied hardware. The nominal distance between the top and bottom attachment points is 46 1/8 inches.

6. LIGHTNING PROTECTION AND BONDING



WARNING: HAVE LIGHTNING PROTECTION MEASURES CARRIED OUT BY PROFESSIONALS.

If there is an existing lightning protection system, the collector casing, their mounting frames, and the piping must be tied into the lightning protection measures by professionals.

Collector Casing (Pan)

Drill into each collector from the bottom and use screw-type devices to tie it into the lightning protection measures. Use two 1/4" (6.3 mm) diameter stainless-steel sheet metal screws for each collector. The drill holes should be predrilled to a diameter of 3/16" (5 mm). See **Figure 29** for locations of holes.

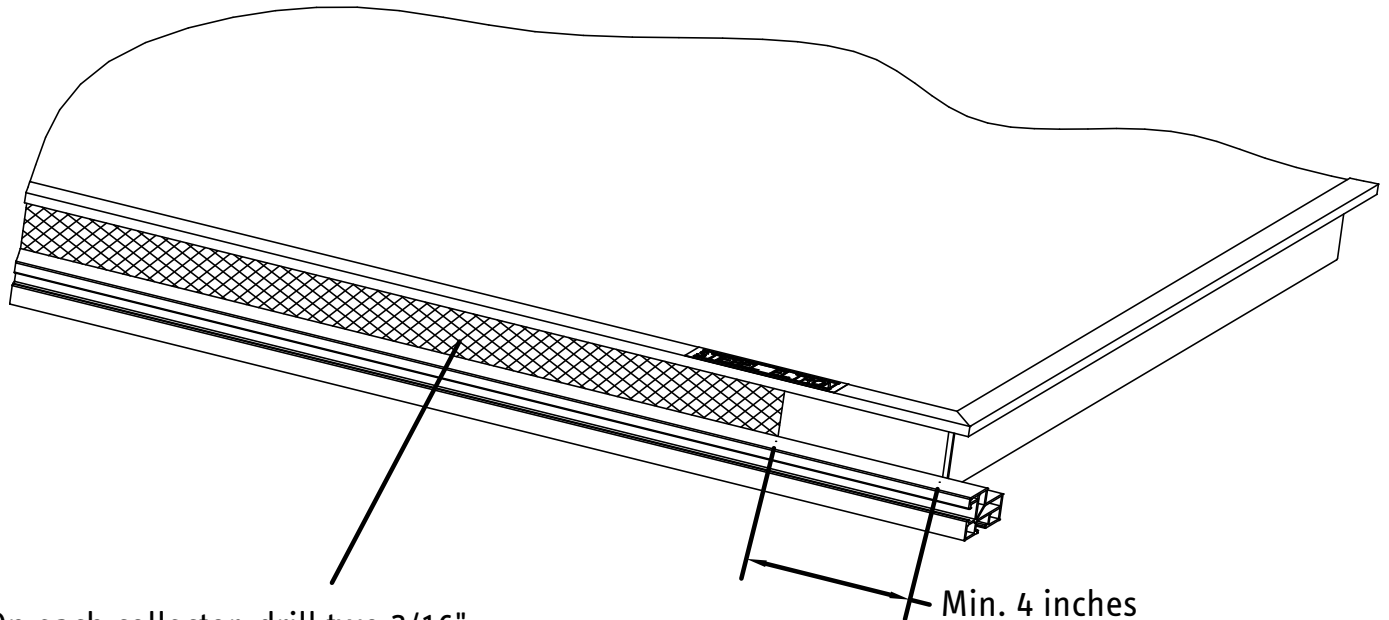
Piping

Make the piping connection by means of pipe clamps in the immediate vicinity of the collectors (above the roof). (Note possibility of corrosion. Use only compatible metals for fastening to the aluminum collector pans and mounting hardware.)

Mounting Frame

Connect the mounting frame to the lightning protection equipment separately via screw-type or clamp connections. Connect the forward and return piping to the building's equipotential bonding system (ground) at frequent intervals.

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On each collector, drill two 3/16" diameter holes in the hatched area and make the connection to the lightning protection equipment with two 1/4" diameter stainless steel sheet metal screws.

Figure 29: Attachment of bonding wire for lightning protection.

7. SETTING UP AND INTERCONNECTING THE COLLECTORS

WARNING: HAVE LIGHTNING PROTECTION MEASURES CARRIED OUT BY PROFESSIONALS.

Secure each collector at the top and bottom with eight (8) angle brackets – four along the top profile frame and four along the bottom – by inserting M10 bolts (from kit 185545 or kit 185546) into the profile rail’s bolt channel, placing the angle brackets into position, and tightening the bolts. See **Figure 30**. (For horizontal mounting systems, secure each collector at the top and bottom with sixteen (16) angle brackets – eight along the top profile frame and eight along the bottom.)

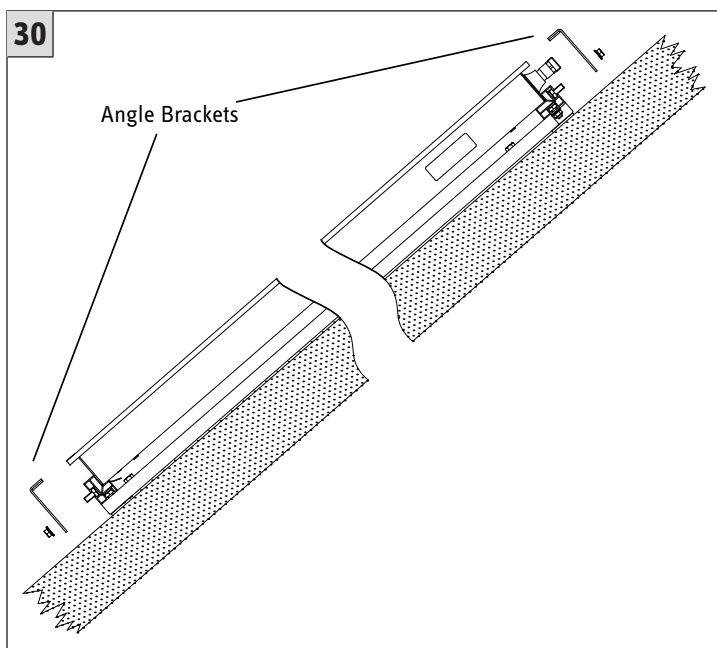


Figure 30: Securing Collectors To Frame Using Angle Brackets.

The collector pipe nipple connections are located on the top of the collector in the case of vertical mounting or on the sides with horizontal mounting. It is recommended that collectors be interconnected by means of a “compensator” (flexible stainless steel tube, p/n 170804), which comes with every R2 (185546) mounting frame. One should also be ordered with every SFC001 frame splice kit if connectors are to be connected in a row. The compensator allows thermal expansion of the collectors, support frames, and piping to occur without over-stressing the fittings and seals. The collector pipe nipples may also be connected to field-supplied piping with either 7/8” UFT, 3/4” G (European), or 3/4” BSPP thread. See Figure 31.

Installation of the compensator tube is followed by placement of thermal insulation (supplied by the customer).

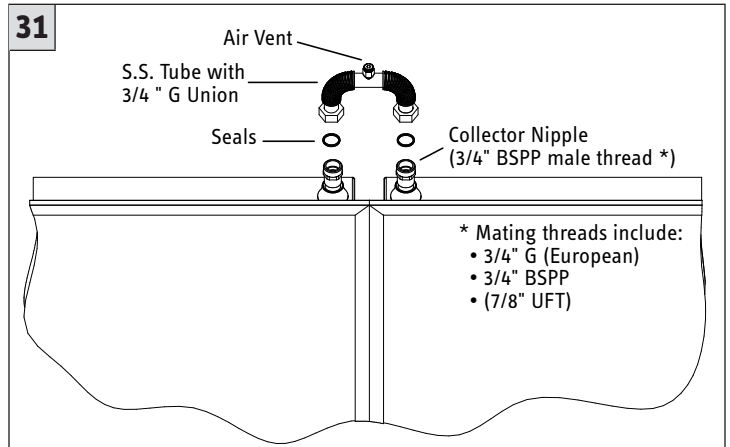


Figure 31: Interconnection of collectors using flexible compensator tube (p/n 170804).

Install the collector immersion sleeve (sensor well) at the outlet of the collector array, as shown in **Figure 2**. It is imperative that the sensor be placed at the collector/array outlet, not inlet, so that the collector temperature can be properly detected by the controller. The system will not work properly without the correct location of the sensor.

IMPORTANT: THE SENSOR MUST BE PLACED AT THE COLLECTOR/ ARRAY OUTLET, NOT INLET, SO THAT THE COLLECTOR TEMPERATURE CAN BE PROPERLY DETECTED BY THE CONTROLLER.

Coat the collector sensor with thermally conductive paste and push it into the immersion sleeve as far as it will go. Do not attempt to twist or readjust the connections once they have been installed. The return piping can now be connected to the unoccupied external thread of the R 3/4” adapter on the collector immersion sleeve (sensor well).

Immediately after installation, run a pressure/leak test, fill and flush the system with propylene glycol mixture (heat transfer medium), and place the system into service as described in Section 8.0.

8. COMMISSIONING THE SYSTEM



WARNING: PRESSURE TEST SYSTEM ONLY WITH DOWFROST 50/50 OR AIR.

NEVER FILL AND PRESSURE TEST THE SYSTEM WITH WATER WHERE THERE IS A RISK OF FROST. (COLLECTORS CAN FREEZE AT TEMPERATURES SIGNIFICANTLY ABOVE AIR TEMPERATURE IF RADIATIONAL COOLING IS STRONG, SUCH AS WITH CLEAR SKIES.)

After the installation is complete, the system may be commissioned for service. Commissioning involves the following procedures, which are explained in detail in this section:

- Pressure and Leak Test (Section 8.1)
- Setting The Expansion Tank Pre-charge Pressure (Section 8.2)
- Flushing The System (Section 8.3)
- Final Charging and Venting The System (Section 8.4)
- Start-up (Section 8.5)

8.1 Pressure and Leak Test

After the pipe work has been installed and the collectors have been connected it will be necessary to pressure-test the system to detect leaks before filling the solar loop with heat transfer fluid. Propylene glycol solutions can leak from much smaller gaps than can water; so such testing is critical to assuring a successful installation. Recommended test pressure is 80 psi. The thermal insulation should be installed only after the leak test has been successfully completed.

It is recommended that compressed air be used to test the system for leaks, as it is very easy to make repairs and it will prevent loss of solar medium, spills, property damage, and messy clean-up problems. Air is also capable of revealing very small leaks, that water may not reveal, through which propylene glycol will often leak. Leaks will be evident from the sound of escaping air, observation of bubbles emanating from fittings and other leak-prone components that are coated with soapy water, and watching the pressure gauge over time. Bear in mind that the pressure gauge will vary some based on temperature of the air, so one must try to read the pressure at nights when the system cools down to ambient temperature or when covered. The following procedure is recommended:

1. Isolate the expansion tank by shutting the isolation valve.
2. Turn check valves in the pumping station to their 45° position to allow two-way flow.
3. Close the bottom fill & drain valve.
4. Connect hose with a Schrader valve to the upper fill & drain valve.
5. Connect an air compressor and raise the solar loop system pressure to 80 psi.
6. The first phase of the leak test, which detects gross leaks or inadvertently open valves, involves listening for leaks or observing if pressure does not immediately reach 80 psi. Repair any such

gross leaks.

7. The second phase of the leak test detects smaller leaks and requires a wait time. Pressurize the system to 80 psi and watch the pressure gauge over a period of 15-60 minutes to see if any pressure loss occurs.

8. After any leaks have been repaired, repeat this test. If pressure appears steady, line up the red dial of the pressure gauge with the needle indication. Check again to see if the pressure holds, relative to the lowest pressure previously indicated by the red dial. Small leaks may be detected by covering suspected locations with soapy water and looking for bubbles.

9. After all known leaks have been repaired, the final phase of the leak test requires waiting a longer time to see if pressure is holding steady. Use the red dial to mark the pressure and see that the gauge returns to the same indication. Remember that the air pressure will vary based on the temperature of the loop, so it may be necessary to read the pressure at night, after the system cools down.

At the conclusion of the leak test, check all fittings and vent the system.

8.2 Setting the Expansion Tank Pre-charge Pressure

While the leak testing (described above) is being performed, the installer should set the expansion tank's pre-charge pressure. Make sure that the "wet" side of the expansion tank (pipe connection) is vented to atmosphere. Using a compressor, pre-charge the tank with air (or use pressurized nitrogen) to a final pressure of 5 psi less than the target system pressure. For example, if the final target system (solar loop) pressure is to be 50 psig, fill the expansion tank to 45 psig (which is the recommended default value). When complete, cap the Schrader valve fitting and re-attach the tank to the pump station. Make sure the expansion tank always faces up (the Schrader valve must be pointed down).

8.3 Flushing the System

The next step of the commissioning process involves flushing the solar loop to purge contaminants and air.

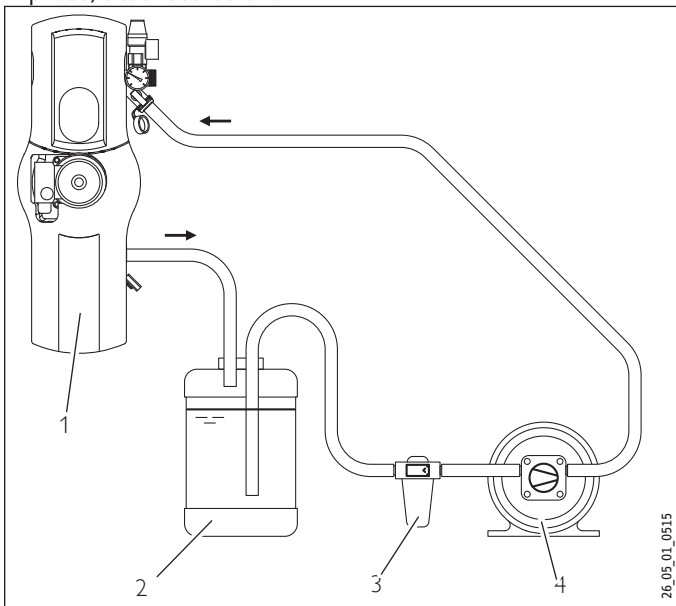
Preparations:

- Use only 50/50 Dowfrost propylene glycol solution for flushing the system. Use of water or any other fluid may adversely affect the operation of the system.
- Never fill the system when it is subject to strong solar irradiation or if the collectors are significantly hotter than the ambient air. This could lead to steam hammer inside the collectors

and possible burns from escaping steam. If the sun shines during start-up, cover the collectors or wait until there is some shade.

The following procedure makes use of a charging pump, screen filter, and large pail or trough to circulate fluid through the system. The sump can have a coarse-mesh screen to prevent large particles from entering the pump. The outlet of the pump can be fitted with 5-micron sediment filter. The intake sump should be set near the bottom of the pail.

1. Connect the charging pump's outlet to the to fill & drain valve in the pumping station.
2. Connect a hose to the boiler drain at the bottom of the loop (bottom fill & drain valve), at the outlet side of the storage tank's heat exchanger.
3. Use a clean, dry pail or catch basin. During this process, hold the drain hose firmly to the container or clamp them. Make sure you have sufficient Dowfrost medium (propylene glycol mixture) to fill the entire system's volume, plus extra for purging.
4. Keep all other vents and valves closed during the flushing operation.
5. Close the flow meter adjusting screw at the pump assembly (horizontal position).
6. Start charging the system and observe the loop fluid draining back into the pail. Make sure that the fluid level in the container always remains higher than the intake hose.
7. The flushing process should continue until the fluid draining back appears clean and free of contaminants. The screens/filters may require cleaning during this process.
8. When the system is fully flushed, proceed to the final charging phase, described below.



- 1 Solar compact installation
- 2 Heat transfer medium
- 3 Filter
- 4 Fill pump

8.4 Final Charging and Venting The System

The solar heating system must be filled exclusively with the premixed propylene glycol heat transfer medium. The bottles have

been premixed and require no further treatment. Never mix water with the heat transfer fluid, otherwise the essential characteristics and corrosion protection can no longer be guaranteed. The system must not be topped off with water.

Follow these steps to complete the final charging and venting (purging of air) of the system:

1. Energize the pump station to activate the electric pump to circulate the solar medium through the system.
2. Open the manual air vent valves on the SOL 27 Premium inlet and outlet connectors and open the ball valve for the flow meter.
3. To purge air from the system, the size of the air bubbles can be reduced (as the system loop pressure increases), by slowly constricting the return flow to the drain bucket via partially closing the lower drain & fill valve while the pump is operating. Also open the bleed screw on the circulator pump.
4. Continue purging the system until no more bubbles are expelled from the drain hose. Allow system pressure to build up to approx. 20-44 psi. This process usually takes 20-30 minutes. Continue looking for leaks.
5. Tighten the safety-leak-cap valve fully and then back off 1/4-turn.
6. Close the bottom fill & drain valve after completing this ventilation step, but before shutting off the pump.
7. Keep the circulator pump running and then close the top fill & drain valve.
8. Open the air vent valve at the highest point, until only solar medium is expelled.
9. Shut off the circulating pump.
10. Open the valve to the expansion tank to connect it to the solar loop. The system pressure will drop slightly.
11. Use the charging pump to raise the system pressure (in a cool state) to its operating pressure of 50 psi (50 to 58 psi).
12. Use a permanent marker to record the pressure, date, and time on the expansion tank.
13. It is further recommended that the installer measure and record the glycol/water mixture using a refractometer or hydrometer. It is critically important that the mixture be correct before turning the system over to the final customer.
14. Set the red dial on the pressure gauge to the expansion tank's precharge pressure. This should be the lowest pressure that the system ever reaches in the coldest day of operation.
15. Let the solar heating system rest overnight and vent again in the morning, via the manual air vent valves, before solar radiation warms the collectors.
16. Turn check valves in the pumping station to their normal position to allow one-way flow.
17. Make sure the controller and pumping station are energized and that the proper settings for the controller have been entered.
18. Cover both fill & drain valves with the caps supplied and tool tighten (not hand removable).
19. If the system does not start automatically, there may still be air in the system. Repeat the venting process, if required.

8.5 Start-up

Re-tighten all fittings prior to start-up.

Complete the Start-up report (Section 8.6) after the first Start-up.

Set the integral controller to “manual” mode to check whether all required relays of the solar control unit are connected, according to the controller’s operating instructions. Then set the control unit back to “automatic” mode. The system should then start automatically, subject to all starting conditions being met. If that is not the case, check in Section 10.0, Troubleshooting, for a possible cause for this fault. See that the solar system places no excessive temperature or pressure on auxiliary system.

Have owner check the system daily to observe pressure, temperature, and flow rate while the pump is on, and to look for evidence of overflows from pressure relief valves. It is also wise to continue checking for leaks periodically. Any deviation from normal should prompt immediate corrective action by the installer.

8.6 Checklist for Start-up Of Solar Installations



CAUTION: IT IS MANDATORY TO PERFORM THE WORK IN COMPLIANCE WITH THE “SAFETY REGULATIONS FOR WORK ON AND INVOLVING ROOFS” AND THE INSTRUCTIONS “SAFETY AND RESCUE HARNESSES” PUBLISHED BY THE TRADE ASSOCIATION. THESE ASSEMBLY AND OPERATING INSTRUCTIONS AND THE ASSEMBLY AND OPERATING INSTRUCTIONS FOR THE SOM CONTROLLER AND THE STORAGE SYSTEM ARE TO BE FOLLOWED DILIGENTLY DURING THE ASSEMBLY WORK.

On the start-up of solar installations provided with Stiebel Eltron Flat Plate Collectors, the following checklist should be reviewed to help ensure successful completion of the installation.

Solar Circuit	Yes	No
Are the collectors installed in their mounting frames in the proper position and secured tightly (free of play) with the top and the bottom screws?		
Has the installation of the pipework between the collectors and the pumping station been performed according to Stiebel Eltron installation instructions?		
Has all the pipework in the solar collector loop been hard-soldered?		
Has all the pipework been insulated?		
Is the pressure relief safety valve (87 psi) and the vent installed according to Stiebel Eltron installation instructions?		
Was the pressure and leak test performed?		
Is the solar loop filled using only the premixed 50% GRAS Propylene Glycol and deionized water heat-transfer medium?		
Have labels been installed on all valves, tank and pipework?		
Are the shut-off valves open, and is the check valve set (per pumping station assembly instructions)?		
Is the collector temperature sensor mounted at the specified position at the outlet pipe of the collector(s) and electrically connected to the controller?		
Has the electrical wiring been performed in accordance with the Stiebel Eltron controller wiring diagram?		
Is the solar controller set according to the assembly and operating instructions?		
Has the test run of the circulation pump been performed? Checked for excessive/unusual noise? Checked for proper heat collection and storage during insolation?		

Hot Water Circuit	Yes	No
Has the solar storage system (tank) been installed to the domestic water pipes according to Stiebel Eltron instructions and all local regulations?		
Has the temperature sensor in the solar storage system (tank) been mounted and electrically connected to the controller according to Stiebel Eltron instructions and all local regulations?		
Has the backup water heater (afterheating or reheating) been tested and properly installed for re-heating? If so, specify the equipment connected and its temperature settings:		
Is the SOM controller properly grounded electrically?		
Was the lightning protection equipment connected by authorized skilled personnel?		
Is the solar controller set according to the assembly and operating instructions?		
Has the test run of the circulation pump been performed? Checked for excessive/unusual noise? Checked for proper heat collection and storage during insolation?		

9. MAINTENANCE AND CARE

Specialists should carry out an annual inspection of the solar heating system to ensure proper functioning of the system and its components, including the control unit, safety equipment, and tank. System components (fittings, thermal insulation, mounting hardware, fasteners, etc.) exposed to the weather must also be checked periodically for their condition. Look for signs of abrasion, wear, corrosion, contamination, or damage. Check the pH value (> 7) and frost protection level ($< -20^{\circ}\text{F}$) of the heat transfer medium annually.

10. TROUBLESHOOTING

Refer to the table below for general fault identification troubleshooting.

Fault	Cause	Remedy
Fault/error message at the controller.	System fault; sensor faulty or incorrectly connected.	See installation and operating instructions for the controller.
Pressure fluctuations in the system immediately after commissioning.	Air pockets in the solar circuit.	Vent the system again.
Collectors mist up.	Moisture ingress during storage.	The internal mist will evaporate after a few weeks in operation by moisture progressively escaping through the integral ventilation slots.
	Overnight condensation of humidity during certain weather conditions.	Moisture will usually evaporate; persistent misting may require the addition of weep holes in the bottoms of collector pans.
The pump does not run, even though the collector is warmer than the tank (neither motor noise nor vibrations are discernible).	Maximum tank or collector temperature exceeded. Indicator lamp or display at the controller activated.	The controller has shut down correctly and restarts again automatically when the actual temperatures drop below their selected maximum temperatures.
	No electrical power.	Check cables and fuses.
	Excessive temperature differential ($>30^{\circ}\text{F}$) selected or the controller does not work.	<ul style="list-style-type: none"> • Check the controller. • Check the temperature sensor. Make sure sensor has been mounted to the outlet pipe of the collector(s). • Reduce the temperature differential.
	Pump shaft blocked.	Briefly switch over to max. speed or insert a screwdriver into the slot and turn manually.
	Pump contaminated.	Dismantle and clean the pump. Close the throughput limiter and pump ball valve.
	Sensor faulty or incorrectly installed.	<ul style="list-style-type: none"> • Make sure sensor has been mounted on the (hot) outlet (not inlet) pipe of the collector. • Check the sensor position, installation and resistance curves; the collector sensor must be securely and fully inserted into the sensor well.

Fault	Cause	Remedy
The pump is running, but no flow rate is discernible at the flow meter with balancing valve. The flow and return temperatures are identical or the tank temperature does not rise or rises only slowly.	There is air in the pipework. System pressure too low. System contaminated.	Check the system pressure. Operate the pump in intervals at maximum pump rate. Open the air-vent valves at the collector, at the pump, and at the solar tank and vent these items. Should this fail to provide any improvement: • Flush the system in both directions; clean fittings, such as flow meters, with balancing valve and dirt traps. • Check the line routing; in case of “up and down”, e.g. at balcony protrusions or around water pipes, change the line routing, if required or insert additional air vent valves. • Check the function of the automatic air vent valve. For this, remove the protective cap and check the float movement with a blunt needle. If necessary, replace the air vent valve.
The pump is running, but no flow rate is discernible at the flow meter with balancing valve.	Flow meter with balancing valve stuck or faulty. Clog in system. Shut-off valve closed.	Check the function of the flow meter with balancing valve. A jammed ring can block the display in the sight glass, even if the flow rate is correctly adjusted. Start the pump in manual mode; the pump piston movement should be discernible. Release the piston through tapping it lightly; in emergencies, replace the flow meter with balancing valve. Open the shut-off valve.
Pump appears to start late and stop early.	The temperature differential between the collector and the tank is too large.	Check for faults again when there is strong solar irradiation.
The pump starts and switches itself off again shortly afterwards (“short cycling”). This is repeated a few times until the system runs correctly. The same happens in the evening.	The solar irradiation is insufficient to heat up the entire pipework.	Check for faults again when there is strong solar irradiation.
	The flow rate is excessive (pump set too high).	Reduce the pump rate.
	The switching temperature differential of the controller is set too low.	Increase the switching temperature differential at the controller.
	Pipework not fully insulated.	Insulate the pipework.
The pressure gauge indicates a loss of pressure.	The tank and collector sensor wiring is reversed (problem occurs after commissioning).	Connect the temperature sensors to the correct sensor terminals (see the control unit installation and operating instructions).
	A drop in pressure seen shortly after the system is filled is normal, as air is still being vented from the system. A subsequent pressure drop can be caused by an air pocket that has shifted later on. In standard operation, the pressure can fluctuate by 3 to 4 psi, subject to system temperature.	Check to be sure that the automatic shut-off valve is closed.
	If the pressure falls continuously, a leak exists at some point in the system.	• First check the fittings, glands at shut-off valves and all threaded connections, then all solder fittings. • Check the expansion vessel inlet pressure and the diaphragm for leaks.
	Fluid loss occurs via operation of the safety valve. The expansion vessel is too small and/or without pressure or is faulty.	• Check the vessel size and precharge pressure.
The pump runs noisily.	Collectors have been damaged by icing/frost as a result of insufficient frost protection and have developed leaks.	• Check the antifreeze level and the pH value.
	Air in the pump.	Vent the pump.
System is noisy.	Insufficient system pressure causes voids and cavitation.	Increase the system pressure.
	This is normal in the first few days after filling the system. If this occurs later, two possible causes: System pressure too low. The pump draws in air via the air vent valve. The pump rate is set too high.	Increase the system pressure. Change to a lower pump rate and check the flow rate at the flow meter with balancing valve.

Fault	Cause	Remedy
The tank cools down excessively overnight. After the pump has stopped, the flow and return operate at different temperatures; the collector temperature is higher at night than the outside temperature.	The check valve is not closed or not closing, thereby causing thermosiphoning and heat loss from the tank to the solar loop.	<ul style="list-style-type: none"> • Check the position of the check valve handle, which should be set for one-way flow. • Inspect the check valve (gravity brake) for leaks (jammed swarf, dirt particle in the sealing surface). • Make sure the tank's heat exchanger's supply lines are configured in a U (downwards) shape to prevent thermosiphoning. • If required, install a two-way valve that is switched off simultaneously with the pump to block thermosiphoning in the solar loop.
	Single pipe thermosiphoning circulation occurs in short pipework with low pressure drop.	Install a check valve (gravity brake) in the flow or a heat insulating loop.
Re-heating does not work. The boiler runs for a short while, stops and restarts again. This repeats frequently, until the tank has reached its setpoint temperature.	Air in the re-heat heat exchanger. Heat exchanger area is too small.	Vent the re-heat heat exchanger. Compare the details supplied by the boiler manufacturer and those of the tank manufacturer. The problem may be resolved by selecting a higher flow temperature at the boiler.
The tank cools down excessively.	Insulation faulty or incorrectly fitted. Re-heating controller setting is incorrect. DHW circulation runs too frequently and/or at night.	Check the insulation; insulate the tank connections. Check the boiler controller setting. Check the switching times and interval operation.
The pump does not stop.	Sensor faulty or sensor position incorrect. Control unit not OK.	Check the sensor position, installation, and resistance curves. Note: The variable speed pump does not stop immediately, but only after it reaches its lowest speed.

11. GLOSSARY OF TERMS

The following is a glossary of terms, definitions of abbreviations and acronyms which appear in this manual:

absorber plate: a metal plate (typically made of copper) which has a selective coating to efficiently convert sunlight into heat and transfer this heat to liquid that circulates through copper pipes attached to the plate.

after-heating: a method to add heat from a non-solar source, such as a fuel-fired boiler, to raise the temperature of water in a storage tank to the minimum required for end use.

altitude angle: angle of sun above the horizontal plane.

anode rod: a metallic rod that is installed in a water storage tank in order to reduce corrosion of the tank and its internal components by serving as a sacrificial electrolytic anode. An anode rod must be replaced when it is depleted, otherwise the tank and/or its internal components will start to corrode.

boiler drains: drain cocks installed in solar and hydronic heating systems to allow portions or all of the system to be drained of their working fluids (heat transfer media).

BSPP: British Standard Pipe (Parallel) Thread for tubes and fittings where the threads do not provide pressure-tight sealing.

bypass valves: valves that are installed in solar heating and afterheating systems to allow portions of the system to be bypassed for maintenance and repair. Bypass valves are typically installed in 2-tank systems to allow flow to bypass the solar storage tanks.

charging (of system): the process of filling the solar loop with heat transfer medium (fluid).

charging pump: a pump used to fill (charge or recharge) the solar loop with heat transfer medium.

check valve: a special type of valve that permits fluid to flow in one direction but not the other. It is typically used in solar heating systems to prevent undesired thermosiphoning of heat transfer medium when the collector pump is switched off.

compensator: a flexible stainless steel tube that is installed between solar collectors and used to connect them to solar loop piping. The compensator allows piping to expand and contract and mounting hardware to move slightly under loads and thermal expansion without placing undue stress on collector fittings. It is very important to avoid repeated stress cycles upon fittings, as leaks may

develop which would cause the system to stop working properly.

controller: an electronic device that senses temperatures and uses control algorithms (rules) to determine when to activate pumps and relays and various warnings and alarms. The controller serves as the “brain” of a solar thermal system and controls how and when the system collects heat, sheds excessive heat, and shuts down to protect various components.

DHW: domestic hot water

DHW mixing valve: a temperature-sensitive regulating valve that mixes cold water with incoming hot water to limit its temperature to prevent scalding and other problems for end users.

Dowfrost™ 50: ready-mixed propylene glycol heat transfer medium that contains approximately 50% propylene glycol anti-freeze fluid.

EPDM: ethylene propylene diene monomer (M-class) rubber, a synthetic rubber that exhibits outstanding heat, ozone and weather resistance and is often used for sealing components in heating systems.

expansion tank: a tank that is attached to heating systems to allow normal expansion of liquids that undergo heating and cooling cycles in order to prevent undue stress on (and failure of) piping, tanks, fittings, and other vessels. Most modern expansion tanks have a chamber filled with air or nitrogen that provides a cushion against which the system liquid may expand; this chamber is typically isolated fluidically by a rubber membrane (diaphragm) that is chemically compatible with the system liquid and capable of withstanding the temperatures of that liquid.

flowmeter: a device used to measure or display fluid flow rates in a fluidic system. They may be electronic or mechanical. Mechanical flowmeters often use an annular orifice/venturi/float system for measuring flow rates.

Flowstar: brand of pump station used in Stiebel Eltron SOLKIT solar systems. They contain a circulator (pump), expansion tank, pressure relief valve, 2 boiler drains, temperature/pressure gauge, flowmeter, check valve, return line thermometer, and air vent.

frame connector (splice): a set of hardware that allows the collector profile (frame) rails to be connected, end-to-end, to form a row array of solar collectors.

GPH: gallons per hour

GPM: gallons per minute

GRAS: Generally recognized as safe (GRAS) is an American Food and Drug Administration (FDA) designation that a chemical or substance added to food is considered safe by experts, and so is exempted from the usual Federal Food, Drug, and Cosmetic Act (FFDCA) food additive tolerance requirements. For solar thermal systems, the GRAS (non-toxic, food grade) designation is often required of the propylene glycol heat transfer medium if there is a possibility of the medium's being introduced into the potable water.

hard-solder: 95/5 lead-free solder used to join piping in the solar loop. It is capable of withstanding the elevated temperatures that solar collectors are capable of generating.

heat-conducting paste: a thermally-conductive paste that aids in transferring heat between components. This paste is typically used in solar thermal systems to allow temperature sensors to read temperatures of components more accurately.

heat exchanger: a device used to efficiently transfer heat between one component and another. In heating systems, heat exchangers are most often used to transfer heat between two separate fluids. There are liquid-to-liquid, liquid-to-gas, and other types of HX.

heat transfer medium: fluid that is used to collect and transport heat energy between solar collectors and storage tanks or other devices in a solar loop.

horizontal collector mounting: a mounting arrangement in which the short dimension of each collector is oriented up/down; the collector's pipe fittings (nipples) point horizontally (to the sides).

HX: heat exchanger

hydrometer: an instrument used to measure the specific gravity (or relative density) of liquids; that is, the ratio of the density of the liquid to the density of water. In solar thermal systems, it is often used to test the composition of the heat transfer medium.

insolation: incoming solar radiation that impinges upon a solar collector or other surface.

installed height: the height above surrounding grade, usually in reference to the height of the solar collectors.

isolation valve: a valve used to cut off and isolate a device (e.g., a vent valve or an expansion tank) from the rest of a fluidic system.

lightning protection: equipment and measures used to ensure that particular equipment and attached structures are protected from lightning strikes and induced charges; these often include special grounding cables and clamps to safely conduct current to earth ground.

MSDS: material safety data sheet – a data sheet that usually accompanies many chemicals and other materials to allow users to take appropriate measures to ensure their safe use.

mounting frame: an assembly of hardware that forms a frame in which solar collectors are held in place on a roof or other structure.

pipe run: the piping in a solar loop (circuit) that connects the collector(s), pump station, and heat exchanger(s) in storage tank(s).

polyisocyanurate: foam typically used as rigid thermal insulation. Its thermal conductivity has a typical value of 0.16 BTU*in/hr*ft²*°F (0.023 W/mK). It has superior resistance to breakdown at high temperatures, which is necessary for solar loops.

pre-charge pressure (of expansion tank): the pressure of the gas

(typically air or nitrogen) cushion on the “dry” side of an expansion tank’s diaphragm. It helps to regulate the system pressure and must be set according to the instructions.

pressure drop: the loss of pressure of a fluid as it flows through pipes and other components, caused by its viscosity or “friction”. Pressure drops must be taken into account when determining pump sizes, system pressures, and other design factors.

profile (frame) rails: extruded aluminum members that form the frame in which to hold collectors and that provide slots for bolt attachments.

propylene glycol: a non-toxic type of heat transfer medium and anti-freeze solution that is often used in closed-loop solar collector systems to prevent freezing of the liquid and related damage to components in very cold temperatures. The correct percentage of propylene glycol in a mixture with water is critical to the proper functioning and safe operation of solar thermal systems.

psi (psia, psig): pounds (force) per square inch (typically for pressure or stress measurement); psia is absolute pressure; psig is gauge pressure. Sea-level atmospheric pressure is approximately 14.7 psia – or 0 psig, as read by a gauge.

Purgomat air vent: an automatic, float-type air vent that is used to purge a hydronic system or solar loop of air and allow efficient heat transfer to take place.

PVC: polyvinyl chloride, a thermoplastic polymer. It is often used as a jacket or cover for solar loop piping and other components.

refractometer: a device used to measure of an index of refraction. For solar thermal systems, the index of refraction is translated to degrees of freeze protection that an anti-freeze solution provides.

reheating: the addition of more heat to the outlet domestic hot water of a solar storage tank to raise it to the desired temperature for final use by a building’s occupants.

RTD: resistance temperature detector or resistance thermometer, a temperature sensor that exploits the predictable change in electrical resistance of some materials with changing temperature. They are most often made of platinum (‘Pt’ is the symbol for platinum). Stiebel Eltron’s SOM 6, 7, and 8 use RTD temperature sensors to measure temperatures of solar collectors, heat exchangers, and storage tanks. RTDs are manufactured to achieve a particular resistance curve vs. temperature.

R-value (insulation): a measure of thermal resistance used in the building and construction industry. The bigger the number, the better the insulation’s effectiveness. R-value is the reciprocal of U-value. In the U.S., the units of measure of R-value are degrees Fahrenheit, square feet hours per BTU, (ft²·°F·h/BTU). Converting to/from SI units, 1 ft²·°F·h/BTU ≈ 0.1761t K·m²/W, or 1 K·m²/W ≈ 5.67446 ft²·°F·h/BTU.

SBB: Stiebel Eltron solar storage tank models.

Schrader valve: most often found on tube-type and tubeless tires,

Schrader valves are used on many refrigeration and air conditioning systems to allow servicing, including recharging with refrigerant. They are also used to conduct leak-down pressure tests on pipe installations. Stiebel Eltron expansion tanks are fitted with Schrader valves to permit easy charging with pressurized air or nitrogen.

sensor well: a cylindrical bore made in a component to allow insertion of a cylindrical temperature sensor that is to measure the component’s temperature. An external sensor well is integrated with pipe fittings to attach to the Stiebel Eltron SOL 25 PLUS solar collector.

shear force: force acting perpendicular to a fastener or member which would shear it off if sufficiently high (above the member’s or fastener’s shear strength)

smooth-tube heat exchanger: a type of immersed-tube HX that does not employ fins to help conduct heat. Stiebel Eltron’s SBB storage tanks employ smooth-tube heat exchangers.

solar loop: the fluidic loop that closed-loop solar systems employ to transport solar-heated liquid from solar collectors to solar storage tanks and/or other devices. The loop may also be used to shed heat if temperatures in the system exceed safe limits.

SOLKIT: Stiebel Eltron solar hot water system kit, which includes one or more solar collectors, a solar storage tank, a pumping station, a controller, and related accessories.

SOM 6 SI differential temperature controller: a solar system controller providing one control function (e.g., one pump) and 3 sensor inputs.

SOM 7 SI differential temperature controller: a solar system controller providing two control functions (e.g., two pumps or one pump and one valve) and 4 sensor inputs.

SOM 8 SI differential temperature controller: a sophisticated solar system controller providing up to nine control functions (pumps, valves, etc.) and 15 sensor inputs. They are typically used for larger, more complex (and/or commercial) systems.

STAK: storage tank accessory kit.

temperature/pressure gauge: a special mechanical gauge that integrates both temperature and pressure indicators.

tensile force: force acting in-line with a fastener or member, placing it in tension, which would pull it apart if sufficiently high (above its tensile strength). Tensile force acts in opposite direction than compressive force (which would buckle or crush the member).

thermal conductivity: the ability of a material to conduct heat, typically in units of W/(m.K); it is the inverse of thermal resistance.

thermo-siphoning: the passive convection or flow of a fluid through a conduit that is caused by density changes due to differences in temperature from one point in the conduit to another. Thermosiphons are particularly prevalent in vertical loops of pipe carrying liquids where one side of the loop is exposed to a warmer

temperature than the other. In some cases thermo-siphoning is undesirable when it causes heat to be transported away from storage.

truss: a triangular-shaped structure used to tilt (incline) solar collectors at an angle relative to the structure (inclination angle) on which they are mounted.

Units of Measure:

BTU: British thermal unit

°C: degrees Celsius

°F: degrees Fahrenheit

ft: foot/feet of distance

K: Kelvin (degree of absolute temperature)

kg: kilogram

kN: kiloNewton (thousand Newtons) of force

lb: pound force or weight

m: meter

mm: millimeter

psi: pounds per square inch

psia: pounds per square inch, absolute

psig: pounds per square inch, gauge

W: watt

UV: ultraviolet radiation (typically a component sunlight).

venting: the process of purging air from the solar loop or other parts of a heating system.

vertical collector mounting: a mounting arrangement in which the long dimension of each collector is oriented up/down; the collector's pipe fittings (nipples) typically point upward.

wind loads: forces generated by winds impinging upon solar collectors and related components.

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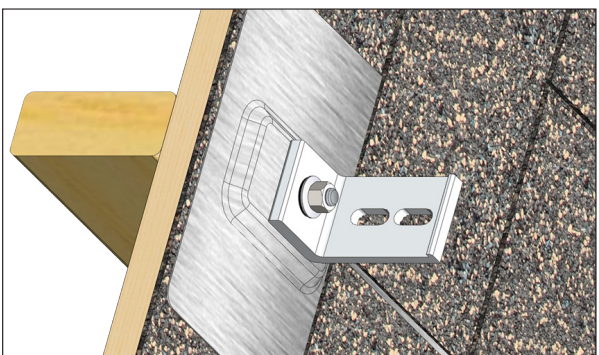
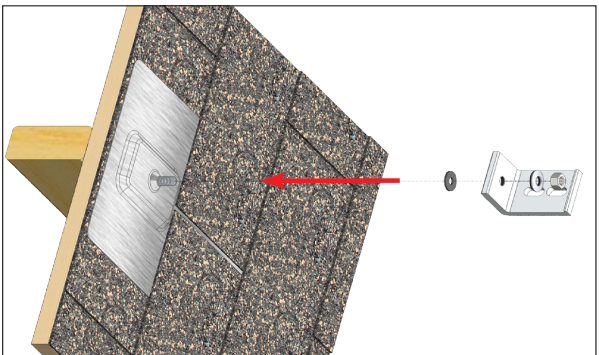
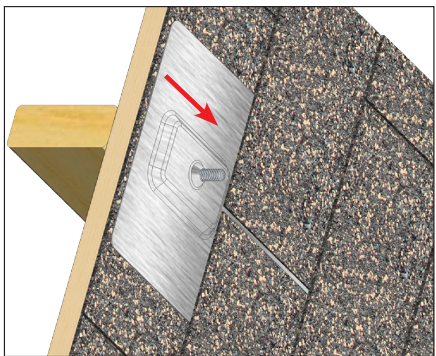
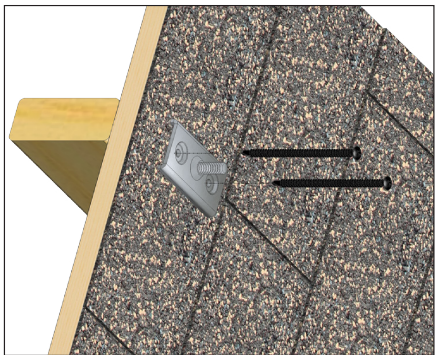
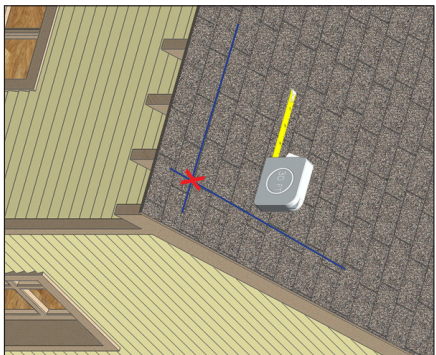
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APPENDIX A SOLAR ROOF MOUNT FLASHING KIT INSTALLATION



Quik Foot – Product Guide

Installation Instructions



1. Locate the rafters and snap horizontal and vertical lines to mark the installation position for each Quik Foot.
2. Install base as shown using appropriate fasteners. *
3. Insert the flashing so the top part is under the next row of shingles and pushed far enough up slope to prevent water infiltration through vertical joint in shingles.
4. Install bare EPDM washer on stud, pushing it down until it is flush with the top of the flashing.
5. Apply compression bracket to stud. Install bonded washer with rubber side down, and tighten stainless nut to 50 inch-pounds.

Consult an engineer or go to www.ecofastensolar.com for engineering data.

* EcoFasten recommends XHD fasteners by OMG.

APPENDIX C

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WARRANTY

STIEBEL ELTRON WARRANTS TO THE ORIGINAL OWNER THAT THE SOL 25 PLUS - FLAT PLATE SOLAR COLLECTOR WILL BE FREE FROM DEFECTS IN WORKMANSHIP AND MATERIALS FOR A PERIOD OF TEN (10) YEARS FROM THE DATE OF PURCHASE.

SHOULD THE PART(S) PROVE TO BE DEFECTIVE UNDER NORMAL USE DURING THIS PERIOD, STIEBEL ELTRON, INC. WILL BE RESPONSIBLE FOR REPLACEMENT OF THE DEFECTIVE PART(S) ONLY. STIEBEL ELTRON, INC. WILL NOT BE LIABLE FOR ANY COSTS OF TRANSPORTATION, REMOVAL, REINSTALLATION, OR ANY OTHER LABOR OR FREIGHT CHARGES THAT MAY ARISE IN CONNECTION WITH A WARRANTY CLAIM OR ANY INCIDENTAL OR CONSEQUENTIAL EXPENSES.

THIS WARRANTY DOES NOT APPLY:

1. TO CONDITIONS RESULTING FROM A FAILED COMPONENT OR PART THAT IS NOT PART OF THE SOLAR COLLECTOR OR ABSORBER PLATE.
2. TO FREEZE DAMAGE
3. TO CONDITIONS RESULTING FROM MISUSE, ABUSE, NEGLIGENCE, ACCIDENT, OR ALTERATION
4. TO MINOR DISCOLORATION OF THE COLLECTOR FRAMEWORK OR ABSORBER PLATE
5. TO GLASS BREAKAGE
6. TO CONDITIONS RESULTING FROM THE INTRODUCTION OF HARMFUL CHEMICALS, CAUSTIC FLUIDS, OR LIQUIDS DELETERIOUS TO COPPER TUBING, INCLUDING IMPROPERLY APPLIED OR MAINTAINED HEAT TRANSFER FLUIDS
7. TO PROPYLENE GLYCOL PH LEVELS ABOVE 10 OR BELOW 8
8. TO PERIODS OF STAGNATION IN EXCESS OF 60 DAYS
9. TO EXCESSIVE PRESSURE
10. TO CLOUDING OR SIMILAR OCCURRENCE RESULTING FROM THE NORMAL INTRUSION OF MOISTURE INTO
11. TO CONDITIONS RESULTING FROM FLOODS, EARTHQUAKES, WINDS, FIRE, LIGHTNING, OR CIRCUMSTANCES BEYOND THE MANUFACTURER'S CONTROL
12. TO INSTALLATION METHODS WHICH DO NOT CONFORM TO RELEVANT NATIONAL, STATE OR LOCAL CODES AND ORDINANCES, GOOD INDUSTRY PRACTICES OR APPLICABLE MANUALS, DIAGRAMS, TECHNICAL BULLETINS OR WRITTEN INSTALLATION INSTRUCTIONS; AND, TO APPLICATIONS OTHER THAN MEDIUM TEMPERATURE.

TO OBTAIN SERVICE UNDER THIS WARRANTY, THE OWNER MUST FIRST SECURE WRITTEN AUTHORIZATION FROM STIEBEL ELTRON, INC. THE OWNER SHALL BE REQUIRED TO SHOW PROOF OF PURCHASE DATE, AND TO PAY ALL TRANSPORTATION COSTS TO RETURN THE DEFECTIVE PART(S) FOR REPAIR OR REPLACEMENT.

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