

# 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 <sup>2</sup> )	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 <sup>2</sup>
Effective collector (aperture) area	27	sq ft	2.5	m <sup>2</sup>
Absorber area	27	sq ft	2.5	m <sup>2</sup>
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 <sub>0</sub>	0.781			
Heat loss value a <sub>0</sub>	0.500	BTU/(hr•ft <sup>2</sup> •°F)	2.838	W/(m <sup>2</sup> •K <sup>2</sup> )
Heat loss value a <sub>1</sub>	0.0027	BTU/(hr•ft <sup>2</sup> •°F)	0.0154	W/(m <sup>2</sup> •K <sup>2</sup> )

## 4. INSTALLATION INSTRUCTIONS FOR THE PROFESSIONAL



### 4.1 Accessories

**Table 4.1.1** shows the mounting accessories available for several common arrangements of SOL 25 PLUS collectors.

\* NOTE: All fasteners in these kits are of stainless steel.

Item	Parts Included	Part No.
R1 frame for one SOL 25 plus collector, vertical installation. In combination with the mounting hardware sets, permits installation on pantile roofs, corrugated sheet roofs, flat roofs or walls.	(2) profile rails (8) anchor brackets (8) sets M10-20 nuts and bolts	185545
R2 frame for one collector, horizontal installation, or two collectors, vertical installation. In combination with the mounting hardware sets, permits installation on sloped roofs, flat roofs or walls.	(2) profile rails (16) anchor brackets (16) sets M10-20 nuts and bolts (1) compensator (flexible stainless steel tube #170804) with vent screw and 2 seals	185546
Frame Connector kit for SOL 25 Plus. Connects two collector frames together.	(2) S113 frame connectors (8) sets M10-20 bolts and nuts	SFC001
Flush mounting kit for vertical installation on a roof or a wall for SOL 25 Plus Collector.	(2) S101 collector rails (vertical) (4) S102 L-brackets (8) sets M10-20 nuts and bolts	SFM001
Flush mounting kit for horizontal installation on a roof or a wall for SOL 25 Plus Collector.	(2) S201 collector rails (horizontal) (4) S102 L-brackets (8) sets M10-20 nuts and bolts	SFM001H
Frame tilt mounting kit for vertical installation of SOL 25 Plus (TWO NEEDED PER FRAME).	(1) adjustable riser strut set (S103U, S103L) (4) S102 L-brackets (1) S109 cross-brace (1) S101 collector rail (vertical) (5) sets M10-30 nuts and bolts (5) sets 1/4"-20 x 3/4" bolts, nuts, and washers	SFT004
Frame tilt mounting kit for horizontal installation of SOL 25 Plus (TWO NEEDED PER FRAME).	(1) adjustable riser strut set (S103HU, S103HL) (4) S102 L-brackets (1) S109 cross-brace (1) S201 collector rail (horizontal) (5) sets M10-30 nuts and bolts (5) sets 1/4"-20 x 3/4" bolts, nuts, and washers	SFT004H
45° mounting frame for vertical installation of SOL 25 Plus (TWO NEEDED PER FRAME)	(1) SE45-110R support riser (1) SE45-110B support base (1) SE45-111 collector rail (vertical) (1) S109 cross-brace (2) sets M10-20 nuts and bolts (3) sets 1/4"-20 x 3/4" bolts, nuts, and washers (3) sets 3/8"-16 x 3" flange bolts and nuts	185543
45° mounting frame for horizontal installation of SOL 25 Plus (TWO NEEDED PER FRAME)	(1) S4528R support riser (1) S4518B support base (1) S107H collector rail (horizontal) (1) S109 cross-brace (2) sets M10-20 nuts and bolts (3) sets 1/4"-20 x 3/4" bolts, nuts, and washers (3) sets 1/4"-20 x 2-1/2" bolts, nuts, and washers	074324
60° mounting frame for vertical installation of SOL 25 Plus (TWO NEEDED PER FRAME)	(1) SE60-110 support riser (1) SE60-108 support base (1) S101 collector rail (vertical) (1) S109 cross-brace (2) sets M10-20 nuts and bolts (3) sets 1/4"-20 x 3/4" bolts, nuts, and washers (3) sets 3/8"-16 x 3" flange bolts and nuts	SE60
Aluminum Clamp for metal roof	(1) clamp (2) 3/8" bullet nosed setscrews (1) M10 bolt with washer	S5U

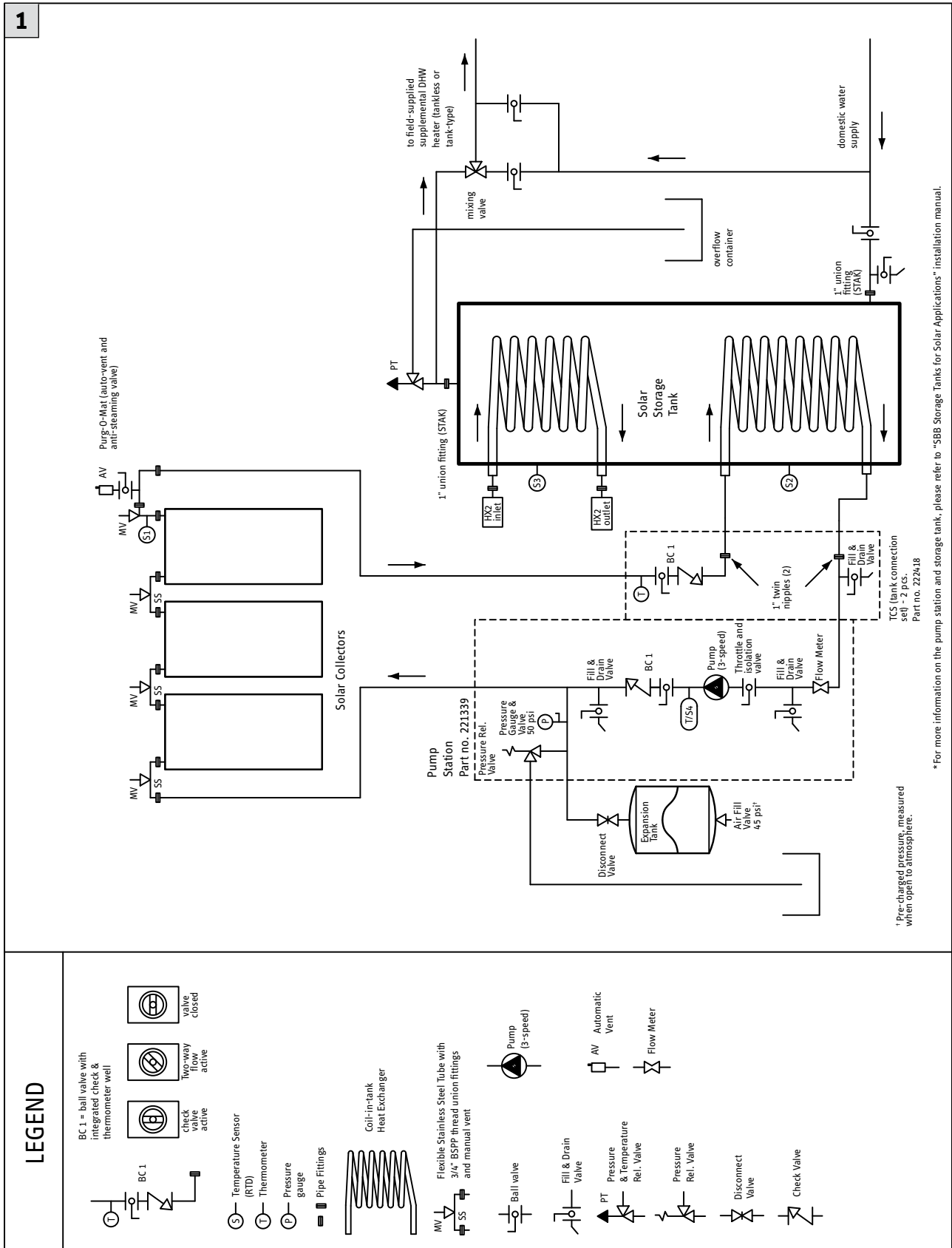
**Table 4.1.2** shows the mounting accessories available for several common arrangements of SOL 25 PLUS collectors.

Item	Parts No.
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 SI differential temperature controller for one control function and 3 sensor inputs; (2) FKP6 temperature sensors included	222140
SOM 7 SI differential temperature controller for two control functions and 4 sensor inputs; V-bus; (4) FKP6 temperature sensors included	222141
SOM 8 SI, temperature differential controller for nine control functions and 15 sensor inputs; V-bus; (6) FKP6 temperature sensors included	227535
Collector sensor well (use one per control unit)	185307
Pt1000 (1K RTD type) temperature sensor for SOM controllers	165818
Purgomat air vent	S10043
Flexible stainless steel tube for SOL 25 PLUS panels	170804
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 anode rod for SBB tanks	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).

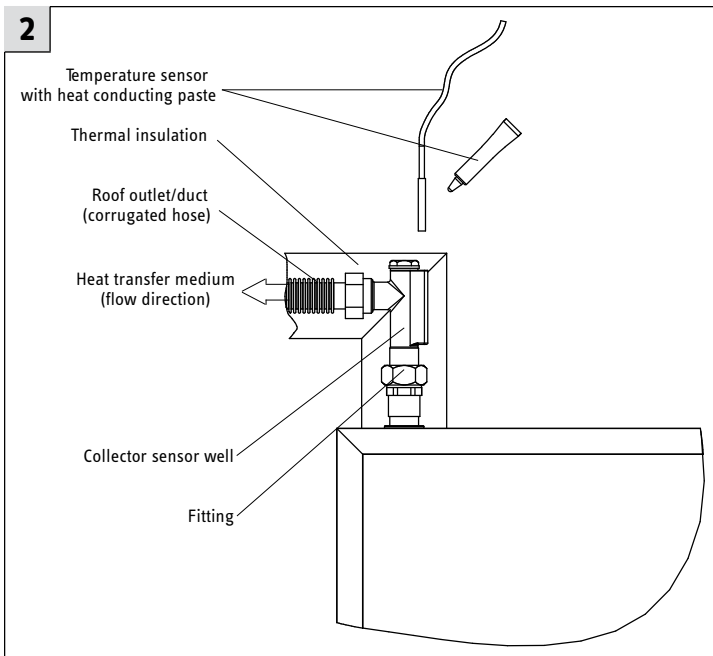
Extremely cold climates that experience nighttime winter temperatures below -30°F may need thicker-than-standard pipe insulation to prevent freeze-ups or slushing of the anti-freeze mixture.

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

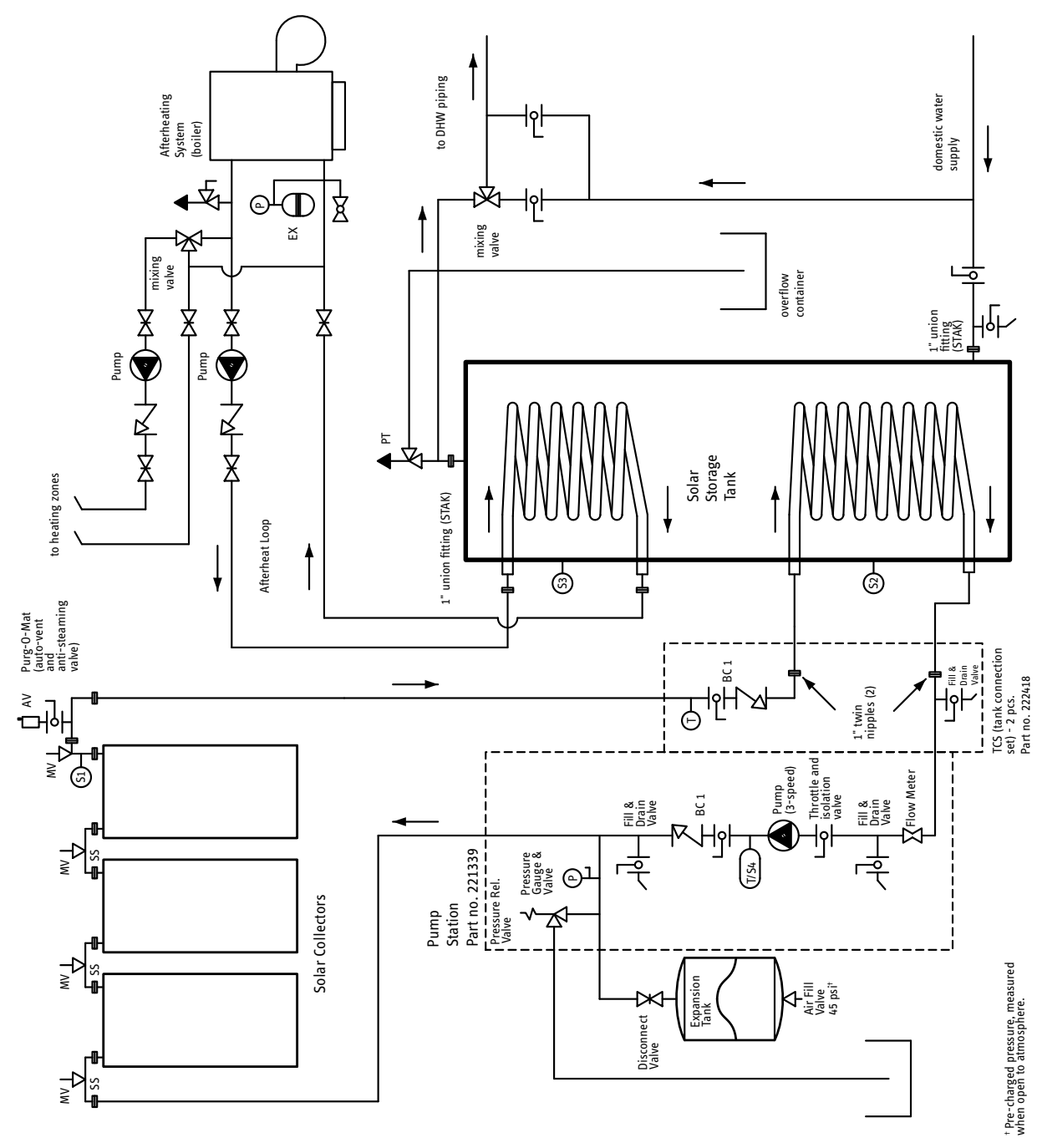
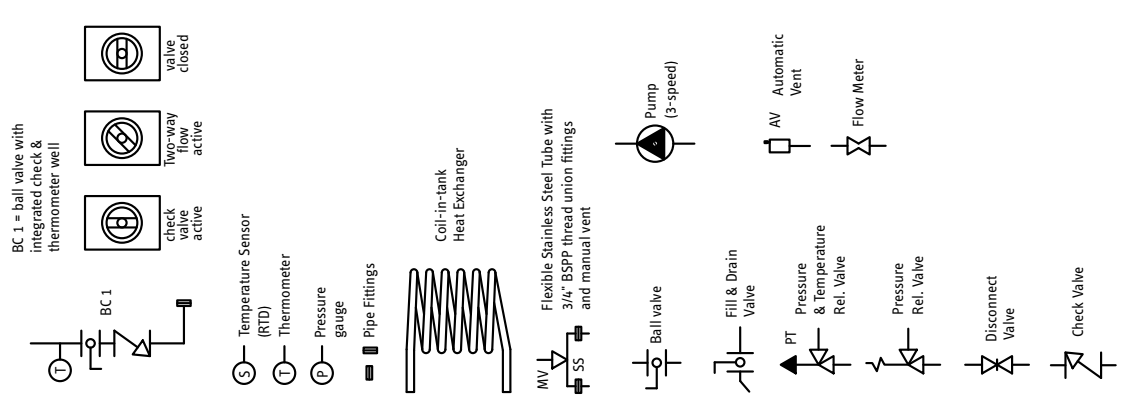
In a standard residential solar heating system, one to three collectors are connected in series to a solar storage tank of 80-163 gallons capacity. Refer to the tank installation instructions for details.

### 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**.



\* 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.

Figure 3: Collector Temperature Sensor Well

## 5. MOUNTING SYSTEMS

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
- 30/60° fixed mount, vertical orientation
- flush mount, vertical orientation
- flush mount, horizontal orientation
- 15-30° tilt mount, vertical orientation
- 15-30° tilt 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 tilted between 10° and 30° from horizontal, as the best solar gain will be obtained for summertime use<sup>1</sup>. 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 Mounting Hardware Kits For SOLKIT Systems**

No. of Panels in Array	Vertical / Horizontal	Flush Mount	15-30° Tilt Mount	45° Mount	30/60° Mount
1	Vertical	(1) 185545	(1) 185545	(1) 185545	(1) 185545
		(1) SFM001	(2) SFT004	(2) 185543	(2) SE60
1	Horizontal	(1) 185546	(1) 185546	(1) 185546	N/A
		(1) SFM001H	(2) SFT004H	(2) 074324	
2	Vertical	(1) 185546	(1) 185546	(1) 185546	(1) 185546
		(1) SFM001	(2) SFT004	(2) 185543	(2) SE60
2	Horizontal	(2) 185546	(2) 185546	(2) 185546	N/A
		(1) SFC001*	(1) SFC001*	(1) SFC001*	
		(2) SFM001H	(4) SFT004H	(4) 074324	
3	Vertical	(1) 185546	(1) 185546	(1) 185546	(1) 185546
		(1) 185545	(1) 185545	(1) 185545	(1) 185545
		(1) SFC001	(1) SFC001	(1) SFC001	(1) SFC001
		(1) 170804	(1) 170804	(1) 170804	(1) 170804
		(2) SFM001	(3) SFT004	(3) 185543	(3) SE60
			(1) S104	(1) S109	(1) S109
3	Horizontal	(3) 185546	(3) 185546	(3) 185546	N/A
		(2) SFC001	(2) SFC001	(2) SFC001	
		(3) SFM001H	(6) SFT004H	(6) 074324	
4		No kit available; requires custom design.			

\* If mounting horizontally in one row.

<sup>1</sup> 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.

Recommended mounting kits for installation sites, and corresponding section numbers:

	Flush Mount	15-30° Tilt Mount	45° Mount	30/60° Mount
Flat Roof	NR	NR	• (Sec. 5.1.1)	• (Sec. 5.2.1)
Wall	NR	NR	• (Sec. 5.1.2)	• <sup>2</sup> (Sec. 5.2.2)
Ground	NR	NR	• (Sec. 5.1.3)	• (Sec. 5.2.3)
Pitched Roof	• (Sec. 5.3)	• (Sec. 5.4)	• (Sec. 5.1.4)	• (Sec. 5.2.4)

**Table 5.2:** Mounting Configurations Available (NR = not recommended for most applications).

## 5.1 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 HARNESSSES"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.

<sup>2</sup> 30° mounting is not recommended for wall mounting without additional supporting structures.

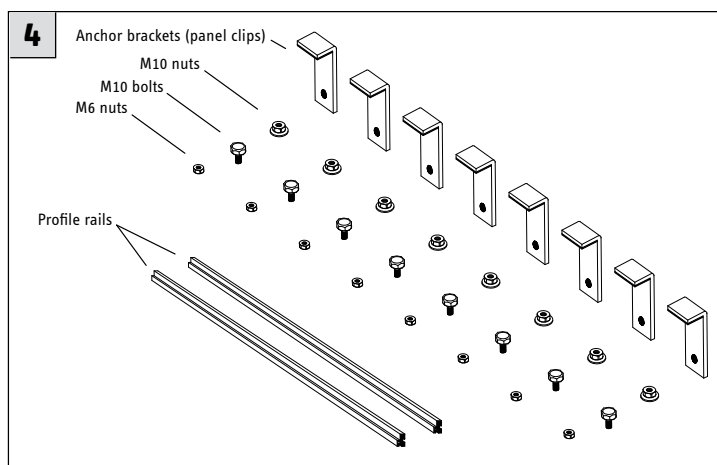
### Tools Needed:

1. Power drill with 1/4" drill bit. Bits of other sizes are recommended as well.
2. 11/16" drill bit for corrugated sheet roof installations.
3. Two 17mm wrenches and/or sockets for M10 bolts.
4. Two 15mm wrenches and/or sockets for M10 nuts.
5. Two 7/16" wrenches/sockets for 7/16" and 1/4" nuts/bolts.
6. Two 9/16" wrenches/sockets for 3/8" nuts/bolts.
7. One 2" adjustable wrench for collector fittings.

### 5.1.1 Mounting on a Flat Roof

Two mounting frames are available for fixed, 45-degree collector tilt:

- R1 for one collector installed vertically (185545). See **Figure 4**.
- R2 for two collectors installed vertically or one collector installed horizontally (185546). See **Figure 5**.



**Figure 4: R1 Mounting Frame for Vertical Collector Arrangement**

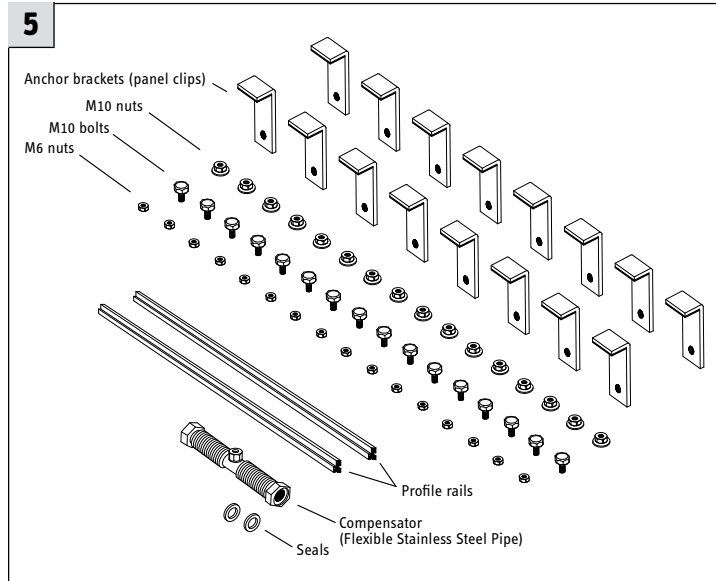
For 45° vertical mounting on a flat roof, two sets of (185543) flat-roof/wall mounting hardware are needed; for two collectors or more, the number of sets required is the same as the number of collectors. See **Figure 6**.

For 45° horizontal mounting on a flat roof or a wall, the number of BF W (074324) flat-roof/wall mounting hardware sets needed is twice the number of collectors. See **Figure 7**.

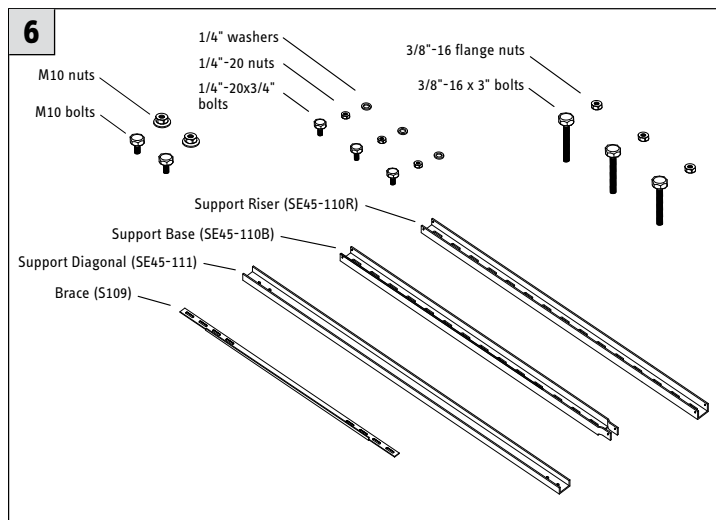


**NOTICE: TO PREVENT EXCESSIVE PRESSURE DROP IN THE SOLAR LOOP, NEVER LINK UP MORE THAN 5 COLLECTORS IN SERIES. ARRANGE THE INDIVIDUAL LINEAR ARRAYS PARALLEL TO EACH OTHER.**

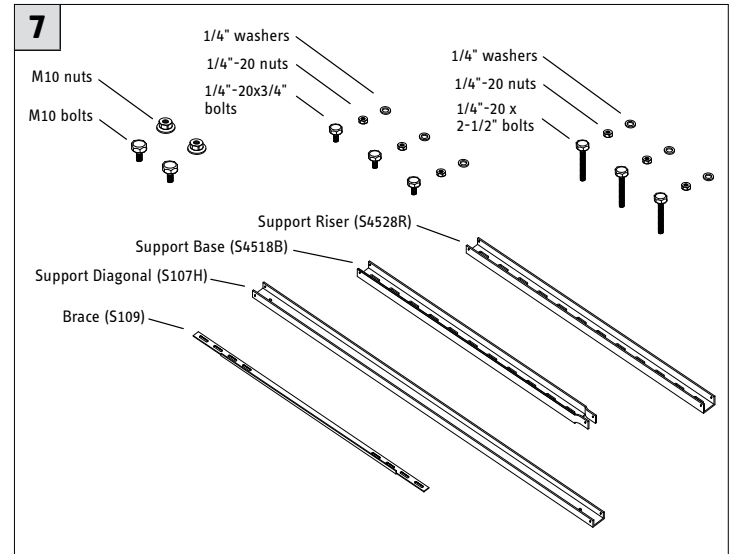
Building penetrations for plumbing and mounting must not impair enclosure integrity or functionality and must not allow rodent or vermin intrusion. They must meet applicable codes and National Roofing Contractors Assoc. practices. Structural members penetrated by solar system components must not be compromised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



**Figure 5: R2 Mounting Frame for Single Horizontal (or Two Vertical) Collector Arrangement.**



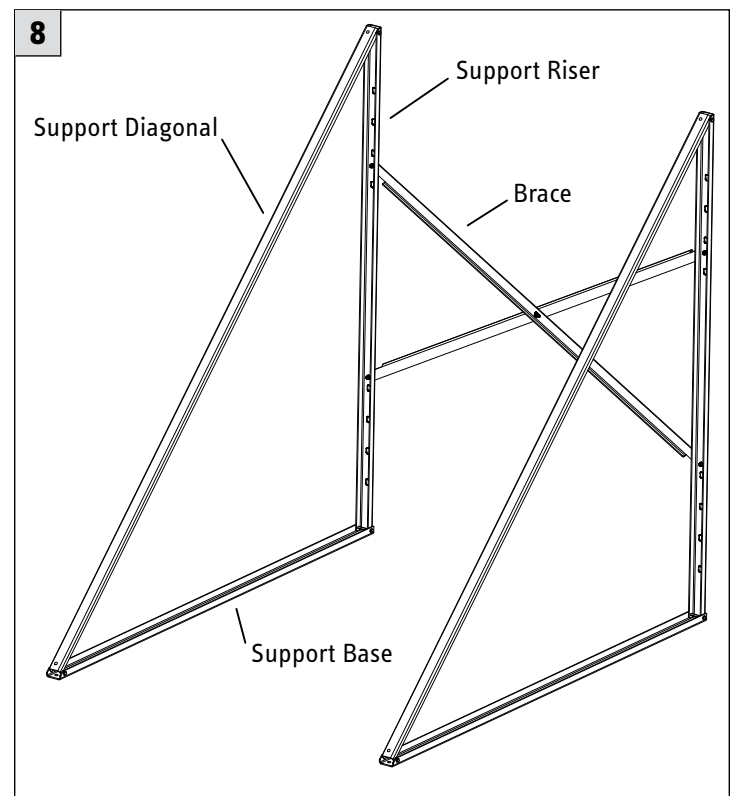
**Figure 6: 45-degree Vertical Mounting Kit (p/n 185543).**



**Figure 7: 45-degree Horizontal Mounting Kit (p/n 074324).**

### Procedure

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Bolt the support base (SE45-110B), support riser (SE45-110R) and transverse support (SE45-111 collector rail) together to form a triangle truss, as shown in **Figure 8**.



**Figure 8: Assembled triangle trusses with cross-braces.**

3. Bolt the resulting truss(es) to the upper and lower profile (frame) rails.
4. If installing one collector, the triangle trusses must be set up at

intervals of  $\leq 82$  in. (210 cm) for horizontal installation or  $\leq 43$  in. (110 cm) for vertical installation.

5. If installing two or more collectors, the triangle trusses are to be positioned at the midpoint, behind the collectors.
6. Whenever two or more triangle trusses are installed, brace the center span with a cross-brace, as shown in Figure 8.
7. When installing four or five trusses, brace both end spans with crossbraces, as shown in Figure 9. For six or more trusses, cross-braces should also be placed in an inside span.
8. If multiple flat-roof mounting frames are being set up next to one another, use frame connector (splice) kits (SFC001, shown in Figure 10) to join them, as shown in Figures 9 and 11. Line up the mounting supports with a string so that the mounting frames will be aligned properly.

9. 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.

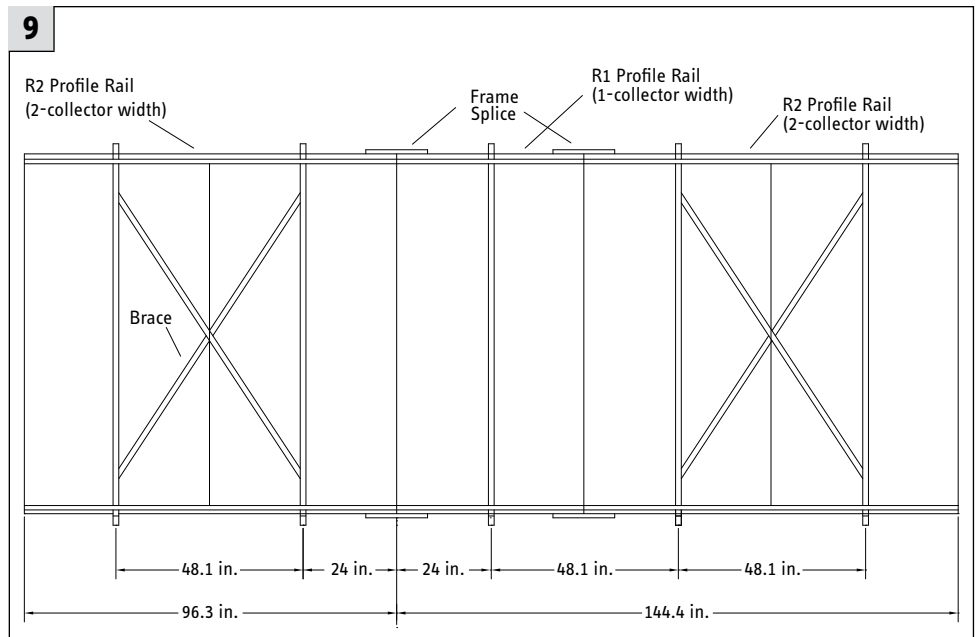
10. For installed heights above 25 ft. (8 m), weighting is not advisable due to the higher wind loading conditions. In this case, the holes in the horizontal support base (SE45-110B) should be used to fasten the mounting hardware to the roof (six M6 bolts per horizontal support).

**Multiple Rows of Collectors:**

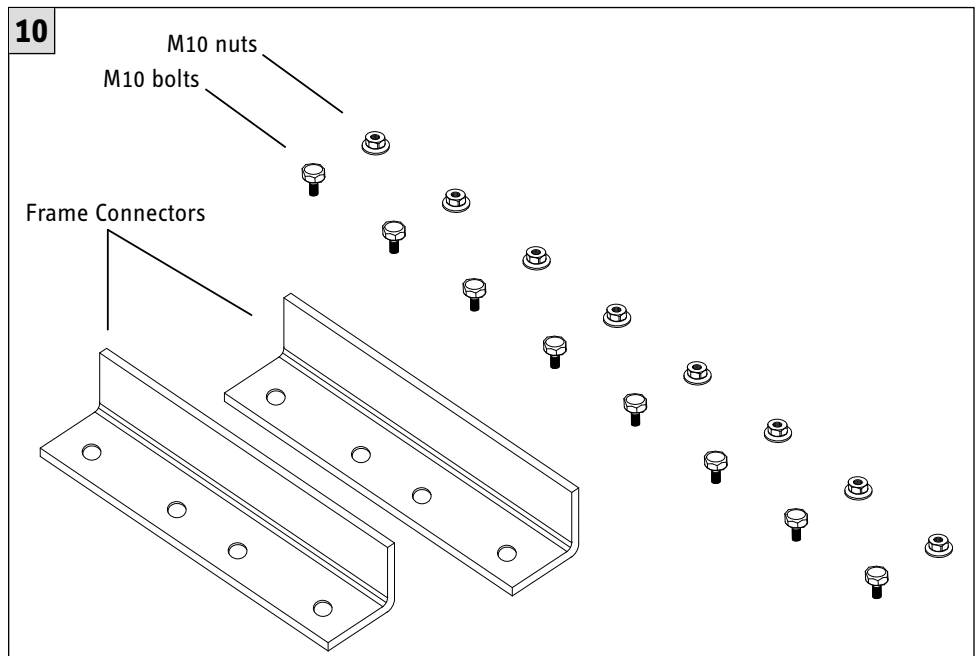
If multiple arrays of collectors are being installed on a flat roof, one behind another, the recommended spacing between them should be:

- at least 25 ft. (7.6 m) for vertical installation, as shown in Figure 12; or
- at least 14 ft. (4.0 m) for horizontal installation, as shown in Figure 13.

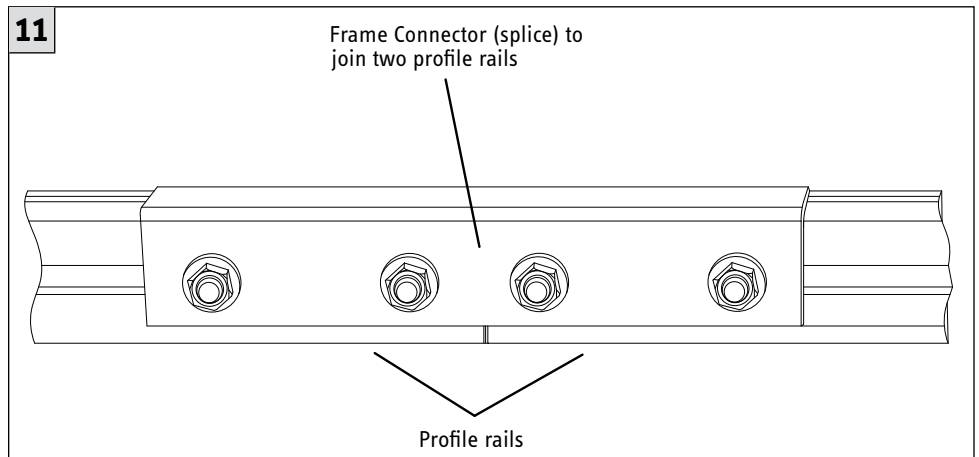
This spacing prevents excessive shading from adjacent rows for latitudes of up to 50°. For latitudes significantly higher than 50°, multiple rows of collectors may not be practical due to low sun altitude angles.



**Figure 9: Multiple-collector framing arrangement, with frame connectors and cross-bracing.**



**Figure 10: SFC001 Frame Connector (Splice) Kit.**



**Figure 11: SFC001 Frame Connector (Splice) Kit.**

## 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)

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.

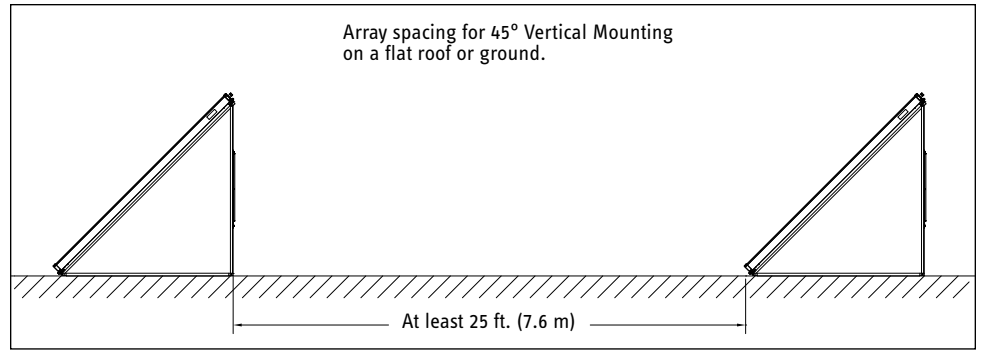
For anchoring in concrete, use six M8 UPAT Multicones or SM M10 anchors, both of stainless steel, per collector.

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

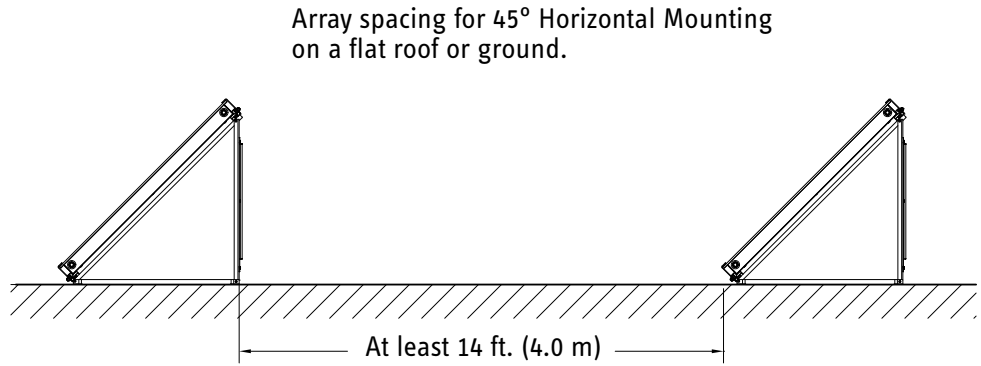
### 5.1.2 45° Mounting On A Wall

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

1. If multiple wall-mounting frames are being set up next to one another, use frame connector (splice) kits (SFC001) to join them. Line up the mounting supports with a string so that the mounting frames will be aligned properly.
2. Fasten the wall mounting supports to the wall in a suitable manner, using the holes in support riser (SE45-110R), then tighten all bolts and screws.
3. Maintain the spacing between connection points (as specified by the manufacturer).
4. Low elevation mounting configurations may be prone to damage from falling



**Figure 12: Recommended row spacing for 45° vertical arrays for latitudes up to 50°.**



**Figure 13: Recommended row spacing for 45° horizontal arrays for latitudes up to 50°.**

ice or nearby vehicles or other hazards. Appropriate precautions should be taken to mitigate these hazards.

### 5.1.3 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.



### 5.1.4 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 the table below. 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

### 5.1.5 Detailed Assembly Instructions for 45° Mounting Kit



**Step 01:** Major components for assembly of the Stiebel Eltron 45° mounting kit (single panel vertical version displayed).



**Step 02:** Align the mounting system components upside down as shown. The longer cutout surface (approx. 1") should be facing toward the center of the rectangle and be parallel to the ground on both the top and bottom. This is the surface on which the back of the collector will rest.



**Step 03:** Prepare to assemble the top left corner.



**Step 04:** Slide M10 bolt into slot of profile rail.



**Step 05:** Position the diagonal support such that the M10 bolt protrudes through the hole closest to the end.

**Note 1:** If assembling a 45° horizontal mounting system, there is only one hole on either end of the diagonal support.

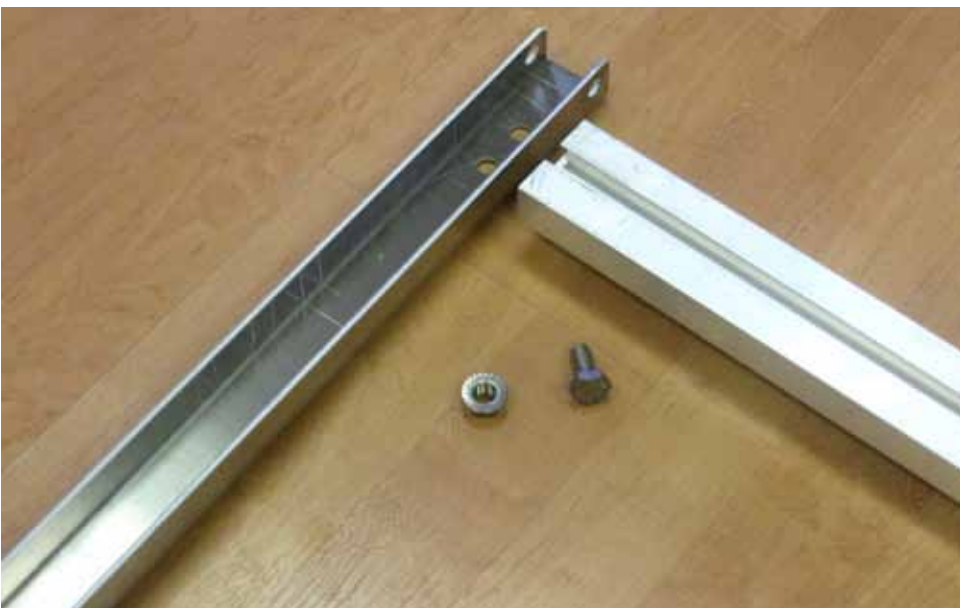
**Note 2:** If assembling a mounting system using the longer profile rails (p/n 185546) the diagonal supports should not be fastened to the ends of the profile rails, but should be assembled such that the supports are approximately 2' from each side of the profile rail and are therefore approximately 4 feet from each other.



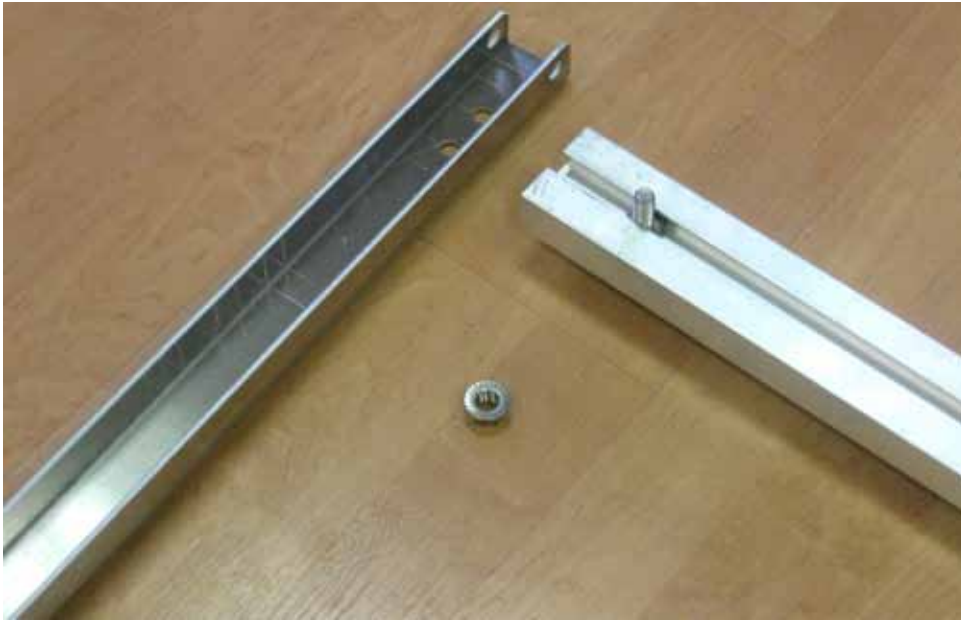
**Step 06:** Install M10 nut. Repeat the last 4 steps for the top right corner.



**Step 07:** Prepare to assemble the bottom 2 corners. Remember to double check that the longer cutout surface (approx. 1") is facing toward the center of the rectangle and is parallel to the ground.



**Step 08:** : Prepare to assemble the bottom left corner.



**Step 09:** Slide M10 bolt into slot of profile rail.



**Step 10:** Position the diagonal support such that the M10 bolt protrudes through the hole furthest from the end.



**Step 11:** Install M10 nut. Repeat the last 4 steps for the bottom right corner.



**Step 12:** Resulting assembly.



**Step 13:** When performing assembly steps involving the base support, make sure to use the same end of said supports for analogous parts of each half of the assembly, as they appear to be symmetrical but are not. To check, line them up as shown. This is the correct orientation.



**NOTE:** This is the incorrect orientation.



**Step 13:** Prepare to assemble one of the 90° joints.



**Step 14:** Align the holes of the two supports and insert one of the 3/8"-16 x 3" bolts.



**Step 15:** Install one of the 3/8"-16 nuts.



**Step 16:** Install the base support to the bottom of the assembled rectangle by repeating the two previous steps. Remember that the bottom is the end in which the diagonal support is attached to the profile rail using the hole furthest from the end (vertical kit only).



**Step 17:** Repeat this process for the top of the rectangle.



**Step 18:** Resulting assembly.



**Step 19:** Repeat these processes for the other half of the rectangle.





**Step 20:** Rotate the assembly so that it is resting on the base.



**Step 21:** Align the cross braces and fasteners as shown and loosely attach the 2 cross braces.



**Step 22:** Loosely attach one of the corners of the 'X' to one of the upper slots of the kit's vertical support using a 1/4" nut, bolt, and washer. The preferable slot to use is dependent upon the distance between the two triangles, which in turn is dependent upon the specificities of each installation. If the collectors are being mounted on a wall it is usually preferable to install the cross braces between the two base supports.



**Step 23:** Loosely attach the 'X' to the same slot on the other vertical support (base support if performing a wall mount).



**Step 24:** Attach the bottom of the 'X' to the requisite lower slots and tighten all nuts and bolts. The unit is now assembled and ready for mounting.

## 5.2 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”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.

### Tools Needed:

1. Power drill with 1/4” drill bit. Bits of other sizes are recommended as well.
2. 11/16” drill bit for corrugated sheet roof installations.
3. Two 17mm wrenches and/or sockets for M10 bolts.
4. Two 15mm wrenches and/or sockets for M10 nuts.
5. Two 7/16” wrenches/sockets for 7/16” and 1/4” nuts/bolts.
6. Two 9/16” wrenches/sockets for 3/8” nuts/bolts.
7. One 2” adjustable wrench for collector fittings.

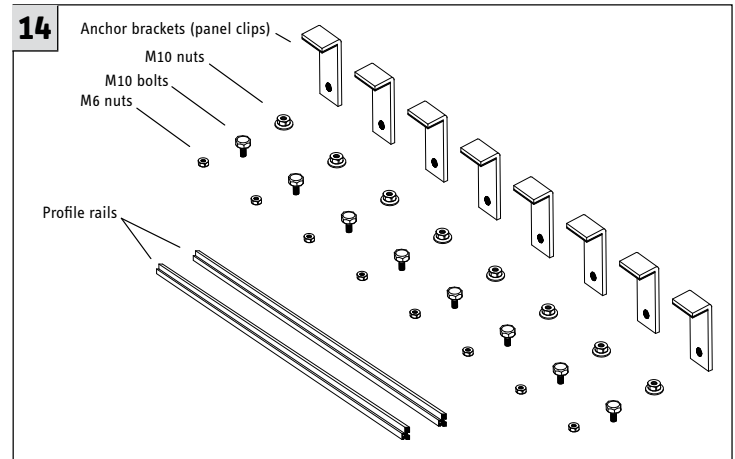
Stiebel Eltron provides a 30/60° fixed mounting kit (p/n SE60) for

vertical arrangement of collectors. The truss that the kit forms can be flipped to provide either tilt angle.

### 5.2.1 30/60° Mounting On A Flat Roof

Two mounting frames are available for fixed 30- and 60-degree collector tilt:

- R1 for one collector installed vertically (185545). See **Figure 14**.
- R2 for two collectors installed vertically or one collector installed horizontally (185546). See **Figure 15**.



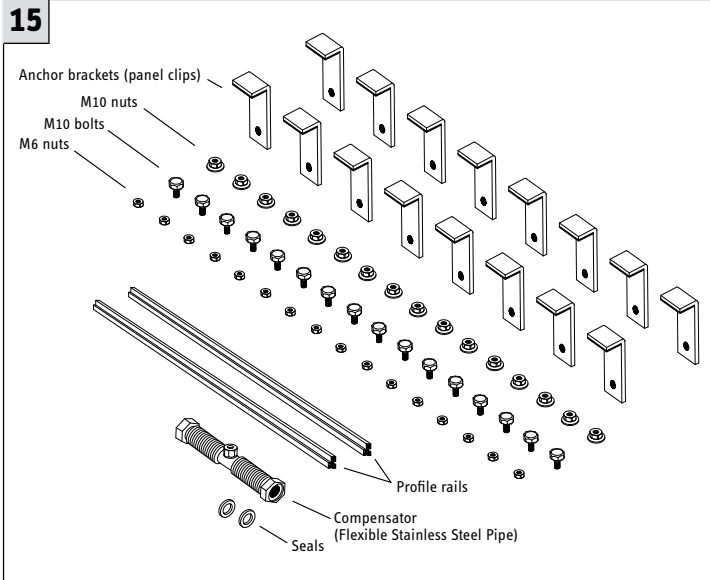
**Figure 14: R1 Mounting Frame for Vertical Collector Arrangement**

For 30/60° vertical mounting on a flat roof, two sets of (SE60) flat-roof/wall mounting hardware are needed; for two collectors or more, the number of sets required is the same as the number of collectors. See **Figure 16**.

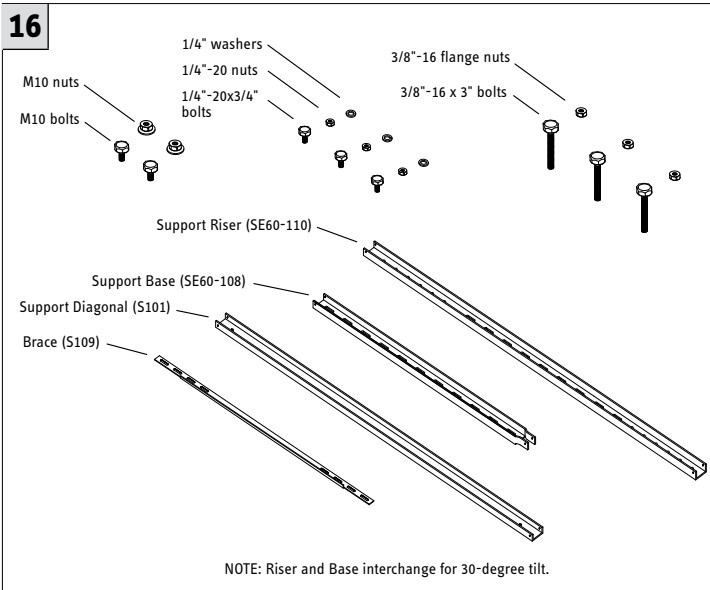


**NOTICE: TO PREVENT EXCESSIVE PRESSURE DROP IN THE SOLAR LOOP, NEVER LINK UP MORE THAN 5 COLLECTORS IN SERIES. ARRANGE THE INDIVIDUAL LINEAR ARRAYS PARALLEL TO EACH OTHER.**

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.



**Figure 15: R2 Mounting Frame for Single Horizontal (or Two Vertical) Collector Arrangement.**

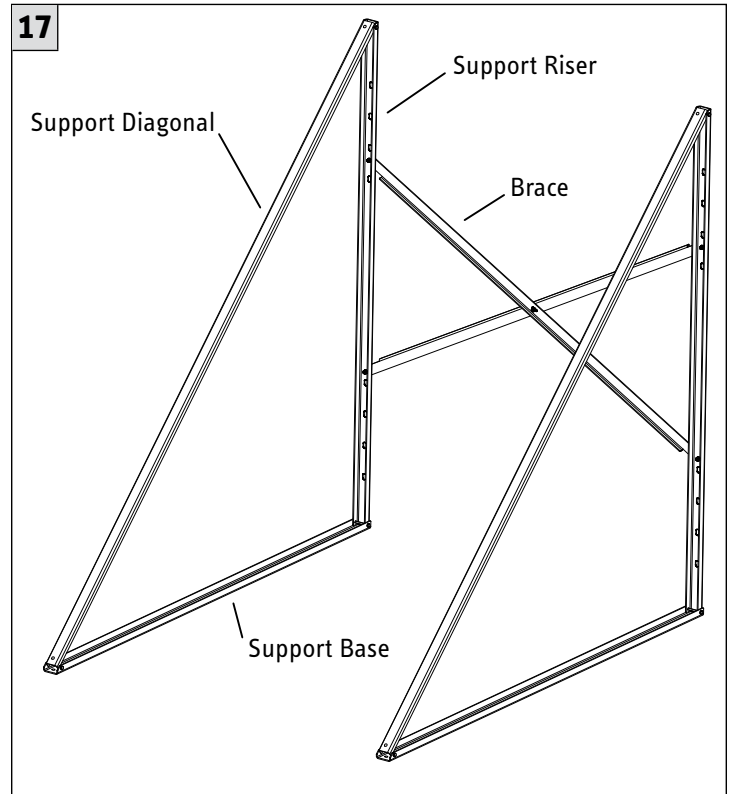


**Figure 16: Vertical 30/60° Mounting Kit (p/n SE60).**

**Procedure:**

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Bolt the support base (SE60-108), support riser (SE60-110) and transverse support (S101 collector rail) together to form a triangle truss, as shown in **Figure 17**.
3. Bolt the resulting truss(es) to the upper and lower profile (frame) rails.
4. If installing one collector, the triangle trusses must be set up at intervals of  $\leq 82$  in. (210 cm) for horizontal installation or  $\leq 43$  in. (110 cm) for vertical installation.

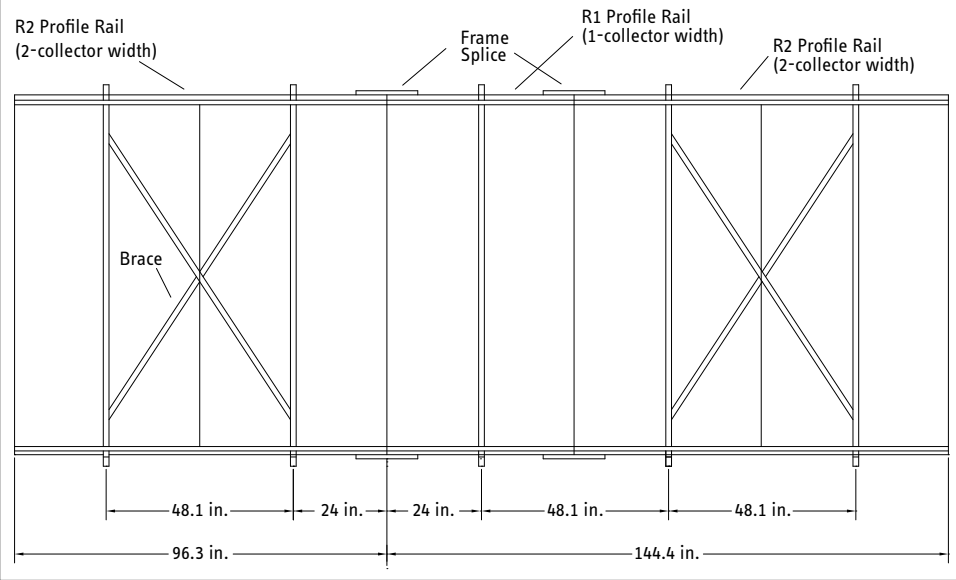
5. If installing two or more collectors, the triangle trusses are to be positioned at the midpoint, behind the collectors.
6. Whenever two or more triangle trusses are installed, brace the center span with a cross-brace, as shown in **Figure 17**.
7. When installing four or five trusses, brace both end spans with crossbraces, as shown in **Figure 18**. For six or more trusses, cross-braces should also be placed in an inside span.



**Figure 17: Assembled triangle trusses with cross-braces.**

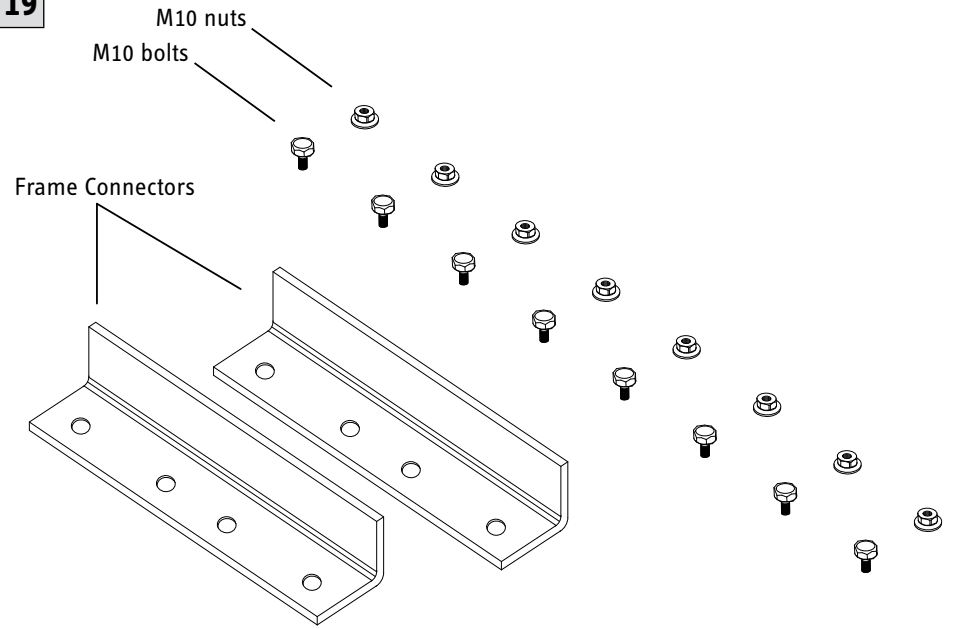
8. If multiple flat-roof mounting frames are being set up next to one another, use frame connector (splice) kits (SFC001, shown in **Figure 19**) to join them, as shown in **Figures 18 and 20**. Line up the mounting supports with a string so that the mounting frames will be aligned properly.
9. Fasten 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.
10. 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 horizontal support base (SE60-108, or SE60-110 if flipped for 30 degree tilt) should be used to fasten the mounting hardware to the roof (six M6 bolts per horizontal support).

18



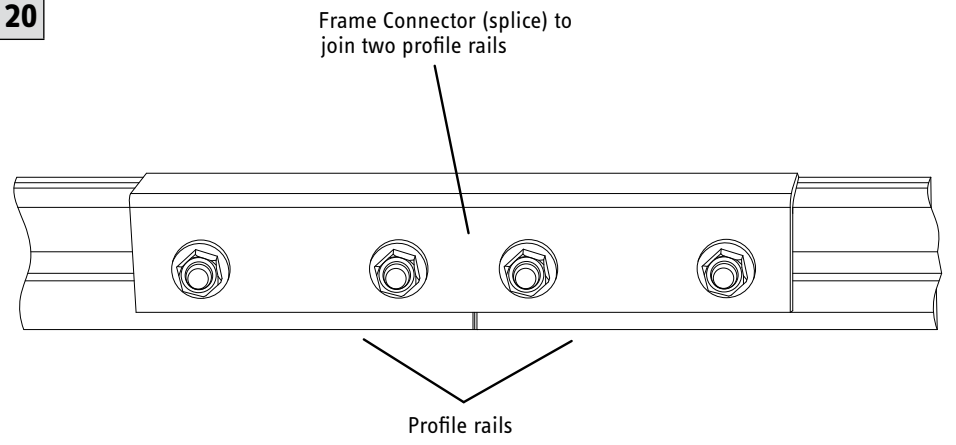
**Figure 18: Multiple-collector framing arrangement, with frame connectors and cross-bracing.**

19



**Figure 19: SFC001 Frame Connector (Splice) Kit.**

20



**Figure 20: SFC001 Frame Connector (Splice) Kit.**

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.

**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 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.

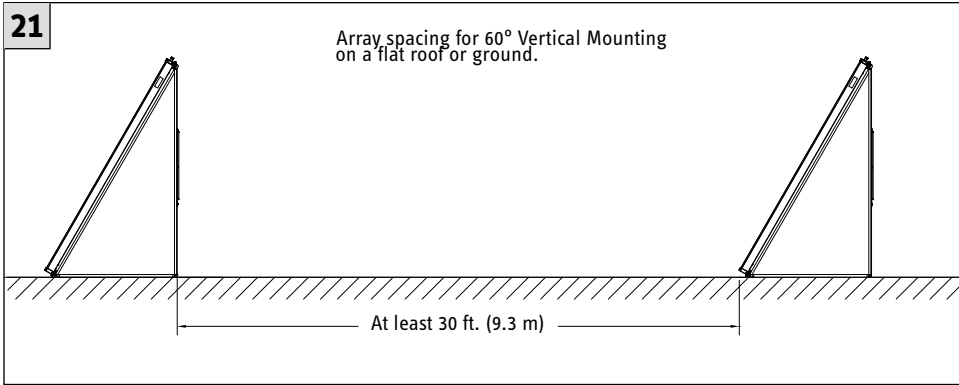
For anchoring in concrete, use six M8 UPAT Multicones or SM M10 anchors, both of stainless steel, per collector.

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

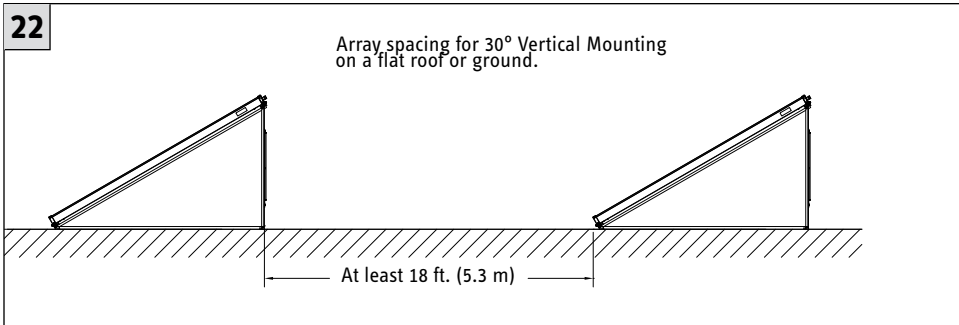
**5.2.2 30/60° Mounting on a Wall**

It is not generally advisable to use the 30° mounting orientation on a wall unless additional supporting structures are installed to bear the loads. Installers should consult with a structural engineer.

Procedures described above for mounting



**Figure 21: Recommended row spacing for 60° vertical arrays for latitudes up to 50°.**



**Figure 22: Recommended row spacing for 30° vertical arrays for latitudes up to 50°.**



**Figure 23: Typical wall-mount installation of a 60° collector array.**

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

1. If multiple wall-mounting frames are being set up next to one another, use frame connector (splice) kits (SFC001) to join them. Line up the mounting supports with a string so that the mounting frames will be aligned properly.
2. Connect the wall mounting supports to the wall in a suitable manner, using the holes in support riser (SE60-110), then tighten all bolts and screws. (or support base, SE60-108, if installing as a 30° system), and transverse support (S101 collector rail).
3. Maintain the spacing between connection points (as specified by the manufacturer).
4. 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 23** shows a typical wall-mount installation of a 60° collector array.

### 5.2.3 30/60° 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.

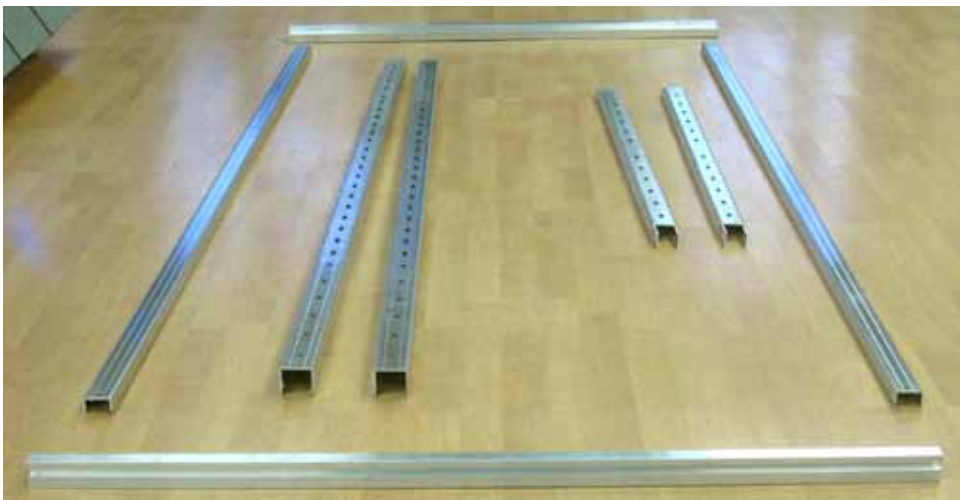
### 5.2.4 30/60° Mounting On A Pitched Roof

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 30° mounting kits add 30° to an existing roof pitch, as shown in the table below. Roofs with pitches above 12-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 w/ 30° Mount	Resulting Collector Tilt Angle w/ 60° Mount
1-in-12	4.8°	34.8°	64.8°
2-in-12	9.5°	39.5°	69.5°
3-in-12	14.0°	44.0°	74.0°
4-in-12	18.4°	48.4°	78.4°
5-in-12	22.6°	52.6°	not recommended
6-in-12	26.6°	56.6°	not recommended
7-in-12	30.3°	60.3°	not recommended
8-in-12	33.7°	63.7°	not recommended
9-in-12	36.9°	66.9°	not recommended
10-in-12	39.8°	69.8°	not recommended
11-in-12	42.5°	72.5°	not recommended
12-in-12	45.0°	75.0°	not recommended

### 5.2.5 Detailed Assembly Instructions for 60° Mounting Kit



**Step 01:** Major components for assembly of the Stiebel Eltron 30/60° mounting kit (single panel vertical version displayed).





**Step 02:** Place the profile rail upside down as shown. The longer cutout surface (approx. 1") should be facing toward the center of the rectangle and be parallel to the ground. This is the surface on which the back of the collector will rest.



**Step 03:** Slide one of the M10 bolts into the slot of the profile rail as shown.



**Step 04:** Prepare to assemble the top left corner of the rectangle. The end of the support rail with the hole closer to the edge is the top side of the rail.

**Note:** If assembling a mounting system using the longer profile rails (p/n 185546) the support rails should not be fastened to the ends of the profile rails, but should be assembled such that the supports are approximately 2' from each side of the profile rail and are therefore approximately 4 feet from each other.



**Step 05:** Insert the threads of the M10 bolt through the hole in the support rail.



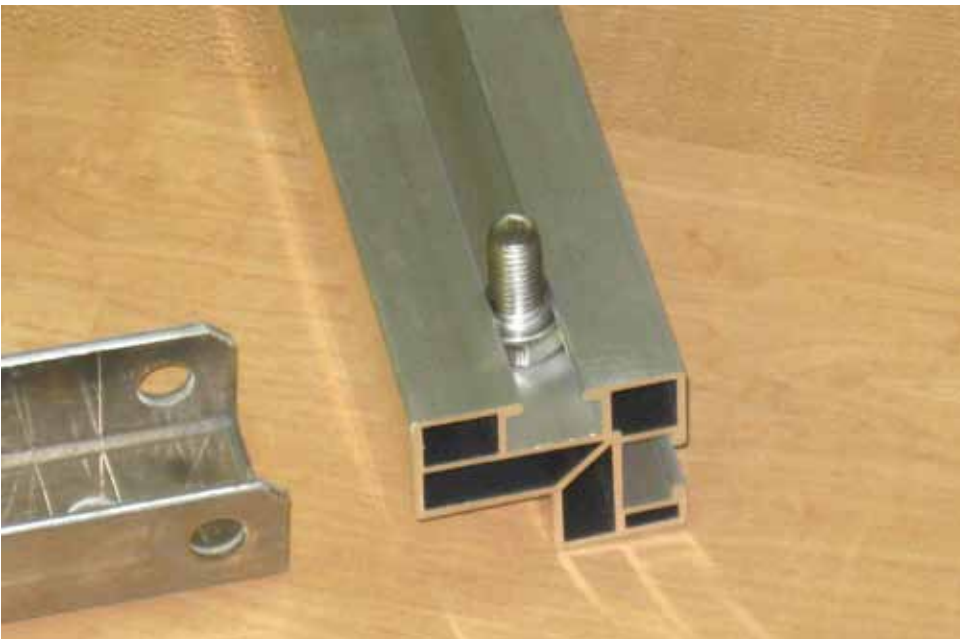
**Step 06:** Install M10 nut. Repeat the preceding 4 steps for the top right corner of the rectangle.



**Step 07:** Align the profile rail in the same manner as the top (The longer cutout surface should be facing toward the center of the rectangle and be parallel to the ground).



**Step 08:** Prepare to assemble the bottom right corner.



**Step 09:** Slide one of the M10 bolts into the slot of the profile rail as shown.



**Step 10:** Insert the threads of the M10 bolt through the hole in the support rail.



**Step 11:** Install M10 nut. Repeat the preceding 4 steps for the bottom left corner of the rectangle.



**Step 12:** Resulting assembly to which the remaining components will be attached to form a 60° mounting system.



**Step 13:** Align the base support and the riser support in the manner shown. Note that the end of the riser which is attached in this step is the end without the cutout.



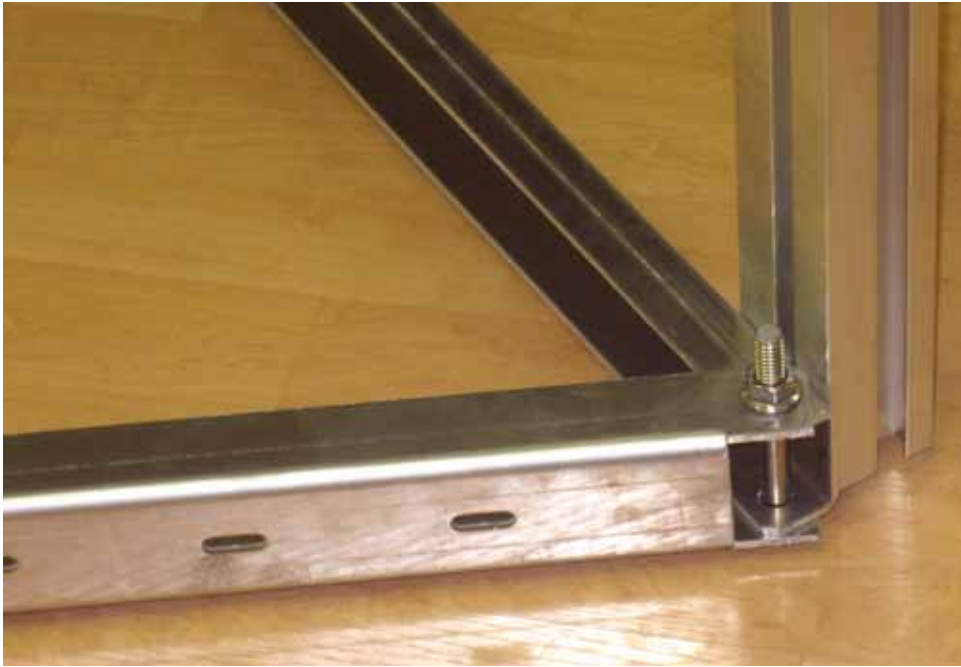
**Step 14:** Align the holes and insert one of the 3/8"-16 x 3" bolts and install a 3/8" serrated flange nut. Repeat these steps for the remaining riser and base supports.



**Step 16:** Close up view of assembly.



**Step 17:** Attach the riser support of one of the right angle assemblies which were just assembled to the top of the rectangular assembly using of the 3/8"-16 x 3" bolts and a 3/8" serrated flange nut. Note that the top is the part in which the diagonal support does not protrude past the edge of the profile rail.



**Step 18:** Attach the other end of the right angle assembly to the bottom of the rectangular assembly using the same fasteners. Repeat these steps for the remaining right angle assembly.



**Step 19:** Rotate the assembly so that it is resting on the base.



**Step 20:** Install one of the cross braces to the riser support using two  $\frac{1}{4}$ " nuts, bolts and washers. If the collectors are being mounted on a wall it is usually preferable to install the cross braces between the two base supports.



**Step 21:** Align the remaining cross brace to the opposite attachment slots and fasten it to the riser support using the same fasteners and attach the two cross braces together in the middle using one  $\frac{1}{4}$ " nut, bolts and washer. The assembly is now ready to be installed at the installation site.

### 5.3 Flush Mounting On A Pitched Roof

Stiebel Eltron provides flush-mounting kits for both vertical and horizontal collector layouts, part numbers SFM001 and SFM001H, respectively. **Figure 24** shows the SFM001 kit and **Figure 25** shows the SFM001H kit. Stiebel Eltron flush mount kits are generally not recommended for mounting upon flat roofs, walls, or the ground. Instead, the 45° or 30/60° mounting systems are more appropriate for mounting to structures other than pitched roofs.

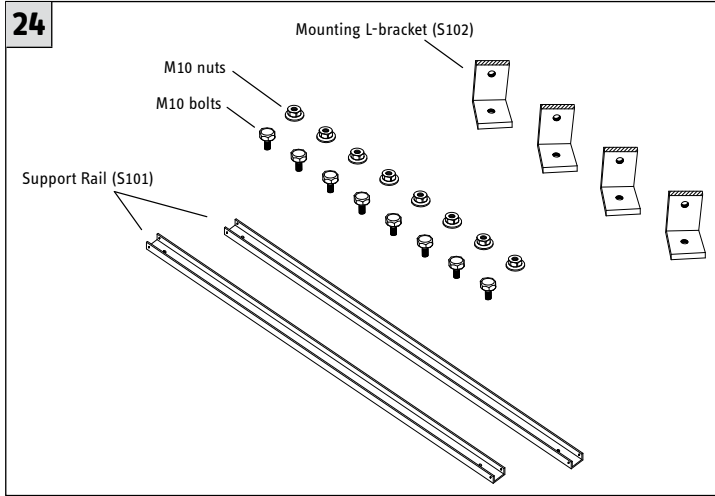


Figure 24: Vertical Flush Mount Kit (p/n SFM001).

The collector mounting frames (p/n 185545 and/or 185546) may be used as templates for locating the support rails and L-brackets. The locations of fasteners may be determined from these templates. After the mounting L-brackets are installed, assemble the frame profile rails to the support rails (S101) with the included fasteners, then bolt the assembly to the L-brackets.

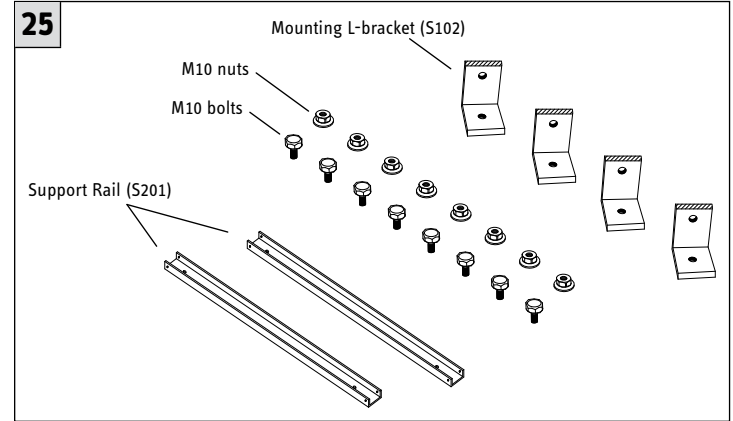


Figure 25: Horizontal Flush Mount Kit (p/n SFM001H).

#### 5.3.1 Detailed Assembly Instructions for Flush Mounting Kit



**Step 01:** Major components for assembly of the Stiebel Eltron flush mounting kit (single panel vertical version displayed).





**Step 02:** Place the profile rail upside down as shown. The longer cutout surface (approx. 1") should be facing toward the center of the rectangle and be parallel to the ground. This is the surface on which the back of the collector will rest.



**Step 03:** Slide one of the M10 bolts into the slot of the profile rail as shown.



**Step 04:** Prepare to assemble the top left corner of the rectangle. The end of the support rail with the hole closer to the edge is the top side of the rail.

**Note 1:** If assembling a horizontal flush mounting system, the holes on either end of the support rail are equidistant from each end.

**Note 2:** If assembling a mounting system using the longer profile rails (p/n 185546) the support rails should not be fastened to the ends of the profile rails, but should be assembled such that the supports are approximately 2' from each side of the profile rail and are therefore approximately 4 feet from each other.



**Step 05:** Insert the threads of the M10 bolt through the hole in the support rail.



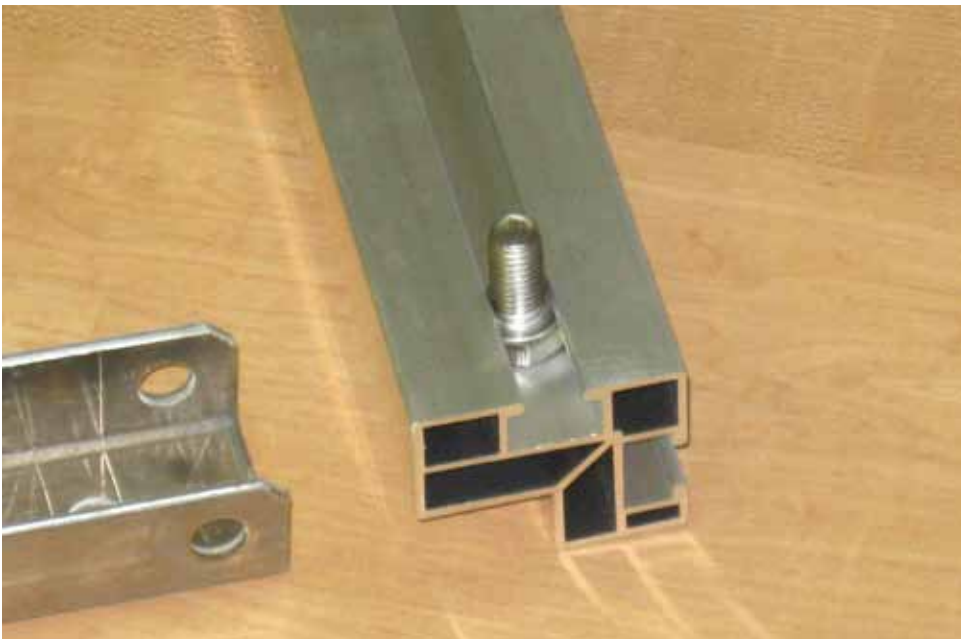
**Step 06:** Install M10 nut. Repeat the preceding 4 steps for the top right corner of the rectangle.



**Step 07:** Align the profile rail in the same manner as the top (The longer cutout surface should be facing toward the center of the rectangle and be parallel to the ground).



**Step 08:** Prepare to assemble the bottom right corner.



**Step 09:** Slide one of the M10 bolts into the slot of the profile rail as shown.



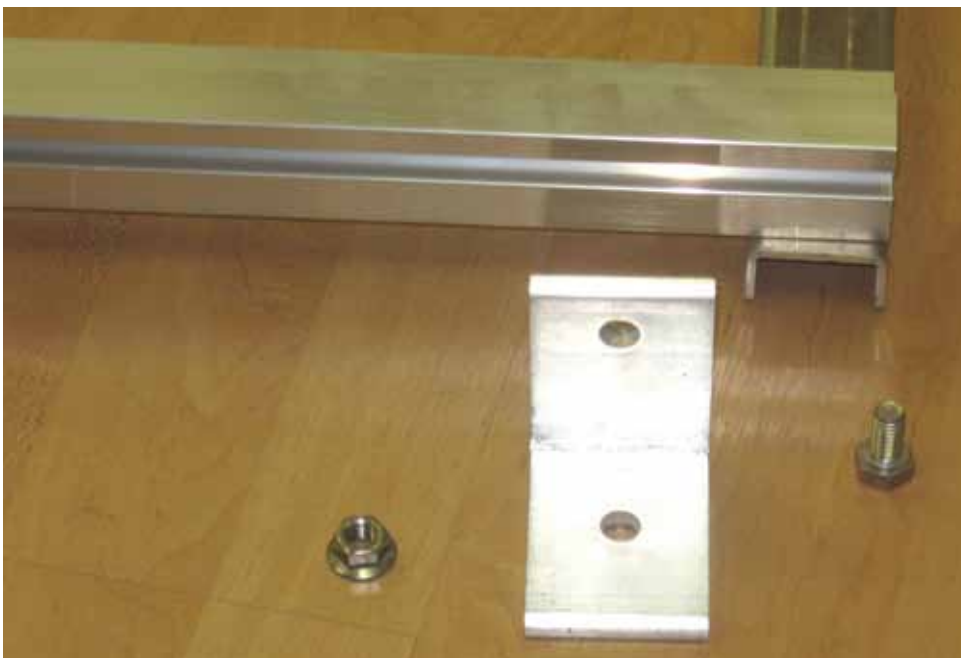
**Step 10:** Insert the threads of the M10 bolt through the hole in the support rail.



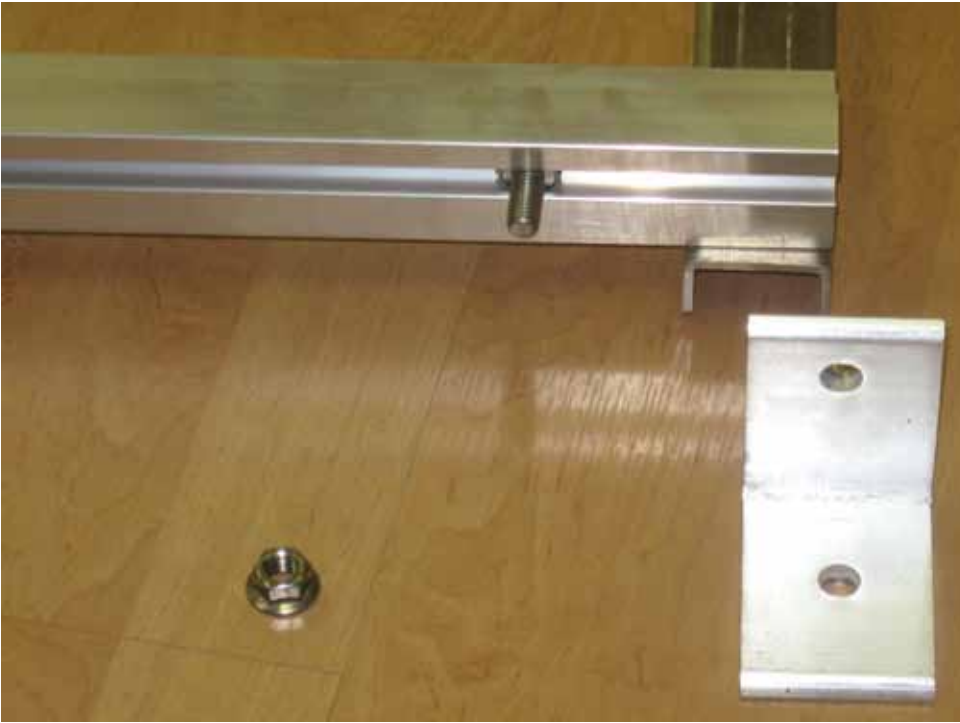
**Step 11:** Install M10 nut. Repeat the preceding 4 steps for the bottom left corner of the rectangle.



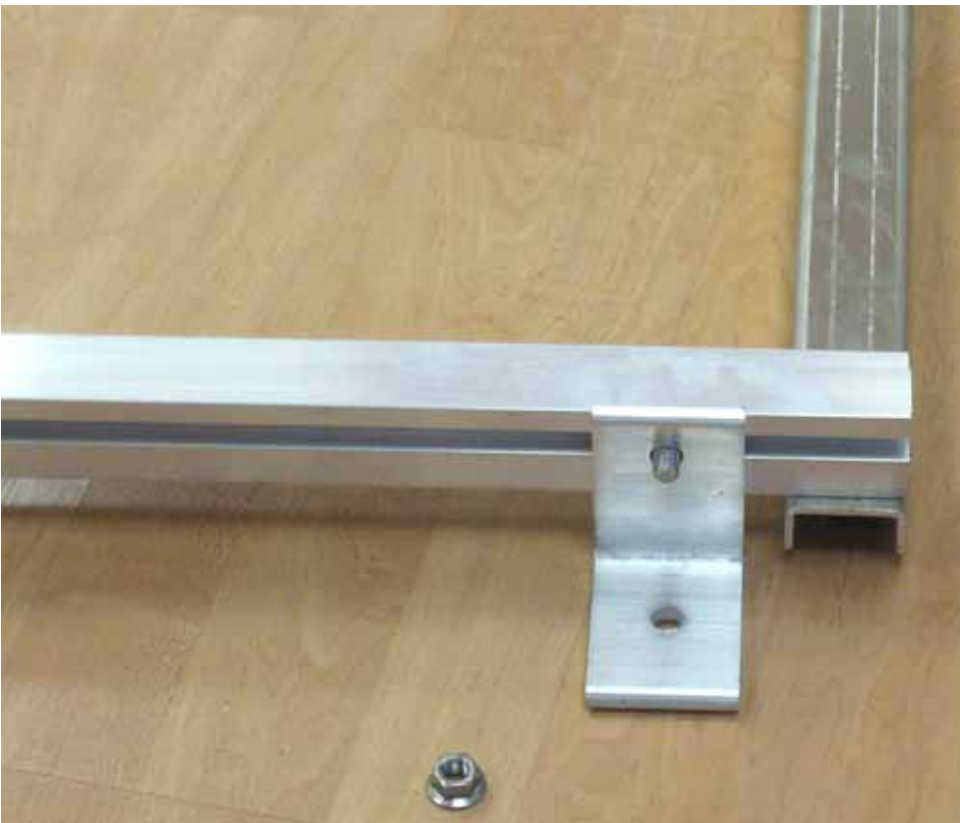
**Step 12:** The resulting assembly. Turn this assembly over so that the support rails are on the ground and the profile rails are slightly elevated before proceeding to the next step.



**Step 13:** Prepare to install the lower right hand 'L' bracket. The vertical portion should contain the hole which is closest to the edge of the bracket.



**Step 14:** Slide one of the M10 bolts into the slot of the profile rail as shown.



**Step 15:** Insert the threads of the M10 bolt through the hole in the vertical portion of the 'L' bracket.



**Step 16:** Install M10 nut. Repeat the preceding 3 steps for the remaining 3 'L' brackets.



**Step 17:** Finished product, top view.

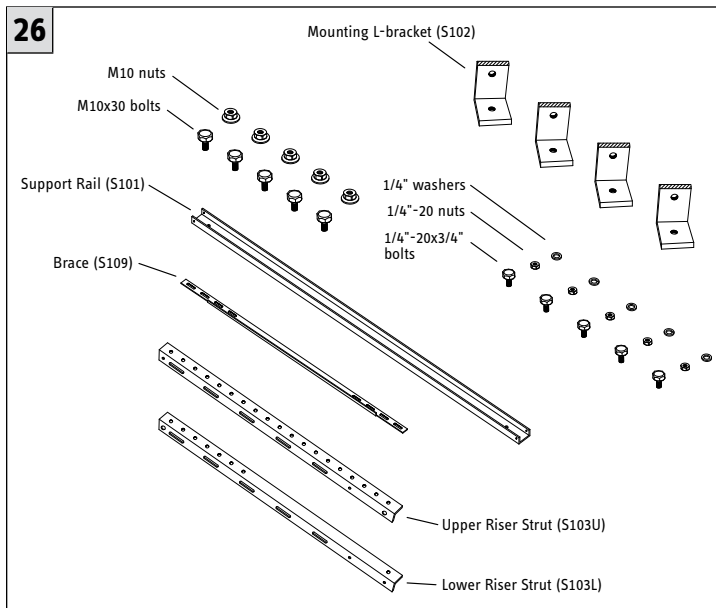
### 5.4 15-30° Tilt Mounting on a Pitched Roof



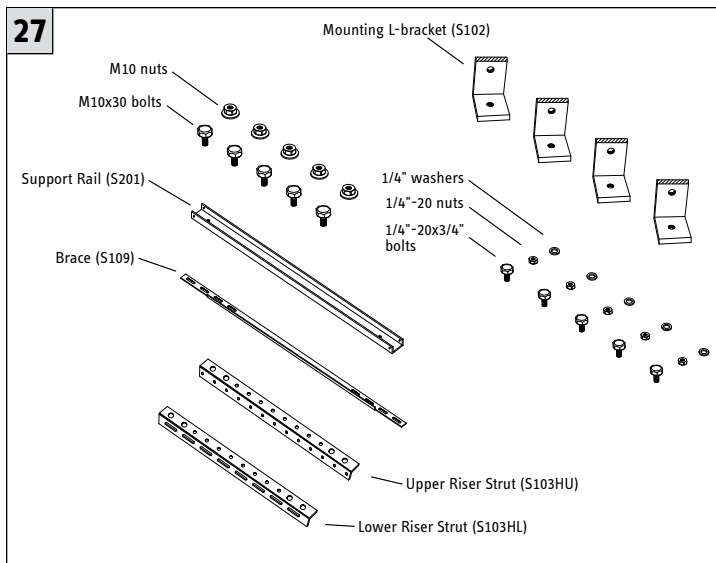
**IMPORTANT: INSTALLED HEIGHT MUST NOT EXCEED 60 FEET.**

Stiebel Eltron provides tilting frame mounting kits for both vertical and horizontal collector layouts, part numbers SFT004 and SFT004H, respectively. **Figure 26** shows the SFT004 kit and **Figure 27** shows the SFT004H kit. The SFT004 frame tilt kit (SFT004H in the case of horizontal mounting) provides adjustment of the collector array from 15° to 30°. For mounting on a roof, two (2) tilt kits are needed per collector frame, for either vertical or horizontal configurations.

Stiebel Eltron tilt mount kits are generally not recommended for mounting upon flat roofs, walls, or the ground. Instead, the 45° or 30/60° mounting systems are more appropriate for mounting to structures other than pitched roofs.



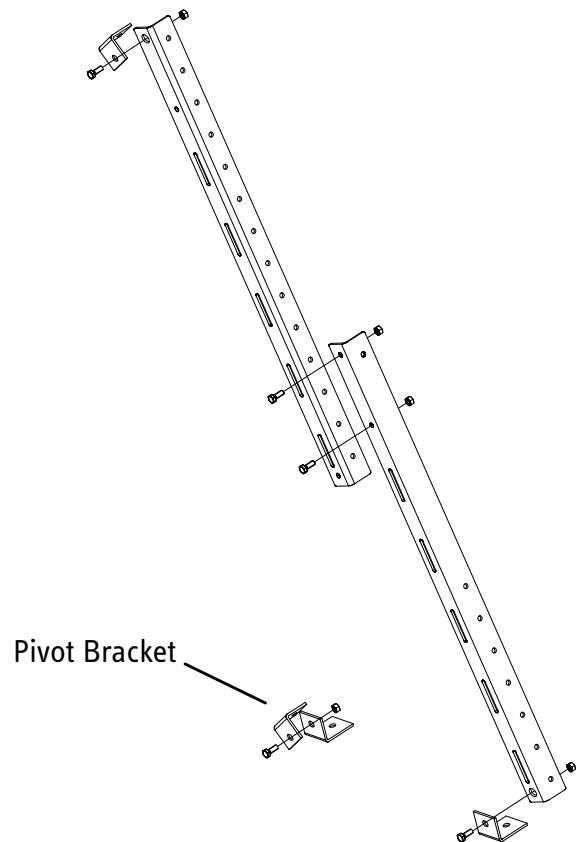
**Figure 26: Vertical Frame Tilt Kit (p/n SFT004).**



**Figure 27: Horizontal Frame Tilt Kit (p/n SFT004H).**

**Procedure:**

1. Choose attachment site, allowing for subsequent pipe penetration.
2. Ensure that two bolts are inserted into the channel of the upper and lower profile rails, before the upper and lower riser struts are bolted to the profile rails.
3. The distance between the collector support rails should be slightly larger than the distance between the upper roof hooks / U strips which have already been installed on the roof.
4. On the roof hooks / U strips, the long sides of the pivot brackets are screwed into the middle drill holes. The short side should be at the top.
5. On the lower roof hooks / U strips, the short side of the second pivot bracket is bolted to the first pivot bracket.
6. Cut the riser struts of the standoff to the proper length for the required angle. For 15° tilt, in the case of vertical installation (or 30° in the case of horizontal installation), only one strut is needed for each pivot point. For 30° vertical installation, the riser struts are bolted together as illustrated in Figure 28. For angles between 15° and 30°, the struts may be bolted together through the intermediate holes.
7. The upwards facing short side of the pivot bracket attached to the upper roof hook / U profile is now bolted to the bottom of the riser strut.



**Figure 28: Tilt Strut Assembly.**

8. As illustrated, another pivot bracket is connected to the top of the standoff strip.

9. When installing two or more collectors, brace the center span. When setting up four or more collectors, brace both end spans. With six or more collectors, braces (S109) should also be placed in an inside span.

10. The frame created from the support rails (S101) and collector profile rails is now bolted to the pivot brackets (34). The bolt located in the channel of the profile rails is bolted into the middle hole of the pivot bracket. (Before bolting together the support rails and profile rails, two bolts must be inserted into the channel of each profile rail).

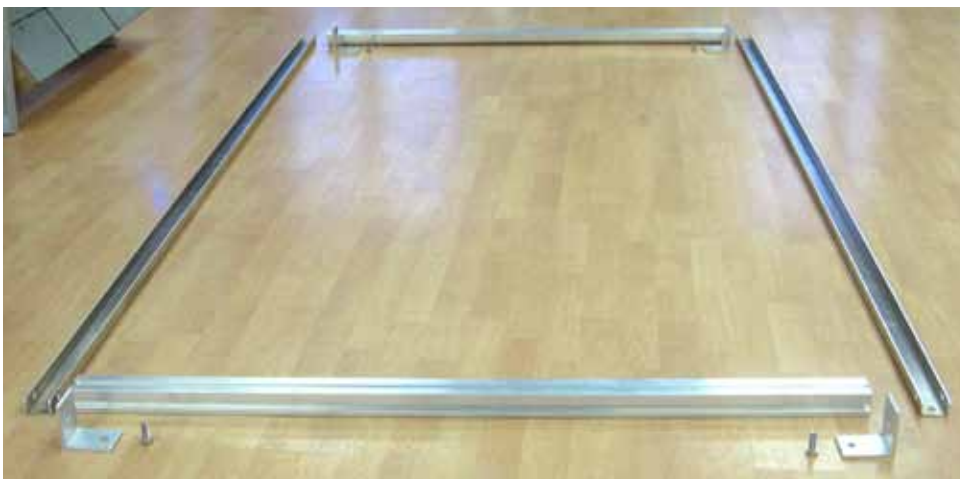
11. If more than one rooftop frame is used, mount the frames to one another using frame connector (splice) kits (SFC001, shown in Figure 19) to join them, as shown in Figures 18 and 20. Line up the mounting supports with a string so that the mounting frames will be aligned properly.

12. Then tighten all bolts and screws.

#### 5.4.1 Detailed Assembly Instructions for Tilt Mounting Kit



**Step 01:** Major components of the Stiebel Eltron Tilt Mounting System (single panel vertical version displayed).



**Step 02:** Align the mounting system components upside down as shown. The longer cutout surface (approx. 1") should be facing toward the center of the rectangle and be parallel to the ground on both the top and bottom. This is the surface on which the back of the collector will rest. The end of the support rail with the hole closer to the edge is the top side of the rail.





**Step 03:** Prepare to assemble top left corner with illustrated components.



**Step 04:** Slide M10 x 30 bolt into the groove of the profile rail as shown.



**Step 05:** Slide the threads of the bolt through the hole of the 'L' bracket. Note that the hole which is closer to the edge is installed on the vertical side of said bracket.



**Step 06:** Slide the threads of the bolt through the hole in the top side of the of the support rail.



**Step 07:** Install the M10 serrated flange nut. Repeat this procedure for the remaining three corners of the rectangle, making sure that the top sides of the profile rails are each attached to the same profile rail.

Note 1: If assembling a horizontal tilt mounting system, there is only one hole on either end of the diagonal support.

Note 2: If assembling a mounting system using the longer profile rails (p/n 185546) the diagonal supports should not be fastened to the ends of the profile rails, but should be assembled such that the supports are approximately 2' from each side of the profile rail and are therefore approximately 4 feet from each other.



**Step 08:** Displayed is the completed rectangle (top view).



**Step 09:** Align an S103U and an S103L. Displayed is the proper alignment (rear view).



**Step 10:** Proper alignment (side view).



**Step 11:** Prepare to assemble S103U and S103L with displayed fasteners.



**Step 12:** Slide the 2 components together as shown.



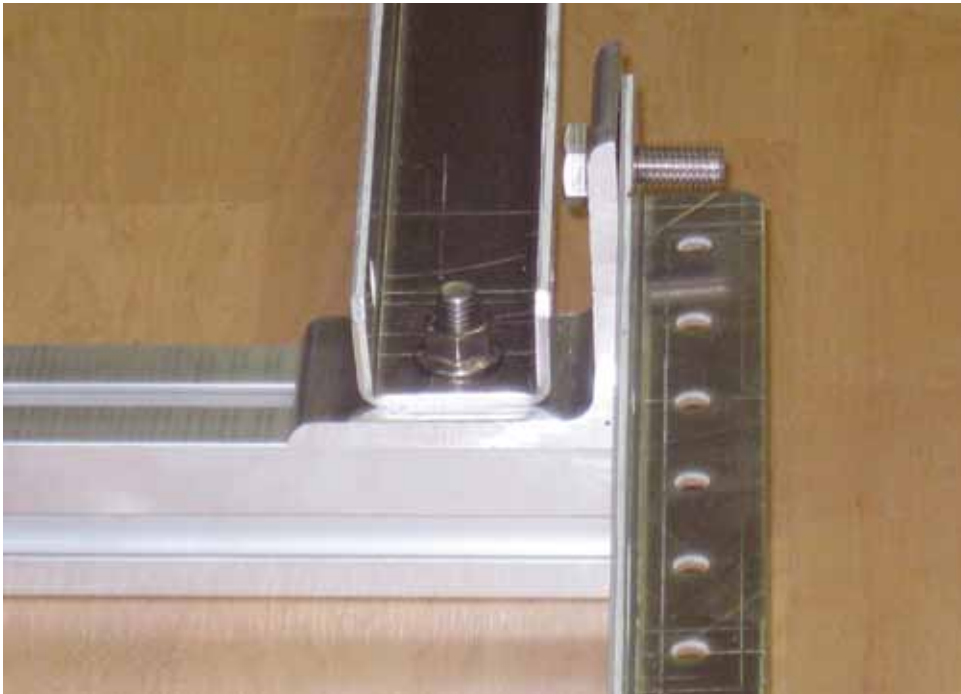
**Step 13:** Slide 2 of the 1/4" bolts through the slots of one component and the holes of the other.



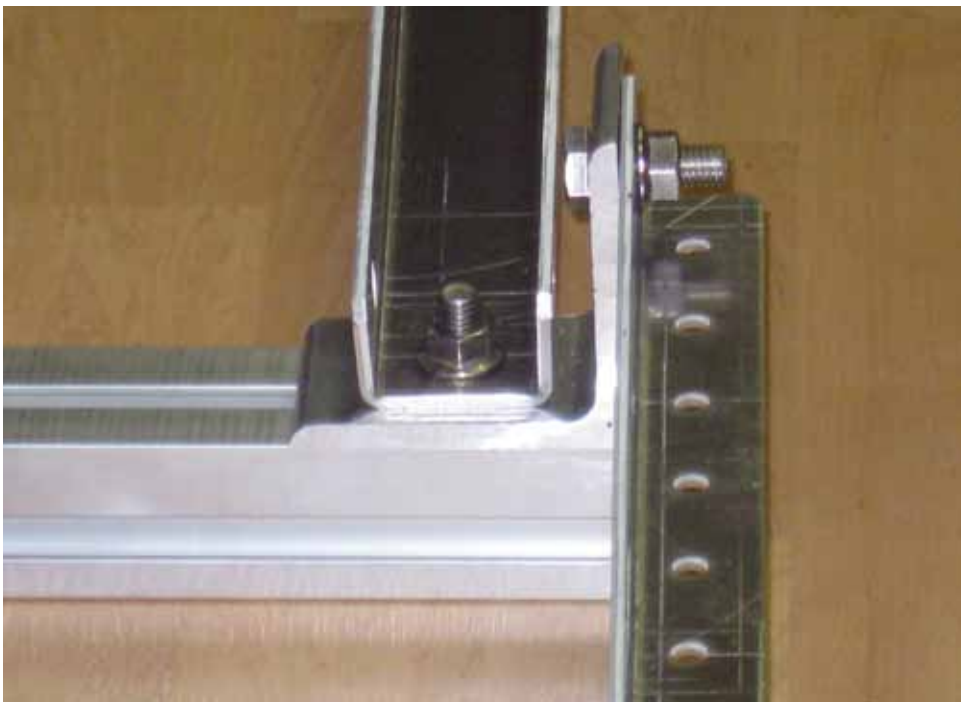
**Step 14:** Install two 1/4" nuts and washers. Repeat this procedure for the remaining two riser struts.



**Step 15:** Align the two riser assemblies with the top side of the assembled support rectangle as shown. Note that the slotted sides of the risers are adjacent to the sides of the rectangle, the sides with the circular holes are flat on the ground, and the bottom of the 'L' of the risers are both facing away from the rectangle.



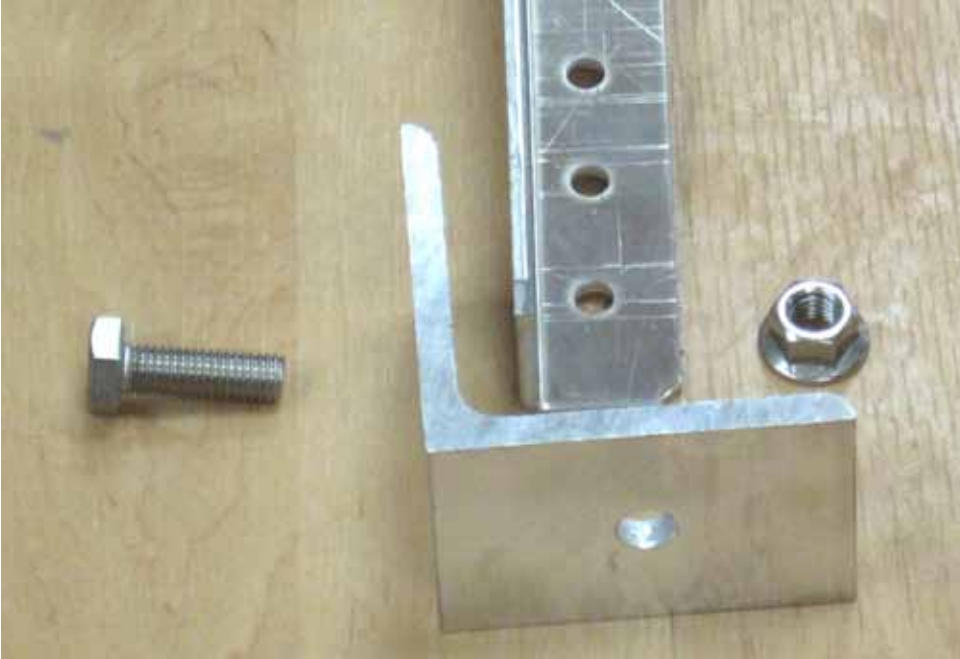
**Step 16:** Install an M10 x 30 bolt through the holes one of the 'L' brackets and one of the riser assemblies.



**Step 17:** Install an M10 serrated flange nut. Repeat this procedure for the other side.



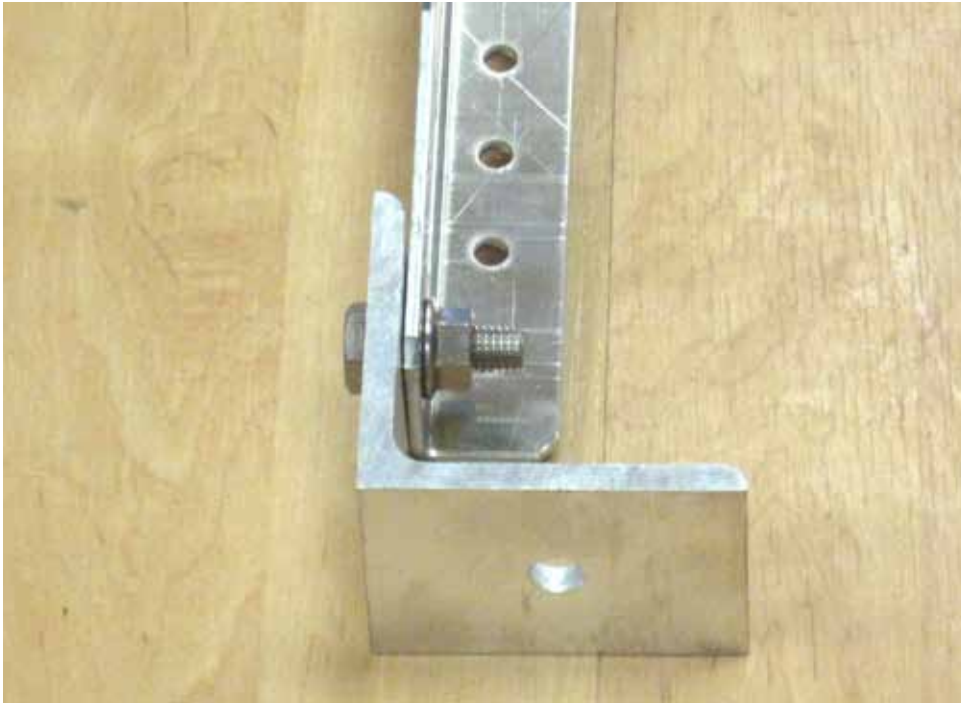
**Step 18:** Assembly thus far including 'L' brackets to be installed during the subsequent steps.



**Step 19:** Prepare to install the bottom right rear 'L' bracket.



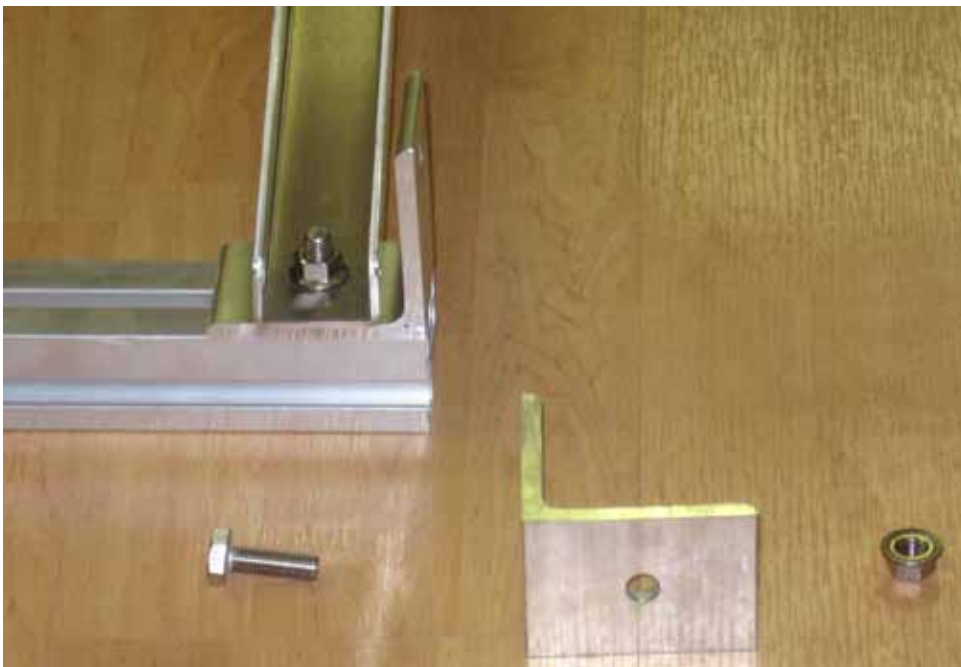
**Step 20:** Prepare to install the bottom right rear 'L' bracket.



**Step 21:** Install an M10 serrated flange nut. Repeat this procedure for the other side.



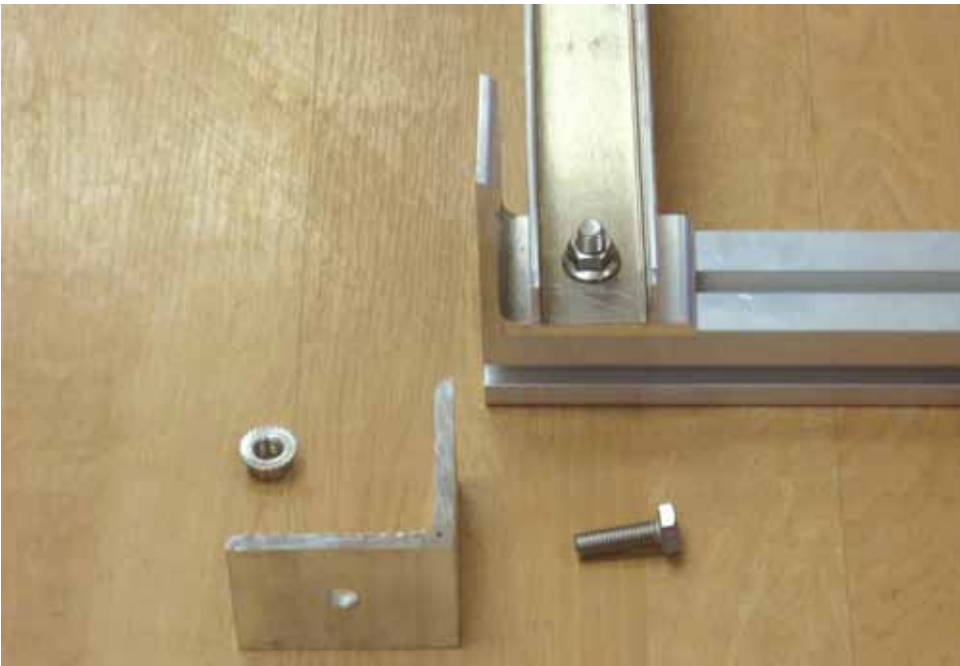
**Step 22:** Align the bottom front 'L' brackets as shown.



**Step 23:** Prepare to install the front left 'L' bracket. Note that the side of the 'L' bracket with the hole closer to the edge is aligned parallel to the support rails.



**Step 24:** Install an M10 x 30 bolt and an M10 serrated flange nut.



**Step 25:** Prepare to install the front right 'L' bracket. Note that the side of the 'L' bracket with the hole closer to the edge is aligned parallel to the support rails.



**Step 26:** Install an M10 x 30 bolt and an M10 serrated flange nut.



**Step 27:** Diagonal view of front right.



**Step 28:** At this point the entire assembly may be flipped over and stood up as shown.



**Step 28a:** Measure the angle of the assembly to make sure that it is at the required angle. If it is not, then it is necessary to adjust the riser struts. The illustrated assembly is adjusted to 30°.





**Step 29:** Front view.



**Step 30:** Install one of the cross braces using two  $\frac{1}{4}$ " nuts, bolts and washers.



**Step 31:** Loosely attach the two cross braces together using  $\frac{1}{4}$ " fasteners. The small part of the 'L' shapes should be facing away from each other.



**Step 32:** Align and attach the two ends of this cross brace to the risers.



**Step 33:** Stiebel Eltron tilt mounting system.

## 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.

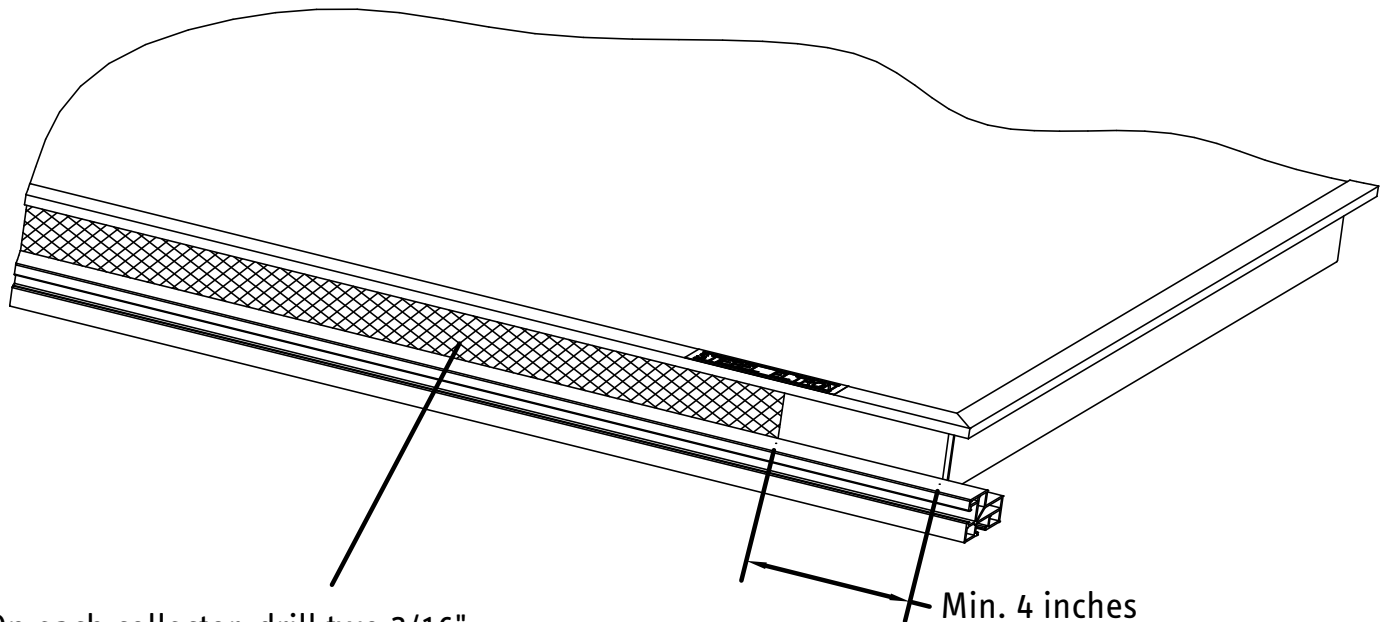
### Piping

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.

29



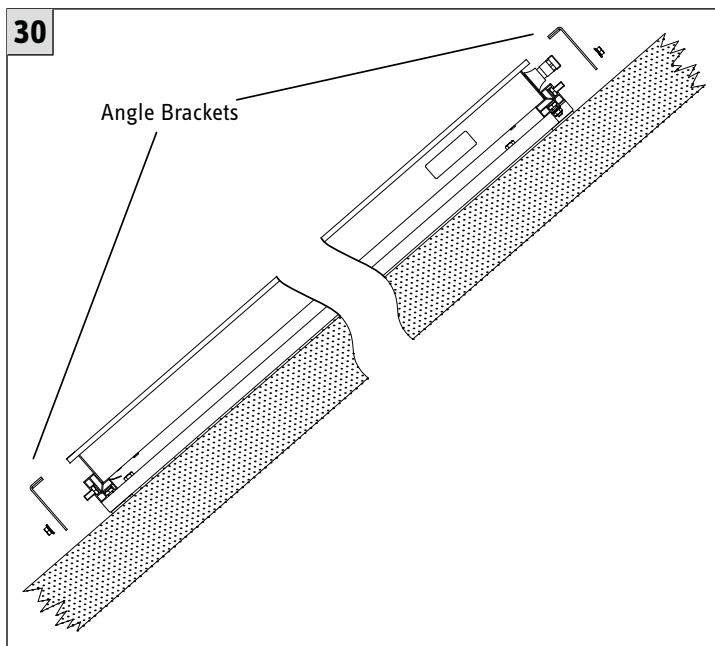
On each collector, drill two 3/16" diameter holes in the hatched area and make the connection to the lightning protection equipment with two 1/4" diameter stainless steel sheet metal screws.

**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.**

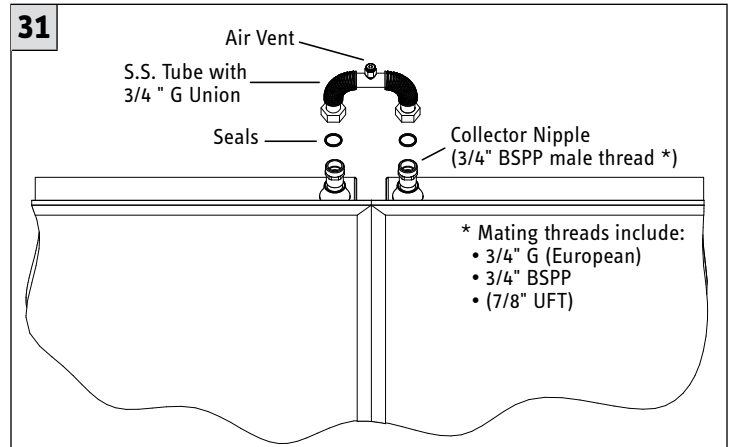
Secure each collector at the top and bottom with eight (8) angle brackets – four along the top profile frame and four along the bottom – by inserting M10 bolts (from kit 185545 or kit 185546) into the profile rail’s bolt channel, placing the angle brackets into position, and tightening the bolts. See **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 COMPRESSED 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 pipework 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 based on temperature of the air, so one must try to read the pressure on successive nights when the system cools down to ambient temperature. The following procedure is recommended:

1. Isolate the Purg-O-Mat and expansion tank by shutting their isolation valves.
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 day or more 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 each evening. Remember that the air pressure will vary based on the temperature of the loop, so it will 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 precharge 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.
- Wear protective gloves and goggles when handling propylene glycol mixtures. Never fill the system when it is subject to strong solar irradiation. 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 should 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 and fill it with sufficient Dowfrost medium (propylene glycol mixture) to fill the entire system's volume, plus some extra.
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.

#### 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 admix water or alternative process media: otherwise the essential characteristics and corrosion protection can no longer be guaranteed. For this reason, 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 air vent valves and Purg-O-Mat at the highest point of the system 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 anti-steaming 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 cold state) to its operating pressure of 50 psi (or other target pressure). (As there is sometimes still a little air remaining in the system, which will eventually be purged via the Purg-O-Mat, it is recommended that this pressure be a few psi higher than the target.)
12. Use a permanent marker to record the pressure and the date/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 normal operation.
15. Let the solar heating system rest overnight and vent again in the morning, via the air vent valve, before solar radiation warms the collectors. Close the air vent valve again.
16. Turn check valves in the pumping station to their normal 90° 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.
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 HARNESES” 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.**

Upon 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.

<b>Installation Operator:</b> Name:	<b>Fitting Company:</b> Name:
Street:	Street:
City:	City:

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?		

<b>Place / Date:</b>	<b>Inspected by (Company name):</b>
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## 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"> <li>• Check the controller.</li> <li>• Check the temperature sensor. Make sure sensor has been mounted to the outlet pipe of the collector(s).</li> <li>• Reduce the temperature differential.</li> </ul>
	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"> <li>• Make sure sensor has been mounted on the (hot) outlet (not inlet) pipe of the collector.</li> <li>• Check the sensor position, installation and resistance curves; the collector sensor must be securely and fully inserted into the sensor well.</li> </ul>

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.  Single pipe thermosiphoning circulation occurs in short pipework with low pressure drop.	<ul style="list-style-type: none"> <li>• Check the position of the check valve handle, which should be set for one-way flow.</li> <li>• Inspect the check valve (gravity brake) for leaks (jammed swarf, dirt particle in the sealing surface).</li> <li>• Make sure the tank's heat exchanger's supply lines are configured in a U (downwards) shape to prevent thermosiphoning.</li> <li>• If required, install a two-way valve that is switched off simultaneously with the pump to block thermosiphoning in the solar loop.</li> </ul> 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\*ft<sup>2</sup>\*°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, (ft<sup>2</sup>·°F·h/BTU). Converting to/from SI units, 1 ft<sup>2</sup>·°F·h/BTU ≈ 0.1761t K·m<sup>2</sup>/W, or 1 K·m<sup>2</sup>/W ≈ 5.67446 ft<sup>2</sup>·°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.

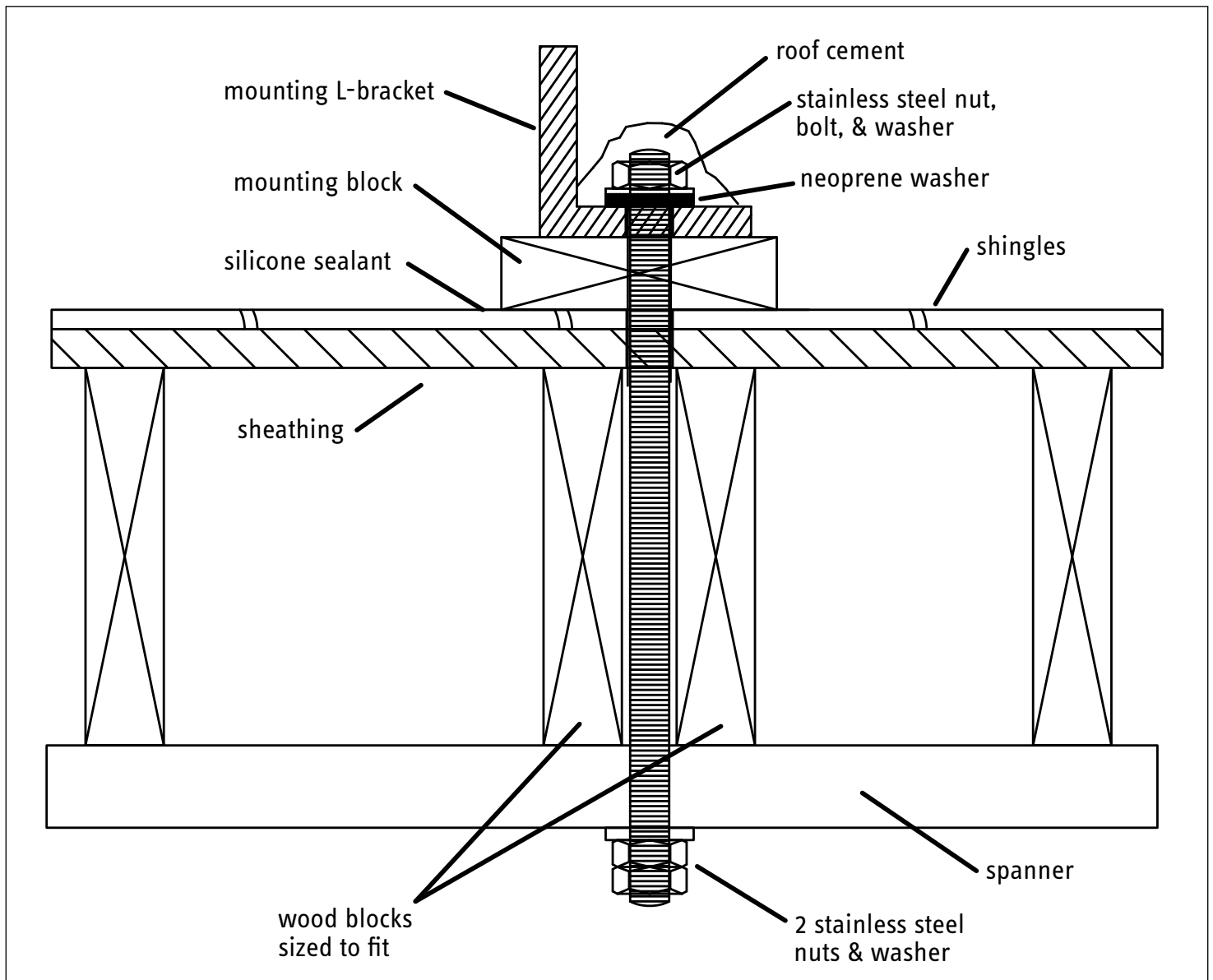
## APPENDIX A ROOF MOUNTING DETAILS

If the roof attic is accessible, we recommend fastening the solar collector mounting hardware using carriage bolts through the roof sheathing and a spanner block that spans across rafters, as shown in Figure A.1. It is important to provide adequate support for the spanner to keep it from buckling, as shown in the diagram, with two spacer blocks to allow the carriage bolt to clamp tightly to the structure.

Choose large enough carriage screws to allow adequate load-bearing for the snow, ice, and wind conditions likely to be present at the site. Keep in mind that solar collectors that are not flush to the roof – particularly those that are inclined steeply – can develop significant wind forces in certain locales.

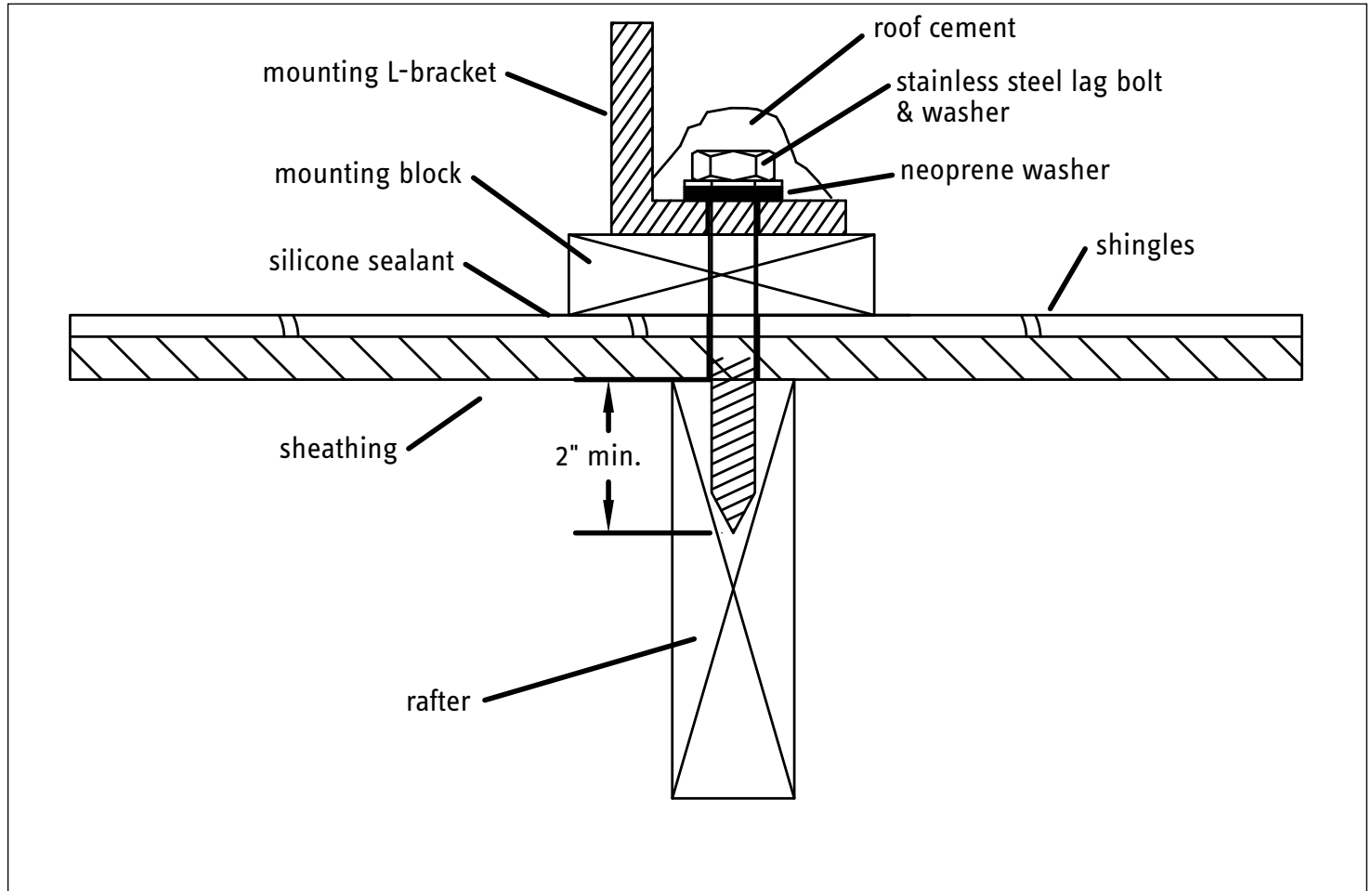
Pre-drill holes through the roof and mounting blocks. The spacer blocks should be sized to fit snugly between the underside of the roof decking (sheathing) and the spanner block. Apply liberal amounts of silicone sealant to the bolt hole and underneath the mounting block to prevent leaks.

It is extremely important to use galvanically-compatible fasteners. Stiebel Eltron mounting hardware (L-brackets, frames, etc.) are made of aluminum; therefore, stainless steel fasteners are strongly recommended to provide the required strength and protection from corrosion in harsh rooftop environments.



**Figure A.1: Roof Attachment Using Spanner Block And Carriage Bolt.**

If the roof deck is inaccessible from below, the collector mounting hardware may be fastened using lag bolts through the roof sheathing and into rafters from above, as shown in **Figure A.2**. Lag bolts must solidly penetrate rafters or other structural members to provide solid anchoring strength. The location of these may be determined by tapping the roof with a hammer. Drill holes through the roof (several sizes smaller than the bolt) to assure a tight fit. The threads of the lag bolt should penetrate at least two inches (2") into the structural member itself (below the roof sheathing)<sup>A1</sup>. It is therefore critical that the installer determine the length of bolt necessary to give the depth of penetration required. Apply liberal amounts of silicone sealant to the bolt hole and underneath the mounting block to prevent leaks. After tightening the bolt, apply more sealant over the entire assembly.



**Figure A.2: Roof Attachment Using Lag Bolt Into Rafter.**

There are other, well-engineered roof fastening systems available that the installer may wish to consider. In all cases, it is prudent to contact the local code enforcement office to determine the appropriate means of attachment to roofs or other structures.

<sup>A1</sup> NOTE: Installers must ensure that no deterioration (e.g., rot or water damage) has occurred to the underlying members; if the roof structure is compromised by deterioration or cracking, it will be necessary to repair it before mounting the solar equipment.





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## APPENDIX C

### CONTACT

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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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