oventrop

OVSOL

Solar System Manual

Solar hot water system installation guide for evacuated tube systems.

REV-022011

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system components

The OVSOL System for solar energy described in this manual, when properly installed and maintained, meets the minimum standards established by the SRCC.
This certification does not imply endorsement or warranty of this product by the SRCC.

System Model	System Contents							
					Tank Capacity and Type			
	OVF-32	OV 5-16	OV 5-8	Regusol EL 130	SIngle Coil	Single Coil Electric	Dual Coil	Dual Coil Electric
OVSOL 5-16-SC	-	1	-	1	80 gallon	-	-	-
OVSOL 5-16-SCE	-	1	-	1	-	80 gallon	-	-
OVSOL 5-16-DC	-	1	-	1	-	-	80 gallon	-
OVSOL 5-16-DCE	-	1	-	1	-	-	-	80 gallon
OVSOL 5-24-SC	-	1	1	1	119 gallon	-	-	-
OVSOL 5-24-SCE	-	1	1	1	-	119 gallon	-	-
OVSOL 5-24-DC	-	1	1	1	-	-	119 gallon	-
OVSOL 5-24-DCE	-	1	1	1	-	-	-	119 gallon
OVSOL FP-2-SC	2	-	-	1	80 gallon	-	-	-
OVSOL FP-2-SCE	2	-	-	1	-	80 gallon	-	-
OVSOL FP-2-DC	2	-	-	1	-	-	80 gallon	-
OVSOL FP-2-DCE	2	-	-	1	-	-	-	80 gallon
OVSOL FP-3-SC	3	-	-	1	119 gallon	-	-	-
OVSOL FP-3-SCE	3	-	-	1	-	119 gallon	-	-
OVSOL FP-3-DC	3	-	-	1	-	-	119 gallon	-
OVSOL FP-3-DCE	3	-	-	1	-	-	-	119 gallon

OVF-32 - Oventrop 4’ x 8’ flat plate collector
OV 5-16 - Oventrop evacuated tube collector with 16 tubes
OV 5-8 - Oventrop evacuated tube collector with 8 tubes

introduction

OVSOL System

This manual provides installation instructions for OVSOL System for solar domestic hot water heating. The OVSOL solar energy system described in this manual, when properly installed and maintained, meets the minimum standards established by the SRCC.

This certification does not imply endorsement or warranty of this product by the SRCC.

Planning before the installation and use of the solar collector array should include:

- Solar hot water system design.
- Properly sized solar storage tank.
- Properly sized and insulated solar loop (plumbing circuit).
- An air bleed valve at the highest point in the collector circuit located for convenient access.
- Roof penetrations for piping to and from the collector.
- System components for closed loop solar systems—tank, heat exchanger, solar loop circulator, pressure relief valve, solar controller, expansion tank, fill and drain valves, pressure and temperature gauges.
- Propylene glycol (antifreeze) to provide protection from frost and high idle mode temperatures of 375 °F.

Requirements for each installation should be fully detailed by a system schematic and specifications. The assembly and installation instructions described in this manual have been carefully prepared. It is very important to read these instructions thoroughly before proceeding with the collector installation. An effort has been made to conform procedures in this manual to the specifications of various governmental and agency solar programs. Also, many programs allow substitution of manufacturers' standards for program standards. If this is the case, the enclosed manual can be used to comply with program standards. Cases where it is unclear whether the enclosed manufacturers' standards can be substituted for program standards should be brought to the attention of the particular program administrator or to Oventrop Corporation for clarification.

Be certain to follow all applicable building and safety codes for installations of solar thermal collectors. Compliance with local codes is essential. Local code requirements must be met for penetrating structural members and fire-rated assemblies. Collectors and piping must be installed in such a way that the performance of any structural member or fire-rated assembly is not reduced. Be especially aware of safety regulations when working upon rooftops. It is the buyer's responsibility to secure all permits and approvals before purchasing and attempting the installation of this equipment.

Specifications are subject to change without notice.

Installing Contractor

Company_____

Installer's name_____

Address_____

City, State, Zip_____

Phone Number_____

section one

Guidelines and Precautions

Installing Collector Arrays

It is not recommended to install more than three 16-tube collectors in a series (64 tubes). Larger installations will require parallel piping for balanced flow through each array. Balancing valves should be installed on multiple arrays. One roof mounting kit is needed for each single collector module. Each additional collector will require an expansion kit.

Closed Loop and Drainback

OVSOL collectors can be installed for both closed loop and drainback solar heating applications.

Freeze Tolerance Limits

Freeze tolerance limits are based upon the freeze and burst protection of the antifreeze used in the solar closed loop, or the mixture of the glycol-to-water ratio. Oventrop NT-40 is a 40% glycol-to-water mix with freeze protection to -6º F and burst protection to -60º F. Oventrop NT-50 is a 50% glycol-to-water mix with freeze protection to -30º F and burst protection to -60º F. For additional protection, the Regusol 130 EL control has an antifreeze function ("OCF") that can be programmed to enable the circulator to protect the antifreeze from freezing or thickening.

Shedding Snow with Evacuated Tube Collectors

In regions of snow accumulation, evacuated tube collector tilt angles above 50° will shed snow from collectors even after severe storms. Therefore, in heavy snow areas, it is critical that evacuated tubes be sloped to at least a 50° tilt angle. If collectors are installed on a flat roof in an area that receives heavy snowfall, the lower end of the units should be at least 18" above the roof level to minimize chances of snow build-up on the bottom of the collectors.

Transport of Collector

The collector should be transported to the roof in parts and then assembled together on the rooftop.

Lightning Protection

In areas of high incidence of lightning, one lightning rod should be considered. If there is a ready-made lightning protection device, please connect it with the collector.

Minimum Inclination Angle of Collector (for Evacuated tube collectors only)

In order to ensure heat pipe delivery, a minimum inclination angle of 25° is necessary for OV SOL-5 collectors. If the tilt angle of the roof is not above 25°, please build necessary roof mounting racks.

Precautions

Temperatures in excess of 390 °F are possible in the condenser (top metal protruding bulb) when exposed to bright sunlight or diffused insolation. DO NOT TOUCH the condenser. Store the tubes in a safe location, *away from the sun,* during the installation of the roof mounting rack. Tubes are installed as the last step. Oventrop Corporation will not be liable for burns or personal injury due to the touching of a hot condenser. Handle the tubes with care to avoid accidental bending of the heat pipe at the condenser which may cause damage to the heat pipe or the vacuum seal.

The maximum solar loop operating pressure is 87 psi. The pressure relief valve must be set to open below 87 psi. A 75 psi pressure relief valve is suggested. Normal operating pressures for a solar closed loop are 25 to 35 psi.

section two

Solar Thermal System Design Guidelines

Solar hot water systems are simple in principal but complicated in practice. This guide is designed to describe and explain the process for designing a solar hot water system. There are many ways to design a solar hot water system to achieve the same end result. The two system types that Oventrop uses are external heat exchanger systems (i.e. the Regusol X) and Immersed coil heat exchangers (i.e. internal coil tanks). All of Oventrop's systems are based on one of these two variants.

Solar Design Basics

Incoming solar radiation at the earth's surface on a perfectly clear day is approximately 300 BTU/H per square foot. With that said, solar collector performance depends on several factors. These factors include, but are not limited to: ambient temperature at the location of the solar collector, required operating temperature of the working fluid in the collector, incoming solar radiation (energy), geographical location of the collector, shading of the collector, and inclination angle of the collector.

The difference in temperature between the working fluid and the ambient temperature drives the heat loss of the solar collector. This temperature difference has the greatest influence on the solar collector's thermal efficiency. This efficiency measures the solar collector's ability to convert incoming solar radiation to usable heat in the form of a hot working fluid. This hot working fluid can be used for any application.

The availability of solar radiation (energy) is dependent on weather, time of year, site shading, and collector inclination angle. Throughout the year, the distance of the sun from the horizon will change from the longest on the first day of summer to the shortest on the first day of winter. This translates to a 47-degree change in the sun's angle with respect to the collector throughout the year. The optimal inclination angle to minimize this change and maximize year-round performance is equivalent to the latitude at which the collector is located. Shading at the collector site determines the amount of available solar radiation to which the collector is exposed.

Understanding that all of the above factors affect the performance of the solar thermal collector, one cannot make a location independent generalization of collector performance.

Design conditions are calculated as the maximum instantaneous solar radiation, in other words, the most energy the system can handle at any given time. For design conditions we assume the collector is at an operating efficiency of 75%, on a clear day, facing south, with no shading. Due to this efficiency the maximum output of the solar collector at design is rated at 225 BTU/H per square foot. This value is in no way a guarantee or estimate of any Oventrop collector's performance. The table below shows the design BTU/H rating of each Oventrop solar collector.

Collector Type	Design Conditions BTU/H rating
OV 5-16 Evacuated tube collector	6,277 BTU/H
OVF-21 Flat plate collector	4,230 BTU/H
OVF-32 Flat plate collector	6,615 BTU/H
OVF-40 Flat plate collector	8,280 BTU/H

Table 2, below, shows the design flow rates for each Oventrop collector type.

Collector Type	Design Flow Rate per collector
OV 5-16 Evacuated tube collector	0.75 GPM
OVF-21 Flat plate collector	0.525 GPM
OVF-32 Flat plate collector	0.80 GPM
OVF-40 Flat plate collector	1.0 GPM

These flow rates were chosen based on the collection area of each solar collector and the incoming solar radiation at design conditions. The flow rates allow the collectors to achieve an 18 degree Fahrenheit temperature rise across the solar loop.

'The sun is the source, the system is the battery.'

Solar energy is only available for a limited time during each day. It is because of this that the energy must be captured and stored for later use. The amount of energy stored is related to the system operating temperature (i.e. radiant floor heat at 100F or fan coil units at 180F), the storage volume, and to the maximum temperature in the storage vessel. Maximum energy storage [BTU's] is calculated using equation 1, below.

Maximum Stored Energy = 8.33 x Storage volume [Gal] x (Max. tank temp. – System operating temp.)

Where, Storage volume is in gallons and all temperatures are in Fahrenheit. Optimization of this equation has determined the design number of gallons per collector. The table below shows the number of gallons of storage recommended per collector.

Collector Type	Gallons of Storage per Collector
OV 5-16 Evacuated tube collector	66 Gallons
OVF-21 Flat plate collector	27 Gallons
OVF-32 Flat plate collector	41 Gallons
OVF-40 Flat plate collector	53 Gallons

These storage values are calculated for a national average. Since daily solar radiation varies significantly from the South to the North, these storage values are not required, only recommended. Less storage can be used in the northern latitudes and more storage can be used in the southern latitudes. The storage values should only vary plus or minus 5% from the recommended values listed above.
Another way to think of solar storage is as the fuel tank of the system. It is used to store energy that can be used over the entire day. In this way the daily load is matched to the daily collector output. Oventrop solar hot water systems are designed to optimize the transfer of energy from the collectors to the solar storage vessel.

Small Systems
Internal coil tanks are used for Oventrop smaller systems. This allows for the ease of installation for system packages. Oventrop has pre-packaged solar domestic hot water systems for daily loads of 80 and 115 gallons. Depending on location these packaged systems will provide between 30 and 70 percent of the annual domestic hot water load.
Using a similar configuration as the pre-packaged systems, larger domestic hot water loads can be accommodated. Variations of small systems are sized by tank size and can be arranged for up to 160 gallons and 230 gallons of daily usage. These small systems are comfortably in the design range of the Regusol EL 130 solar pumping station. This pumping station is designed for a maximum flow rate of four (4) gallons per minute. Because the Regusol EL 130 is constructed in ¾", the maximum flow rate is based on the maximum trouble free flow through ¾" pipe.

Medium Systems
Medium systems are above the flow range established for the Regusol EL 130 and have increasingly larger storage requirements. It is for these reasons that the Regusol-X pumping station with heat exchanger was developed. External heat exchangers provide flexibility of design and reduce cost when considering larger storage volume and collector arrays. The Regusol-X is designed to be used with any storage vessel that is built for hot water storage; it does not require internal heat exchangers.

The design limits for the Regusol-X are based on the pressure drop through the heat exchanger, the pump capacity, and the maximum output of the heat exchanger. The table below lists the maximum number of collectors allowed to be used with each Regusol-X.

For Single Speed Pumps

Collector Type	Maximum number of collectors on one Regusol EL130*	Maximum number of collectors on one Regusol-X 15**	Maximum number of collectors on one Regusol-X 25**
OV 5-16 Evacuated tube collector	3	6	8
OVF-21 Flat plate collector	7	9	12
OVF-32 Flat plate collector	5	6	8
OVF-40 Flat plate collector	4	5	6

Using an external heat exchanger allows for either multiple or single tank configurations. As long as the storage is sized correctly the tanks can be in any configuration.

For Three Speed Pumps

Collector Type	Maximum number of collectors on one Regusol EL130*	Maximum number of collectors on one Regusol-X 15**	Maximum number of collectors on one Regusol-X 25**
OV 5-16 Evacuated tube collector	4	7	8
OVF-21 Flat plate collector	7	10	12
OVF-32 Flat plate collector	5	6	8
OVF-40 Flat plate collector	4	5	6

* No more than three (3) OV 5-16 tube collectors are to be piped in series through the Regusol EL130 without a booster pump.
** No more than two (2) OV 5-16 tube collectors are to be piped in series through the Regusol X without a booster pump.

Oventrop Solar Systems Sizing Chart
The following solar sizing charts shows various combinations of solar collector quantities to Regusol pumping stations an the design solar storage volume.

Tank selections are up to the designer for Regusol X systems and larger.

For Single Speed Pumps

Collector Type	**OV 5-16 Evacuated tube collector**		**OVF-21 Flat plate collector**		**OVF-32 Flat plate collector**		**OVF-40 Flat plate collector**	
Number of collectors	Pumping Station	Storage in Gallons	Pumping Station	Storage in Gallons	Pumping Station	Storage in Gallons	Pumping Station	Storage in Gallons
1	**OVSOL 5-16 package**		N/A					
1.5	**OVSOL 5-24 package**							
2	Regusol EL130	160	Regusol EL130	54	**OVSOL FP-2 package**		Regusol EL130	106
3	Regusol EL130	230	Regusol EL130	81	**OVSOL FP-3 package**		Regusol EL130	159
4	Regusol X-15	264	Regusol EL130	108	Regusol EL130	160	Regusol EL130	212
5	Regusol X-15	330	Regusol EL130	135	Regusol EL130	205	Regusol X-15	265
6	Regusol X-15	396	Regusol EL130	162	Regusol X-15	246	Regusol X-25	318
7	Regusol X-15	462	Regusol EL130	189	Regusol X-25	287		
8	Regusol X-25	528	Regusol X-15	216	Regusol X-25	328		
9			Regusol X-15	243				
10			Regusol X-25	270				
11			Regusol X-25	297				
12			Regusol X-25	324				

For Three Speed Pumps

Collector Type	**OV 5-16 Evacuated tube collector**		**OVF-21 Flat plate collector**		**OVF-32 Flat plate collector**		**OVF-40 Flat plate collector**	
Number of collectors	Pumping Station	Storage in Gallons	Pumping Station	Storage in Gallons	Pumping Station	Storage in Gallons	Pumping Station	Storage in Gallons
1	**OVSOL 5-16 package**		N/A					
1.5	**OVSOL 5-24 package**							
2	Regusol EL130	160	Regusol EL130	54	**OVSOL FP-2 package**		Regusol EL130	106
3	Regusol EL130	230	Regusol EL130	81	**OVSOL FP-3 package**		Regusol EL130	159
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9			Regusol X-15	243				
10			Regusol X-15	270				
11			Regusol X-25	297				
12			Regusol X-25	324				

section three

Collector Layout, Orientation, and Siting

Place the collector where it will receive the maximum amount of sunlight available in your location. OVSOL collectors may be installed on a roof, against a south facing wall, or on the ground.

Orientation

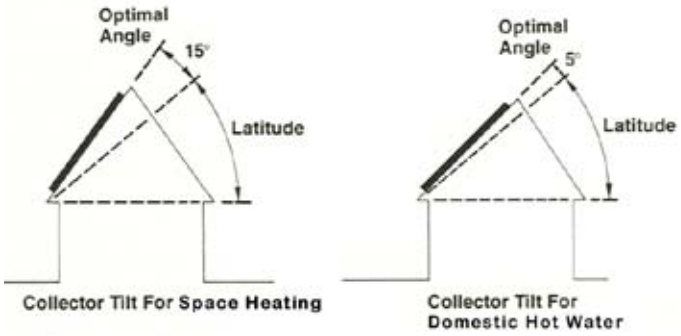
Orientation and tilt are critical to performance. The OVSOL collectors should be oriented (faced) as close to true south as practical, although they may be faced as much as 20° east or west of true south with less than 5% loss in capacity. Because the earth's magnetic field is not aligned parallel to the earth's north-south axis, there are some parts of the United States where the needle of a magnetic compass can point as much as 20° east or west of true north. There are several ways to determine true south in your area. You can consult a local surveyor, a plot map in your local tax office, or a recent isogonic chart of the United States published by the U.S. Coast and Geodetic Survey. Adjust your magnetic compass reading according to the meridian nearest to you. Do not use old charts, as there are annual variations in the readings. When using a magnetic compass, beware of standing near large metallic objects or power lines because they will affect the compass readings.

Shading

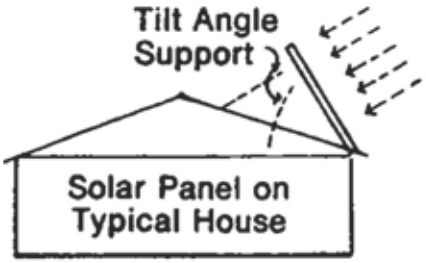
Trees, chimneys, dormers, other buildings, new construction, and even fences may shade the collector array, especially in the winter when sun angles are low and shadows are long. Be sure the collectors are placed where they will be not shaded by these obstructions. As a rule, no more than 5% of the collector area should be shaded between the hours of 9:00 a.m. and 3:00 p.m. It is highly advised to make use of a solar site selector while determining suitability for a collector site.

Angle of Inclination *or* Tilt Angle

For domestic water, use an optimum tilt of the site's latitude plus 5°, although the slope may be 10° greater or less with a capacity loss of under 5% for the system. For a solar space heating system, a steeper tilt angle is important for optimal winter performance. The steeper tilt will favor winter system operations when the sun is low in the sky. Therefore, for space heating systems chose a tilt of latitude plus 15°.
The variation of 10° either way will not seriously affect the total annual performance of the system, all other things being equal.



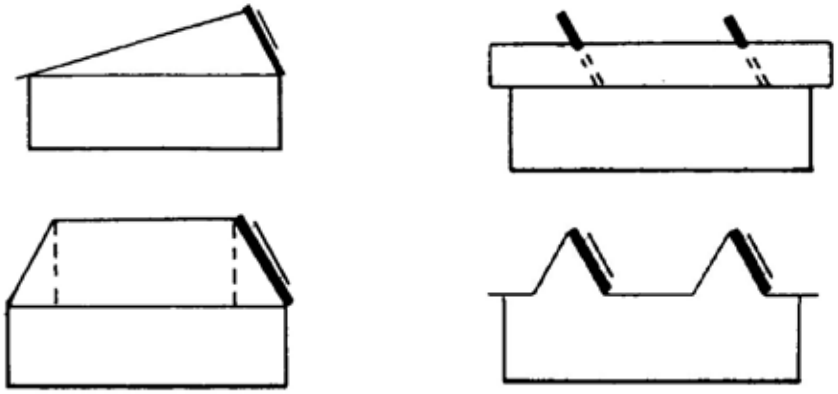
The following chart will help you determine the tilt angle of roof pitches. For space heating systems, always have collectors sloped at optimal tilt for winter performance. Install a collector rack for tilt angle support whenever necessary.



Roof Pitch	Tilt Angle	Roof Pitch	Tilt Angle
4/12	18°	12/12	45°
6/12	26°	14/12	49°
10/12	39°	22/12	61°

Integrating with Building Architecture

Maintaining a pleasing appearance to the building's architecture is important for adding solar collectors to a roof or on the ground. Most homes are not oriented well for solar gain, so getting the collectors at just the right orientation and tilt may not integrate well with the roof lines.



With domestic hot water systems, there may be greater variations to tilt and orientation without large annual losses, and in some cases may justify flush-mounting collectors. Space heating systems must have a steep slope and be oriented within 30° of true south. For these larger space heating systems, the layout should integrate into the roofline. For new construction, integrating OVSOL collectors into the building's roof system should be addressed by the solar designer to the architect.

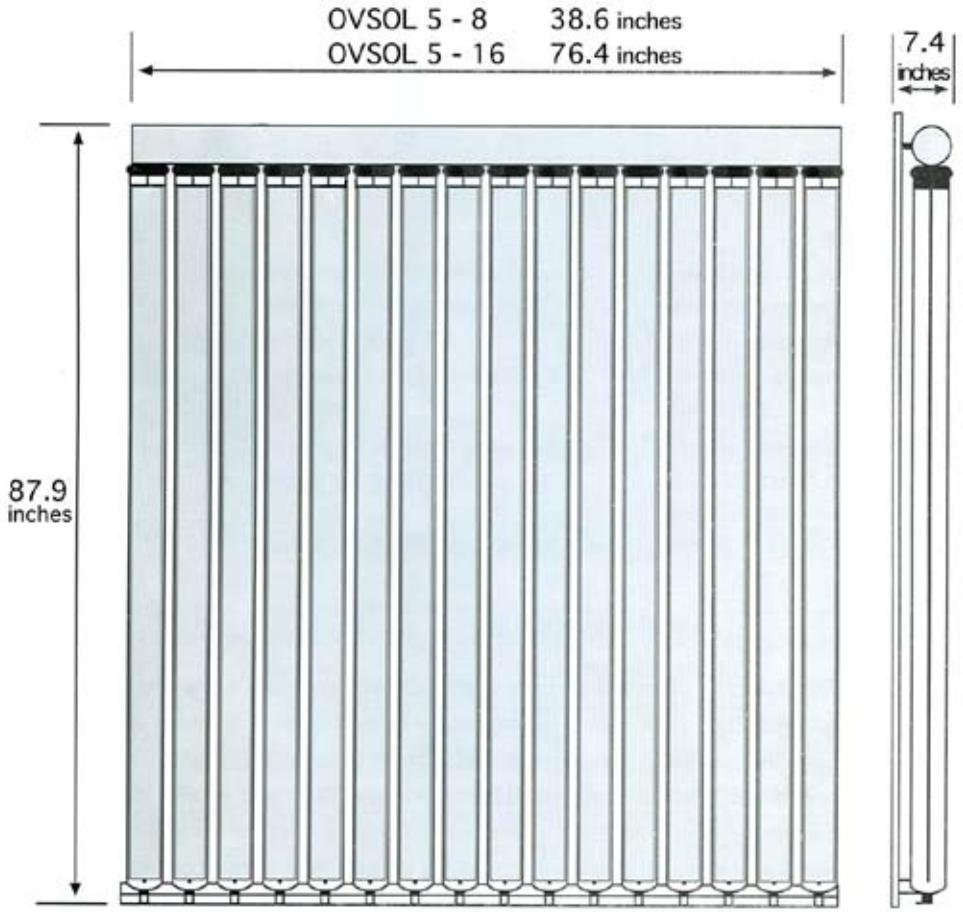
Shedding Snow with evacuated tube collectors

A tilt angle of 50° or more is necessary in regions of heavy snowfall and accumulation. Tilt angles of 50° and above will shed snow from OVSOL evacuated tubes even after severe storms. It is critical in heavy snow areas that the collectors be sloped to at least a 50° tilt angle. If collectors are installed on a flat roof in an area which receives heavy snowfalls, the lower end of the units should be at least 18" above the roof level to minimize chances of snow build-up on the bottom end of the collectors.

Shading

To avoid shading by collectors on each other, the front to front dimension must be 2.5 times the highest point of the front collector.

Collector Dimensions and Technical Data
Dimensions of OVSOL 5 8 or 16 tube collectors



Technical Data:

OVSOL 5 - 8: 87.9L x 38.6W x 7.4D inches

OVSOL 5 -16: 87.9L x 76.4W x 7.4D inches

Gross collector area:	OVSOL 5 - 8	**22.28 sq. ft.**
	OVSOL 5 - 16	**44.67 sq. ft.**
Net absorber area:	OVSOL 5 - 8	**19.37 sq. ft.**
	OVSOL 5 - 16	**38.75 sq. ft.**
Gross weight:	OVSOL 5 - 8	**110 lbs.**
	OVSOL 5 - 16	**220 lbs**

Inclination angle: 25° to 90°

Typical operating temperature: 158 - 248 °F

Stagnation temperature: 375 °F

Pressure drop per module
at 1.0 gpm: 0.47 ft/hd

Aluminum nitride absorber

Vacuum grade: 10 mbar

Connection: Dn22 mm fitting

Oventrop OV - 5

Evacuated Tube Solar Thermal Collector

Eight tube model - **540 00 08**

Sixteen tube model **540 00 16**

Contents:

Aluminum manifold header

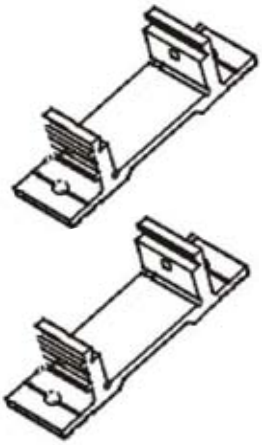
- **540 00 08** contains eight (8) tube connections
  Dimensions: 38L x 5-1/4D inches
- **540 00 16** contains sixteen (16) tube connections
  Dimensions: 76L x 6D inches

Bottom collector support rail with steel spring clips

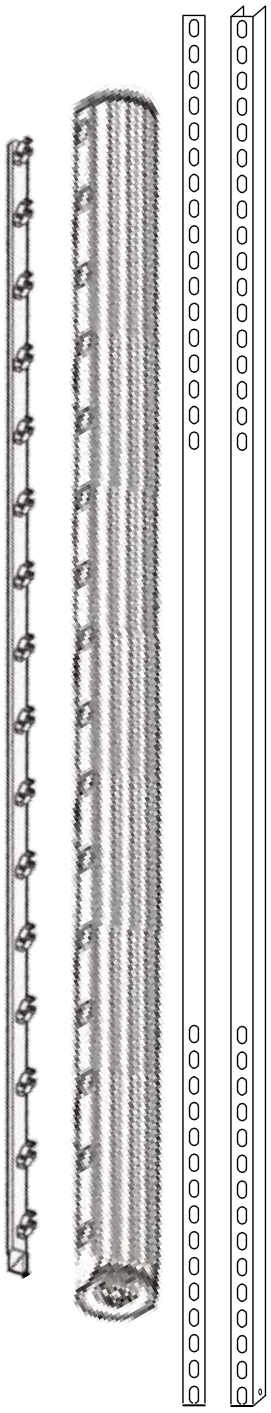
- **540 00 08** contains eight (8) tube connections
  Dimensions: 76L inches
- **540 00 16** contains sixteen (16) tube connections
  Dimensions: 38L inches

2 x Stainless steel collector frame rail
Dimensions: 85L x 1.5W x 1.0D inches

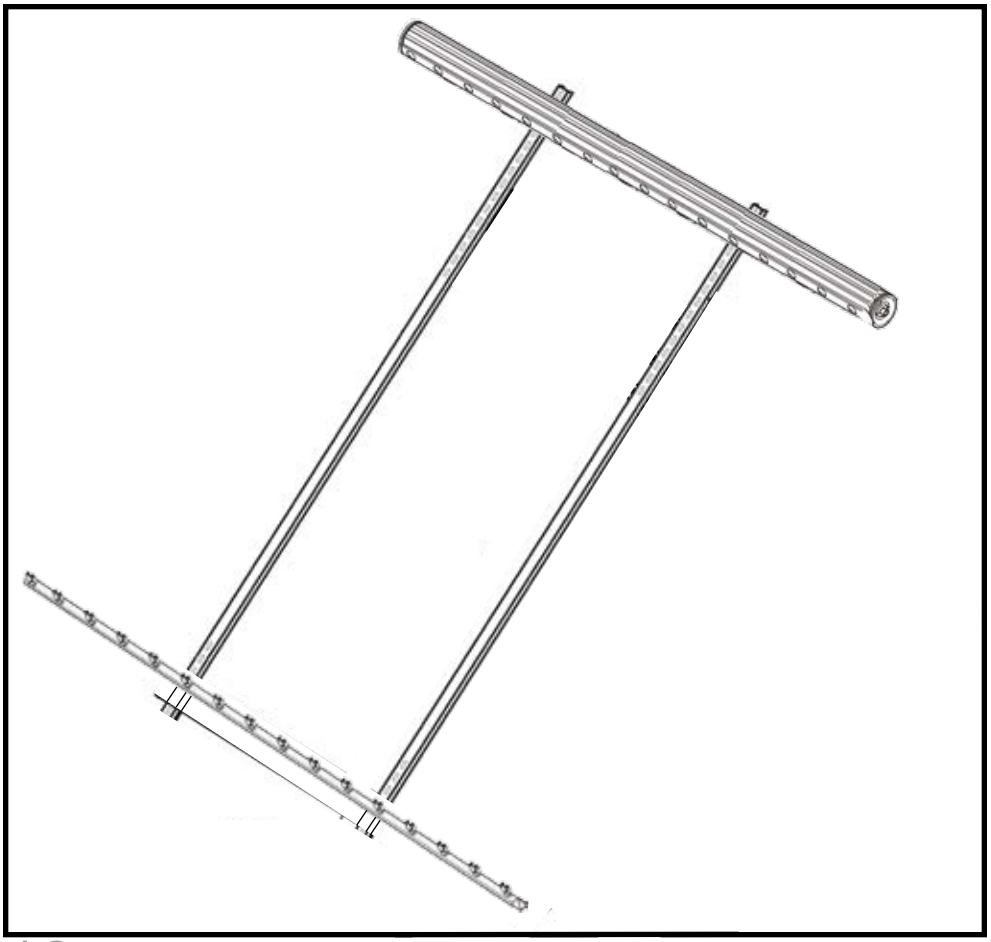
2 x Aluminum manifold header bracket



The top of collector frame rail does not have holes in either side of the frame rail walls.

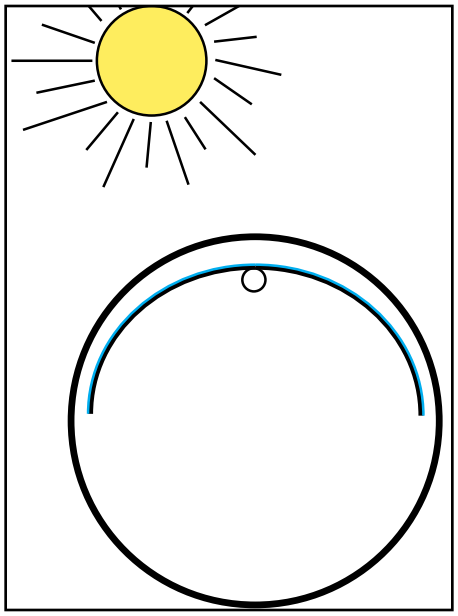


The bottom of collector frame rail has one hole in either side of the frame rail walls.



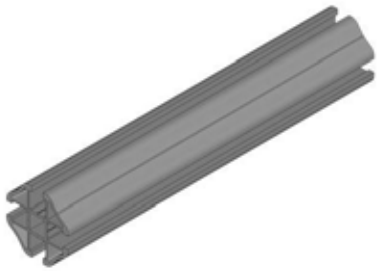
OV - 5, evacuated tube with heatpipe
540 00 08 contains eight (8) tubes
540 00 16 contains sixteen (16) tubes
Dimensions: 79L x 4D inches

Evacuated tubes are shipped eight (8) to a box.



Evacuated tubes are installed with the blue side facing the sun.

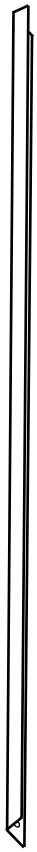
Contents: Adjustable Rack Mounting Kit 540 00 28



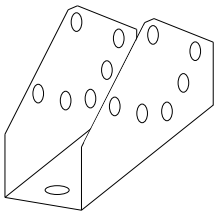
2 x Aluminum back support rail
Dimensions: 76L x 2.0D inches

4 x Double stud base mount nut with washer

6 x Rail nut and bolt set



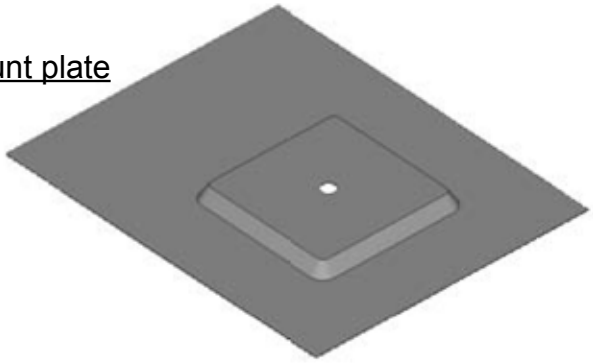
6 x Collector bracket
4 - Foot brackets
2 - Pivot brackets



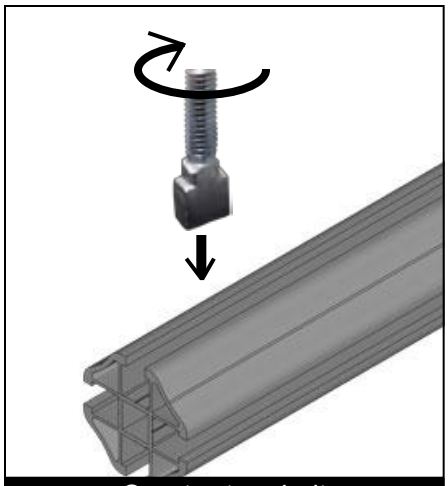
2 x Front foot spacer

4 x Base mount plate

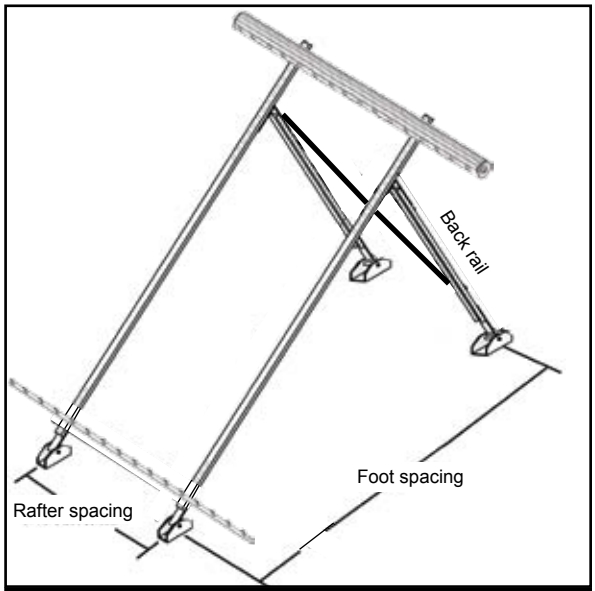
4 x Flashing cover for base mount plate



Aluminum structural angle cross brace
Dimensions: 60L x 1.5W inches



Quarter-turn bolt



Rack assembly without tubes

STEP: 1

Rack Tilt And Spacing Selection

Shedding Snow

A tilt angle of 50° or more is necessary in regions of heavy snowfall and accumulation. Tilt angles of 50° and above will shed snow from OVSOL evacuated tube collectors even after severe storms. It is critical in heavy snow areas that the collectors be sloped to at least a 50° tilt angle. If collectors are installed on a flat roof in an area which receives heavy snowfalls, the lower end of the units should be at least 18" above the roof level to minimize chances of snow build-up on the bottom end of the collectors.

Angle of Inclination and Tilt Angle

As a general rule, for domestic water, use an optimum tilt of the site's latitude plus 5°. For a solar space heating system, a steeper tilt angle is important for optimal winter performance. The steeper tilt will favor winter system operations when the sun is low in the sky. Therefore, for space heating systems chose a tilt of latitude plus 15°.

The variation of 10° either way will not seriously affect the total annual performance of the system, all other things being equal. Collector mounts must be capable of maintaining tilt and azimuth of the collector.

The chart will help you determine the tilt angle of roof pitches. Install a collector rack for tilt angle support whenever necessary.

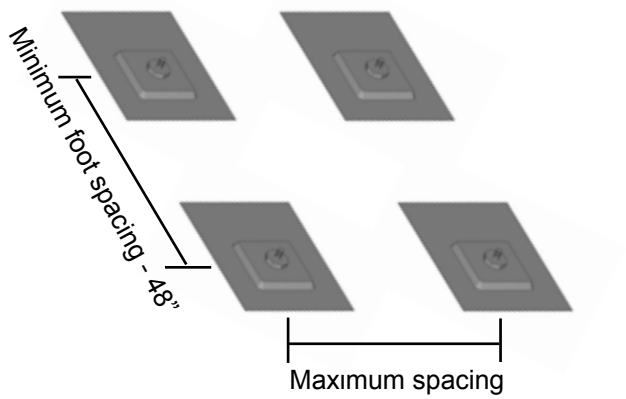
Roof Pitch	Angle of inclination
1:12	5°
2:12	9°
3:12	14°
4:12	18°
5:12	23°
6:12	27°
7:12	30°
8:12	34°
9:12	37°
10:12	40°
11:12	43°
12:12	45°

Rack Tilt	Foot spacing	Back rail length
5°	75 3/4	6 1/2
10°	74 3/4	13 1/4
15°	73 1/2	19 3/4
20°	71 1/2	26
25°	69	32
30°	65 3/4	38
35°	62 1/4	43 1/2
40°	58 1/2	48 3/4
45°	53 3/4	53 3/4
50°	48 3/4	58 1/4
55°	48	62 1/2
60°	48	66 1/2
65°	48	70 3/4
70°	48	74 3/4

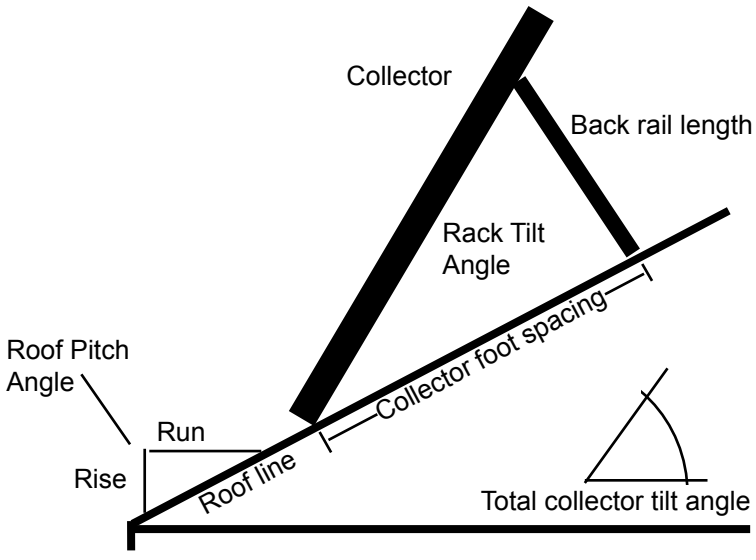
Choose the necessary rack tilt angle:

Latitude:	____
Add for DHW: +5 or Add for SPCHTG: +15 or Subtract for Pool: -15	____
Subtract Roof angle of inclination:	____

Necessary rack tilt: ____

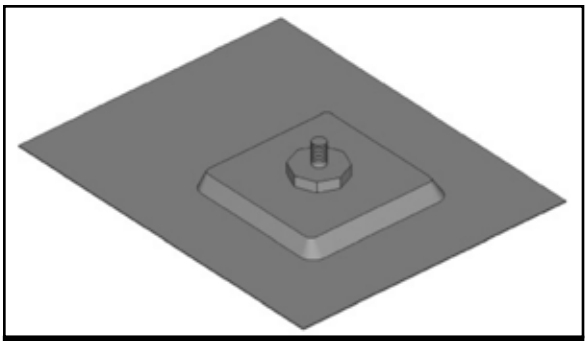


16 tube collector - 48" / 8 tube collector - 32"

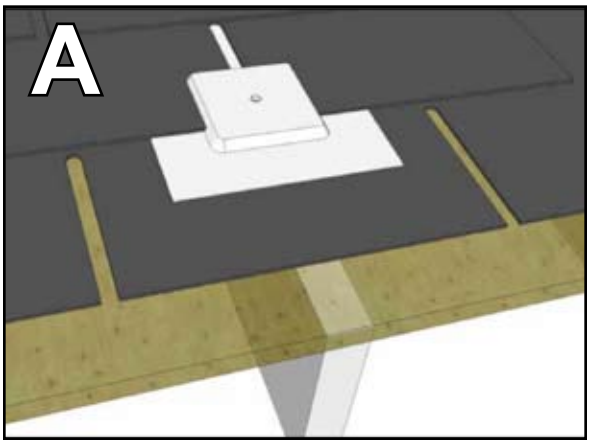


STEP: 2

On Roof Installation



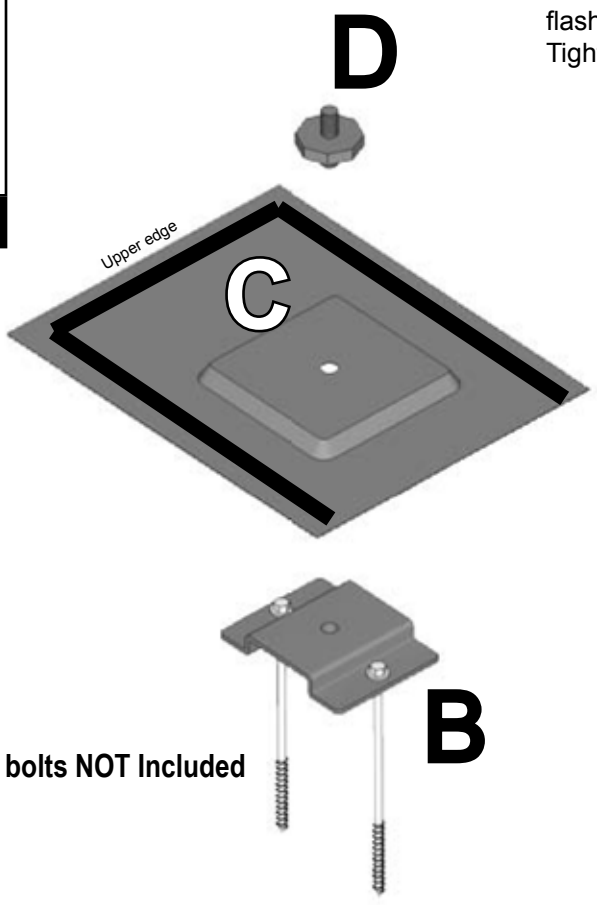
Complete base mount assembly



Collector foot

Base plate

Double Stud



Lag bolts NOT Included

A:
Fit flashing cover to shingles. The top edge of the flashing cover must be fully covered by the shingles.
Once the flashing cover is fitted to the shingles, remove the flashing cover and set aside.

B:
Align to rafters and secure base plate to roof using appropriate length 3/8” lag bolts. Do not drill or fasten through the center hole.
Lag bolts NOT Included

C:
Apply sealant to the **underside** of the flashing cover, where indicated by the solid black line. There must be no gaps in the line of sealant.

Place flashing plate under the shingles and over the base plate so that the center holes in the base plate and the flashing plate are aligned.

D:
Insert double stud with the red washer set in the recessed area between the head and the flashing plate.
Tighten to 35 ft-lbs.

Rack Tilt	Front to back Foot spacing
5°	75 3/4
10°	74 3/4
15°	73 1/2
20°	71 1/2
25°	69
30°	65 3/4
35°	62 1/4
40°	58 1/2
45°	53 3/4
50°	48 3/4
55°	48
60°	48
65°	48
70°	48

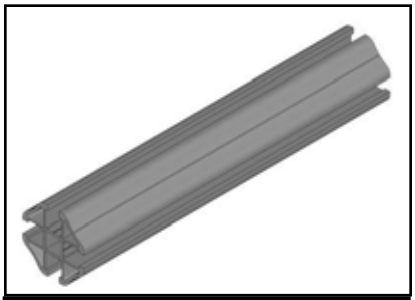
STEP: 3

On Ground Preparation

Rack Tilt	Back rail length
5°	6 1/2
10°	13 1/4
15°	19 3/4
20°	26
25°	32
30°	38
35°	43 1/2
40°	48 3/4
45°	53 3/4
50°	58 1/4
55°	62 1/2
60°	66 1/2
65°	70 3/4
70°	74 3/4

Measure and cut back rails

A:
Measure and cut the 76” aluminum back rail to the length that corresponds to the selected rack tilt angle in the chart at left.



Back rail

The bottom end of the frame rail has through holes on the side walls.

Assemble back and frame rails

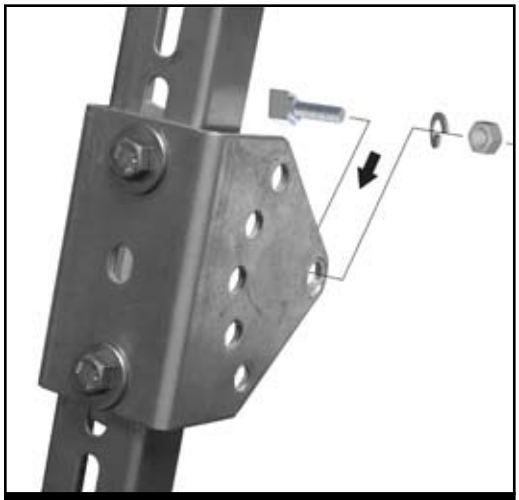
B:
Using the 5/16” x 1” nut and bolt sets, fasten the pivot bracket to the frame rail through holes four and six from the **top end** and bottom out, as shown.

C:
Insert one quarter-turn bolt into the peak of each side of the pivot bracket, as shown.

D:
On the cut back rail, using a marker, indicate a distance of one inch in from one end.

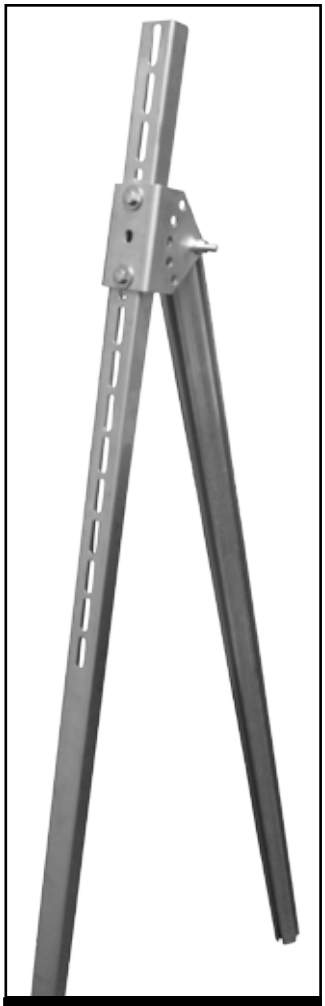
E:
Slide the marked end of the back rail into the pivot bracket so that the quarter-turn bolts are aligned with the mark at one inch on the rail.

F:
Tighten the quarter-turn bolts until the split lock washer is flattened. Do not over tighten.



Pivot bracket and frame rail

Back rail and pivot bracket



Frame rail, pivot bracket, and back rail assembly

STEP: 4

On Ground Preparation

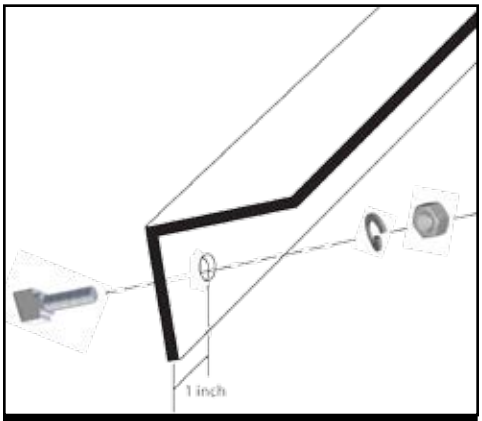
Maximum cross brace length		
Rack Tilt	48” width spacing	32” width spacing
5°	50 1/2	34 3/4
10°	51 3/4	36 3/4
15°	54	39 1/2
20°	56 1/2	43 1/4
25°	59 3/4	47 1/4
30°	60	51 3/4
35°	60	56
40°	60	60

No cutting is required above 35 degrees of rack tilt for 32” spacing or 25 degrees of rack tilt for 48” spacing.

A.
Cut cross brace to the length that corresponds to the selected rack tilt angle.
No cutting is required above 35 degrees of rack tilt.

B.
Drill one 5/16” hole, one (1) inch in from either end on the same side at opposite ends.

C.
Insert one bolt into each hole as shown.



Cross brace with bolt

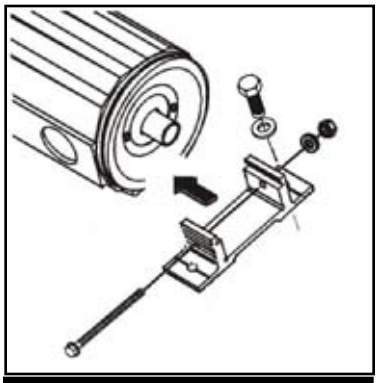
STEP: 5

A.
Before sliding the bracket onto the header besure that both rail nuts and bolts are in place on the bracket.

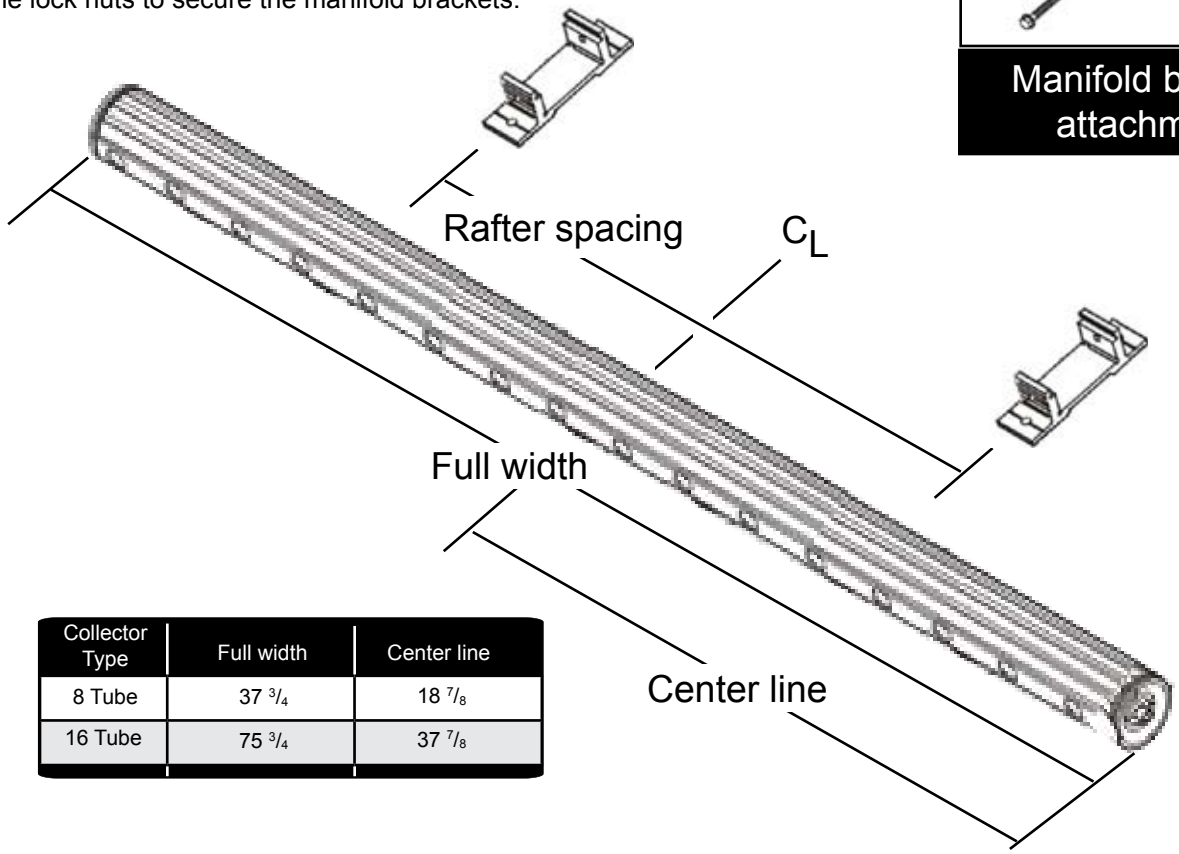
B.
Using the rafter spacing measurement as the width between the manifold brackets, align the manifold brackets centered on the manifold center line.

C.
Tighten the lock nuts to secure the manifold brackets.

In the case of multiple collector configurations see page 21 for installation dimensions.



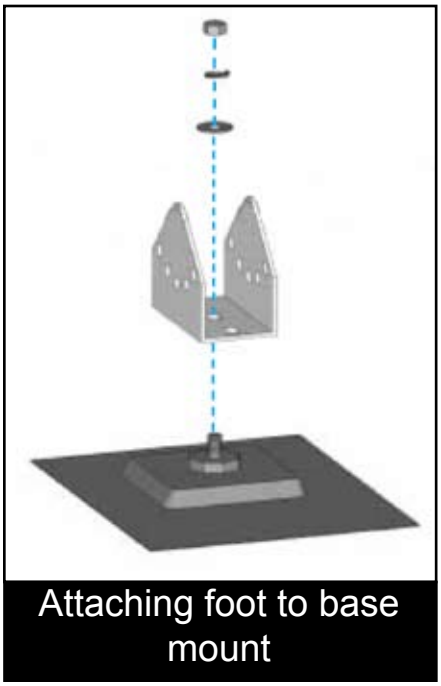
Manifold bracket attachment



Collector Type	Full width	Center line
8 Tube	37 3/4	18 7/8
16 Tube	75 3/4	37 7/8

STEP: 6

On Roof Installation



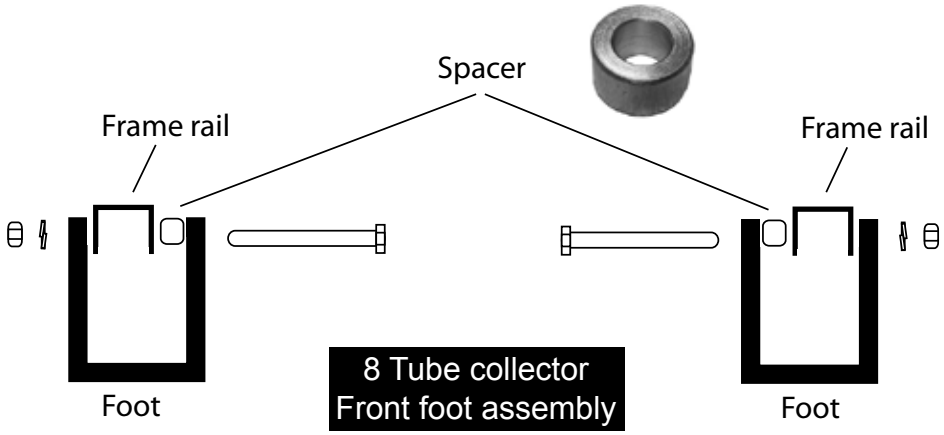
Attaching foot to base mount

A:
Attach foot through center hole to the top of the stud using the 3/8” nut, flat washer, and lock washer.

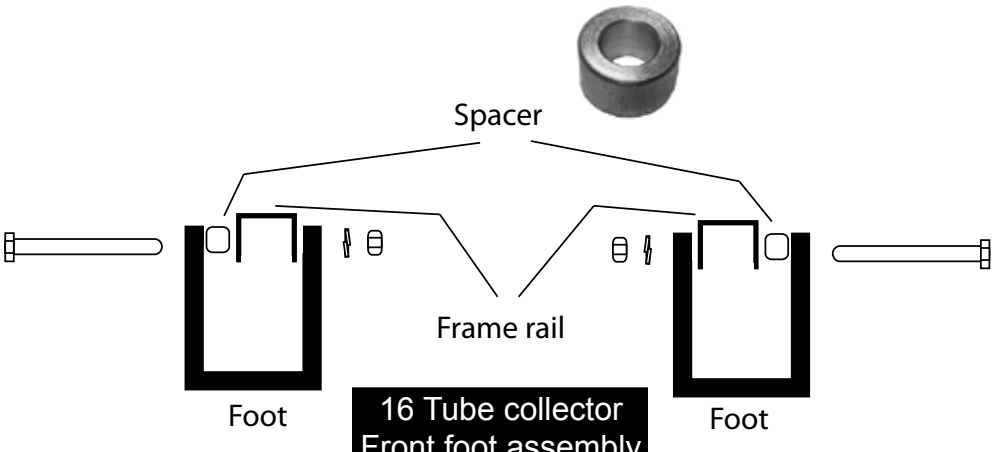
B:
Insert back rail into rear foot. Four(4) quarter-turn bolts per foot are inserted into the top and bottom holes.
Allow the back rail to settle fully on the base mount nut. Fully tighten bolts. This will give the frame stability and prevent side to side motion.

C:
Attach bottom of frame rail to front foot. Insert the 2 1/2” hex bolt through the top hole in the foot and the frame rail and fasten.
Tighten until split lock washer is flattened. Do not deform the collector foot. Do not deform the frame rail.

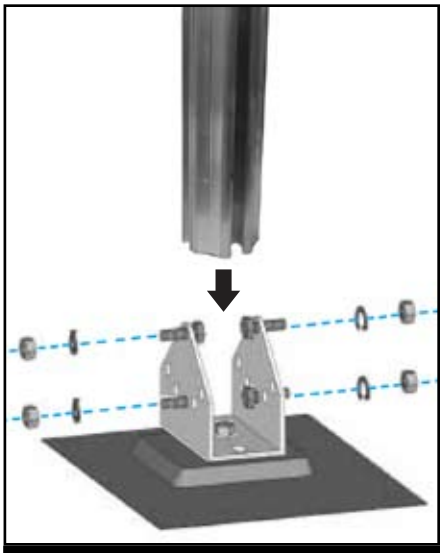
One side complete assembly



8 Tube collector
Front foot assembly



16 Tube collector
Front foot assembly



Back foot assembly

STEP: 7

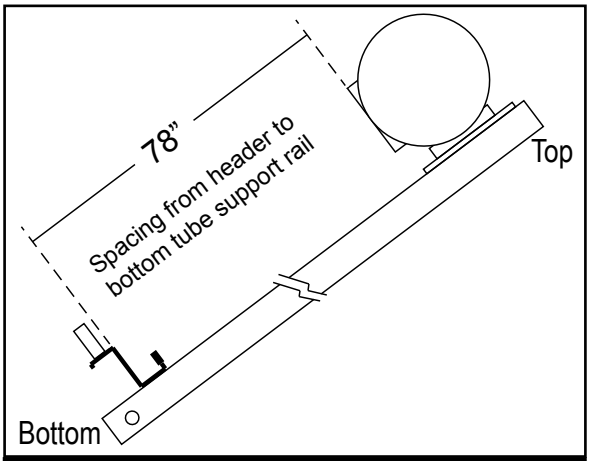
On Roof Installation

A:
Using the rail nuts, attach header and bracket assembly through holes one and three at the top of the frame rails, slide to the top of the slots, and tighten.

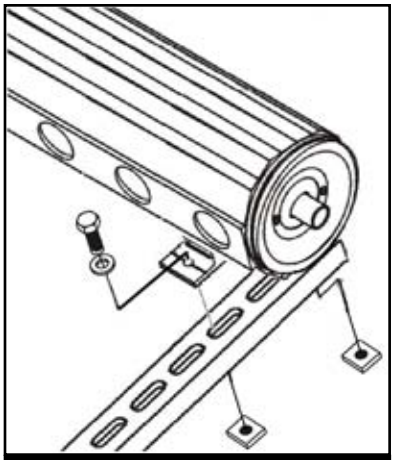
B:
Using the rail nuts, attach bottom support rail with the bolt through the second hole from the bottom of the frame rails. Do not tighten.

C:
The large vertical face of the bottom support rail should be 78” from the opposing face of the header manifold.
The bottom support rail will be approximately in the middle of the slot.

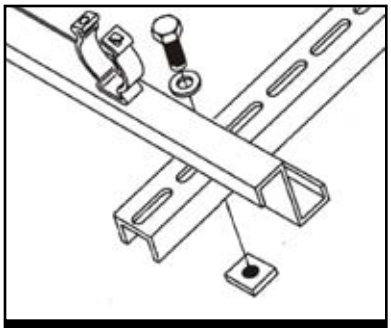
D:
Tighten all fasteners.



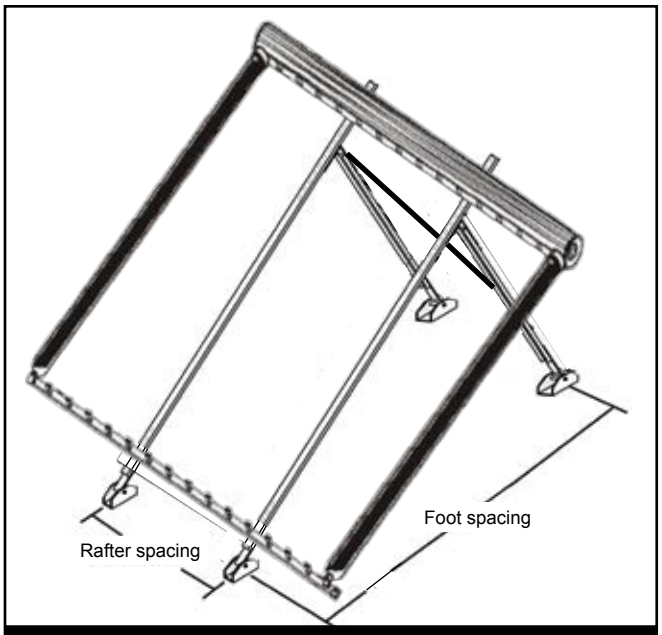
Header to bottom support rail spacing



Attaching header and bracket assembly to frame rail



Attaching bottom support rail to frame rail



Outer tubes and cross brace

E:
Insert outer tubes and check for square lines

F:
Install the aluminum back brace diagonally from the top of the right side back support rail to the opposing back support rail.

G:
Tighten brace fasteners

H:
Install remaining tubes

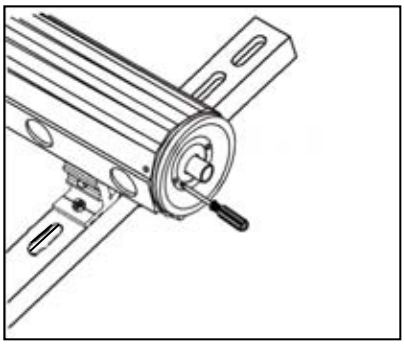
Multiple Collector Configurations

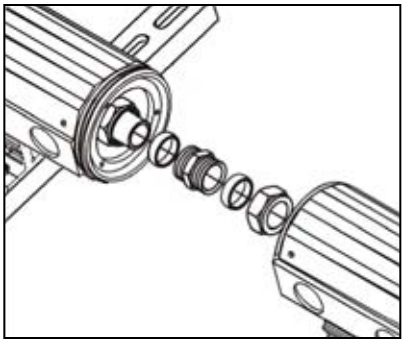
Adding Collectors - **Collector Extension Kit**

If there is more than one collector, you may add a coupler between the manifold ends to connected them together.

Disassemble the end cover with screwdriver.

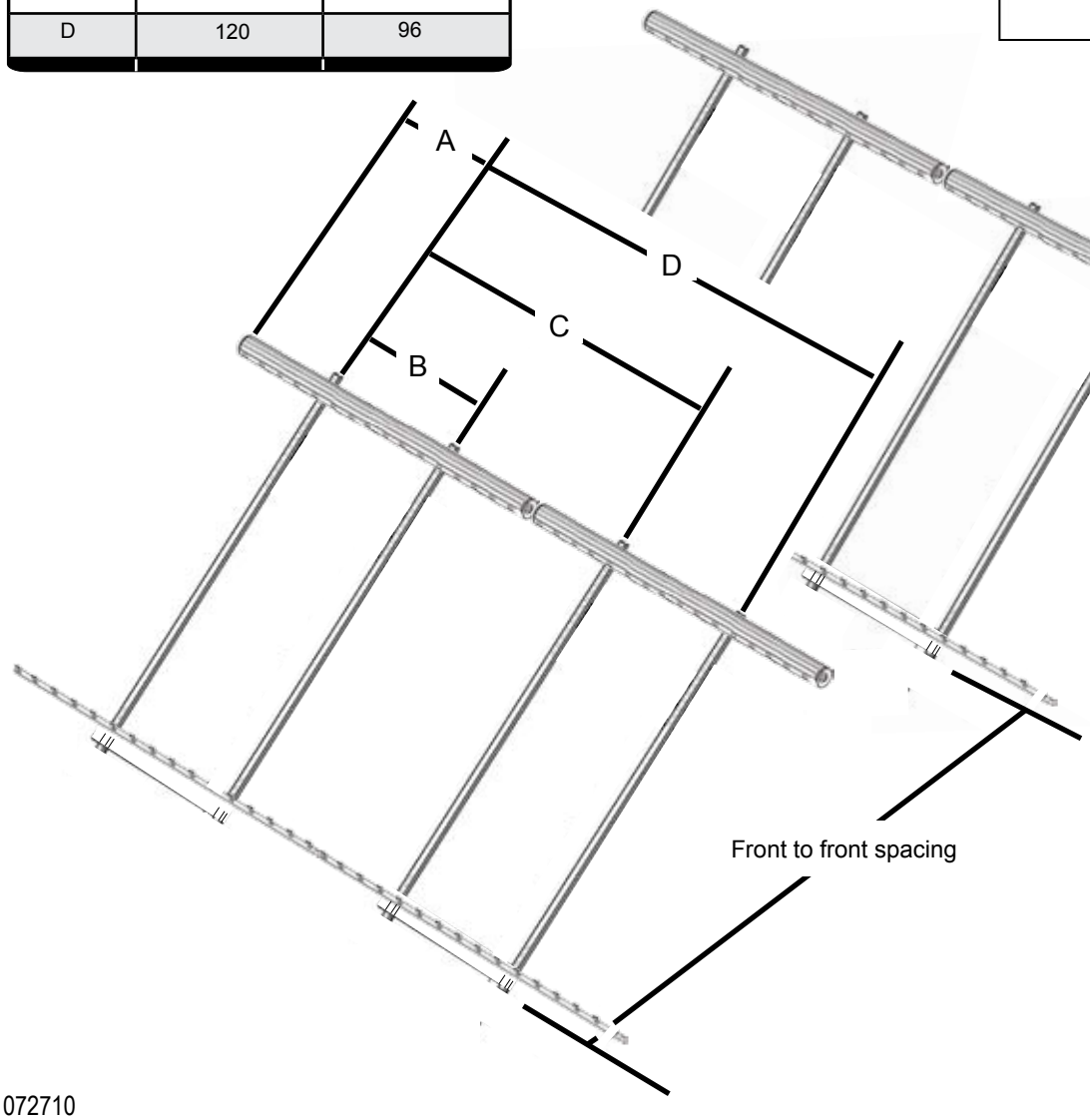
Connect two header boxes with compression couplings supplied — keep distance of 2 - 1/8" between the two header boxes for the manifold connector cuff.





See page 23 for alternate installation if these dimensions do not align with rafters.

Multiple collector dimensions		
Dimension	32 tubes	24 tubes
A	11	14
B	48	48
C	72	64
D	120	96



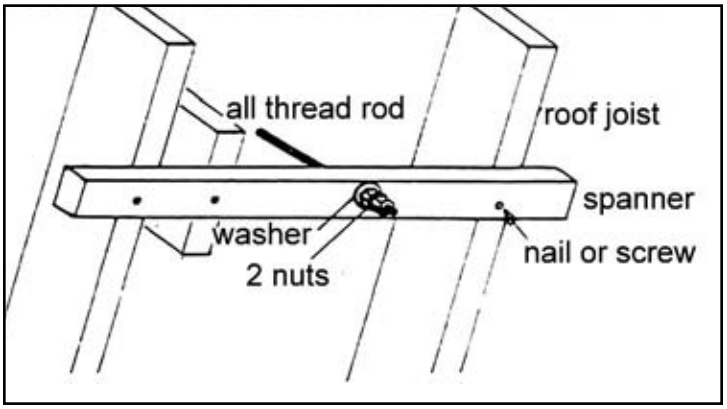
Rack Tilt	Front to Front
5°	-
10°	-
15°	-
20°	90
25°	105
30°	120
35°	134
40°	147
45°	159
50°	171
55°	181
60°	190
65°	197
70°	204

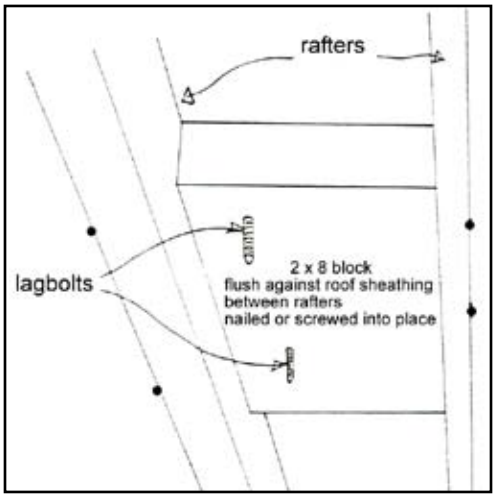
Special Considerations For Roof Mounting

Working with Spanners or Blocks to Secure Collector Feet into Roof Framing

If the collector feet are not in line with roof rafters, blocks may be nailed into the joint cavity and the feet then lag-bolted to the block. Securing collector feet to the roof rafter may also be done by using nuts and an all-thread rod to bolt down the feet. An additional wood block between the trusses must be placed beside the all thread rod to prevent bowing of the sheathing when tightening the nuts in the all thread rod. Spanners may be required in areas prone to hurricane-force wind.

It is important, in any case, that the collector feet are bolted to the roof frame.

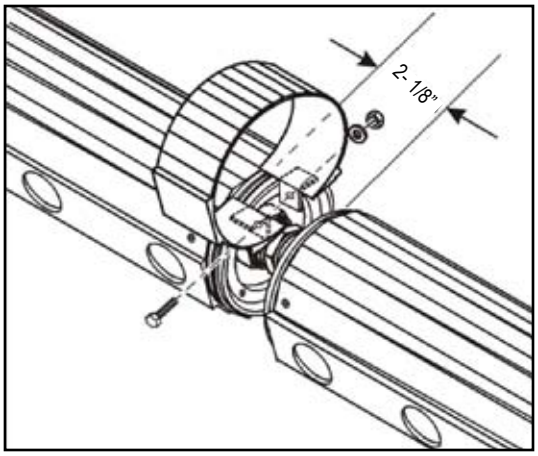




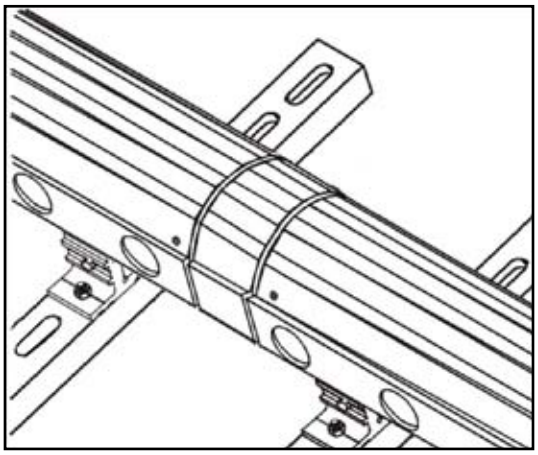
Collector Extension Kit continued

Insulation in the collector cuff cavity. Use high temperature (300F+) elastomeric foam insultube, or comparable.

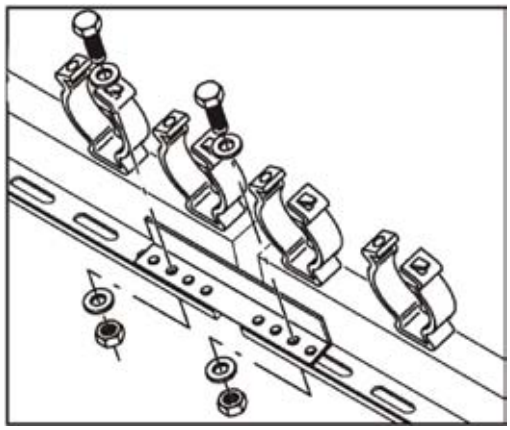
Install and attach the connection cuff.



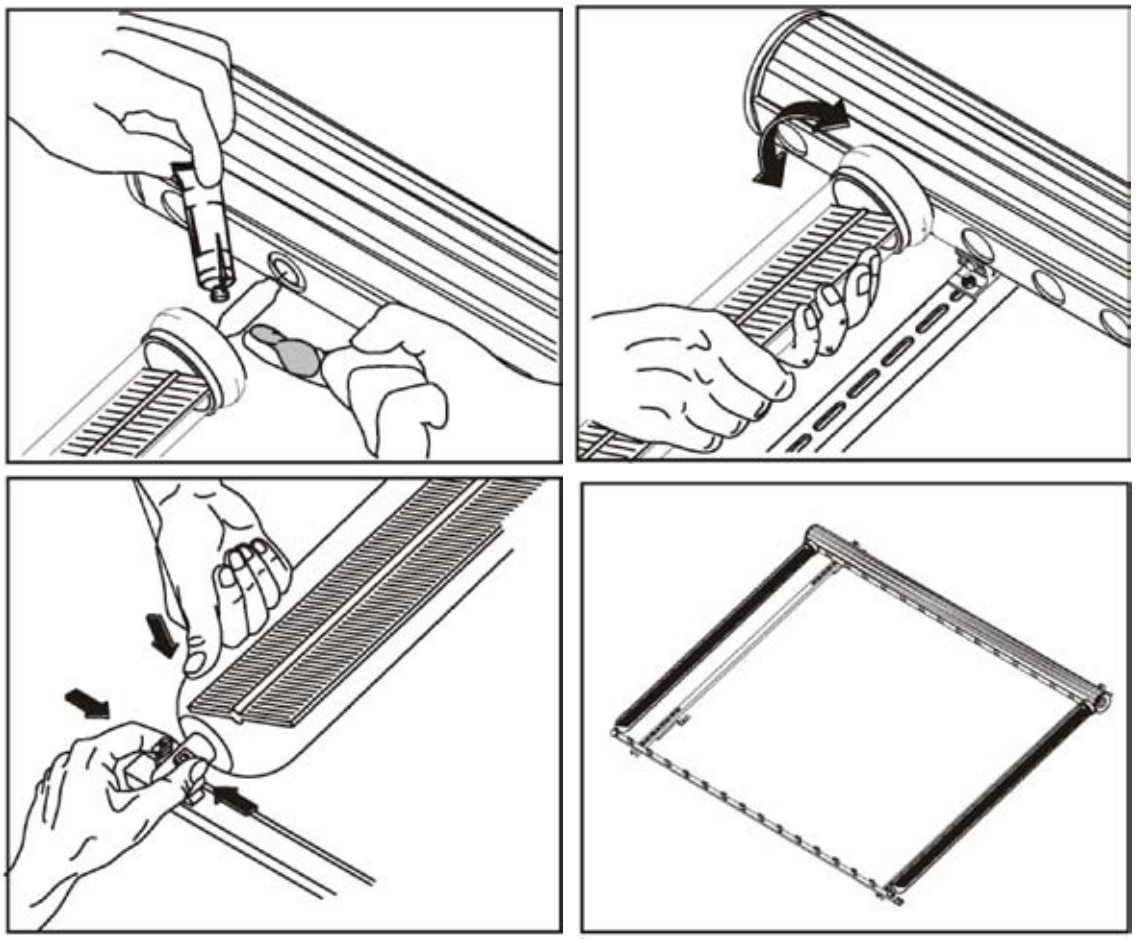
Tighten the screw slot bolt and nut to clamp the connection cuff.



The bottom rails are connected with a bottom support connection.
Screw nut and bolt the bottom support connector into place between the two collector bottom rails.



Installing the Evacuated Tubes



Installing the vacuum tubes
Grease condenser with heat transmission paste. Note: Use a glove or a cloth to apply the paste.

Do not touch a hot condenser which could be as high as 390 °F! Keep tubes covered before installation. When tubes are exposed to the sun, the temperature of the condenser could reach 390 °F or higher.

Align the tube and slide the condenser gently into the manifold while turning the tube gently back and forth. Adjust vacuum tube. **Keep blue selective coating side facing upward**. The rubber gasket atop the vacuum tube must be set within manifold hole in header to securely seal heat pipe in manifold.

Put the end cap of the tube into the clip. If necessary, adjust the location of the bottom support. The end of the tube should rest on the rubber strip of the bottom support. Close clip. **Clip is sharp, use gloves to close clip.**

Install one vacuum tube on either end, and check the whole collector for square lines.

Install each vacuum tube from one end to the other.

Connect Piping to the Manifold

With each roof mounting kit, there are adapters to pipe to the manifold. Included are:

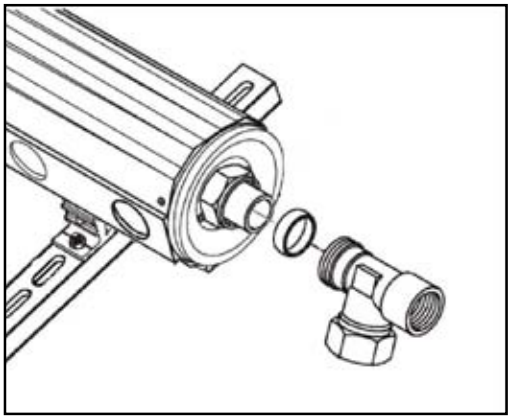
- Two compression tees to attach to the supply and return terminations on each collector manifold or collector array;
- Two copper pipe adapters that adapt from 22mm copper pipe size (at compression tee) to 3/4" copper pipe. Also included in some roof kits are two stainless steel flexible hoses and additional compression couplings for copper pipe adapters.

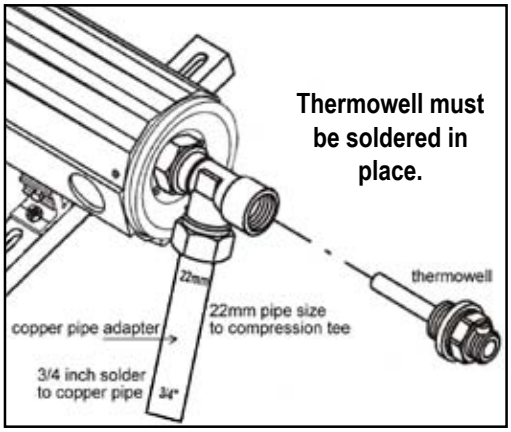
NOTE: Use 1/2" copper supply and return for collectors with up to 24 tubes (one 8- and one 16-tube collector) and 3/4" copper for collectors with a 4- to 16-tube collector array. Preferably use Type L. ***Do not use PEX plastic tubing. PEX tubing cannot withstand temperatures above 200°F and will fail.*** Always insulate outdoor tubing with high temperature Insultube and weather proofing against UV degradation. Use insulation with a wall thickness of at least 3/4".

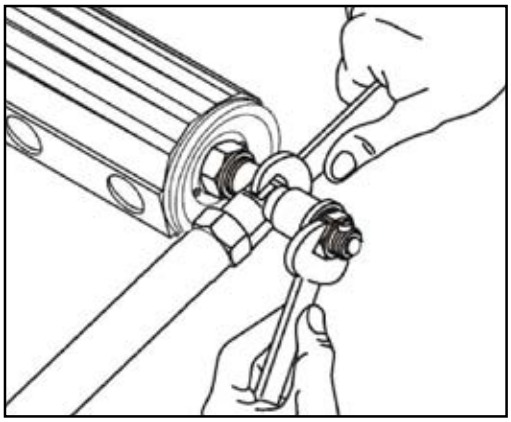
Install compression tees at supply and return on collector manifold. Make sure the compression ring is well onto the copper pipe terminating the manifold so that the compression ring will not slide off the pipe as the compression nut is tightened.

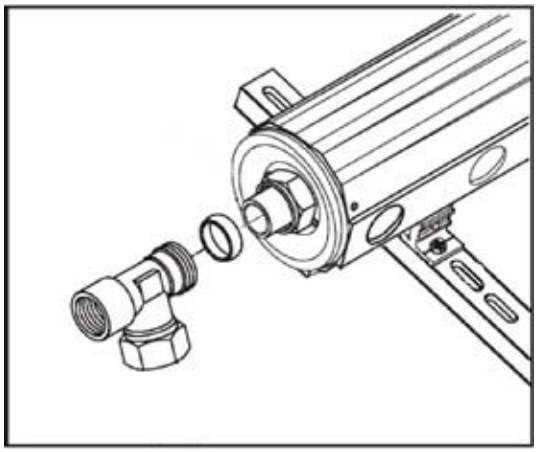
Install the Thermowell, which is for the collector sensor, on the return outlet tee. **Solder the threaded Thermowell into the tee** before installing the compression tee to the header. Smear some heat transmission paste on the sensor and insert the sensor into the Thermowell. Lock sensor into place with set screw on the Thermowell.

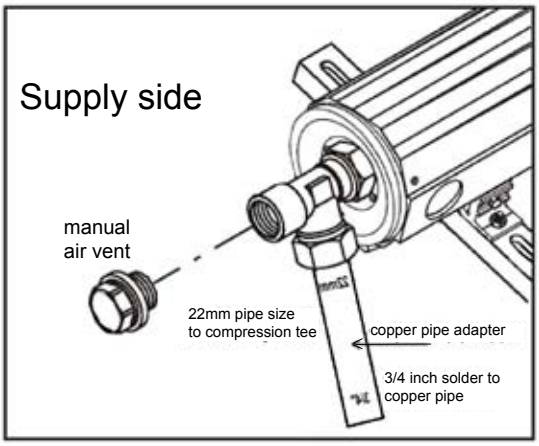
Install the manual air vent on the manifold's supply inlet tee. If the piping rises above the collector on a closed loop system, add an additional manual air vent at the highest point of the loop.











Section Six

System Piping Schematics

The OVSOL System for solar energy described in this manual, when properly installed and maintained, meets the minimum standards established by the SRCC.
This certification does not imply endorsement or warranty of this product by the SRCC.

System Model	Piping Schematic page #
OVSOL 5-16-SC	26
OVSOL 5-16-SCE	27
OVSOL 5-16-DC	28
OVSOL 5-16-DCE	29
OVSOL 5-24-SC	30
OVSOL 5-24-SCE	31
OVSOL 5-24-DC	32
OVSOL 5-24-DCE	33

OVSOL System 5-16-SCE / 80 gallon, Evacuated tube, Single coil electric tank

System Assembly

Installing OVSOL System 5-16-SCE
Model Number 540 00 16K-SCE
Solar Closed-Loop Domestic Hot Water System

Oventrop Components

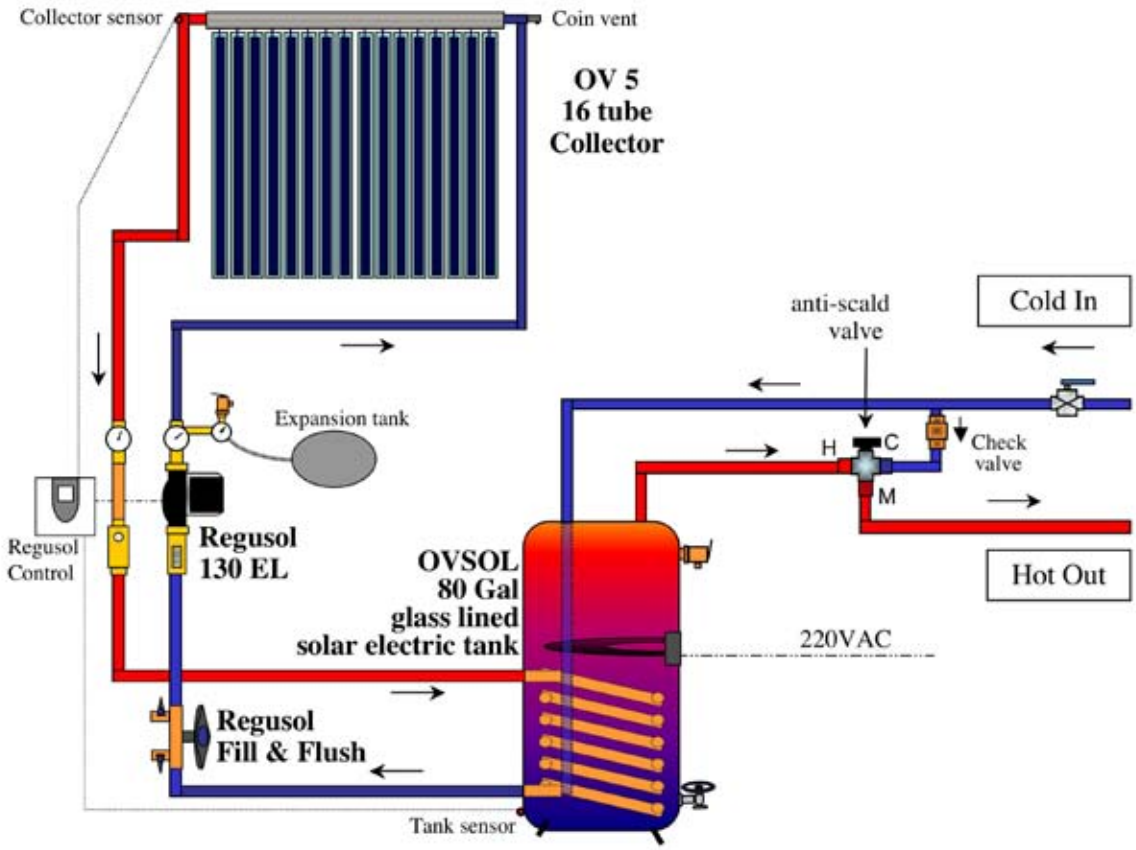
OVSOL 5 -16 Evacuated Tube Collector	filled weight: 225 lbs.
Regusol 130 EL Solar Transmission Station	filled weight: 20 lbs.
80 Gallon OVSOL glass lined Tank.	filled weight: 920 lbs.

Regusol Fill and Flush Valve
Oventrop NT Propelyne Glycol Antifreeze

System Design Description

The solar closed-loop heating system consists of the Oventrop Regusol 130 EL pump and control station, one OV-5 evacuated tube collector, and an 80 gallon glass lined tank with one internal coil and electric backup element. An expansion tank is installed at the Regusol on the safety group. Oventrop NT propelyne glycol antifreeze is filled into the closed loop system through the Regusol fill and flush valve.

Cold water is piped to the solar tank. An anti-scald valve must be installed for hot water mixing to hot water fixtures if the solar tank high limit in the Regusol controller is set above 120 ^{o}F.



OVSOL System 5-16-DC / 80 gallon, Evacuated tube, Dual coil tank

System Assembly

Installing OVSOL System 5-16-DC
Model Number 540 00 16K-DC
Solar Closed-Loop Domestic Hot Water System

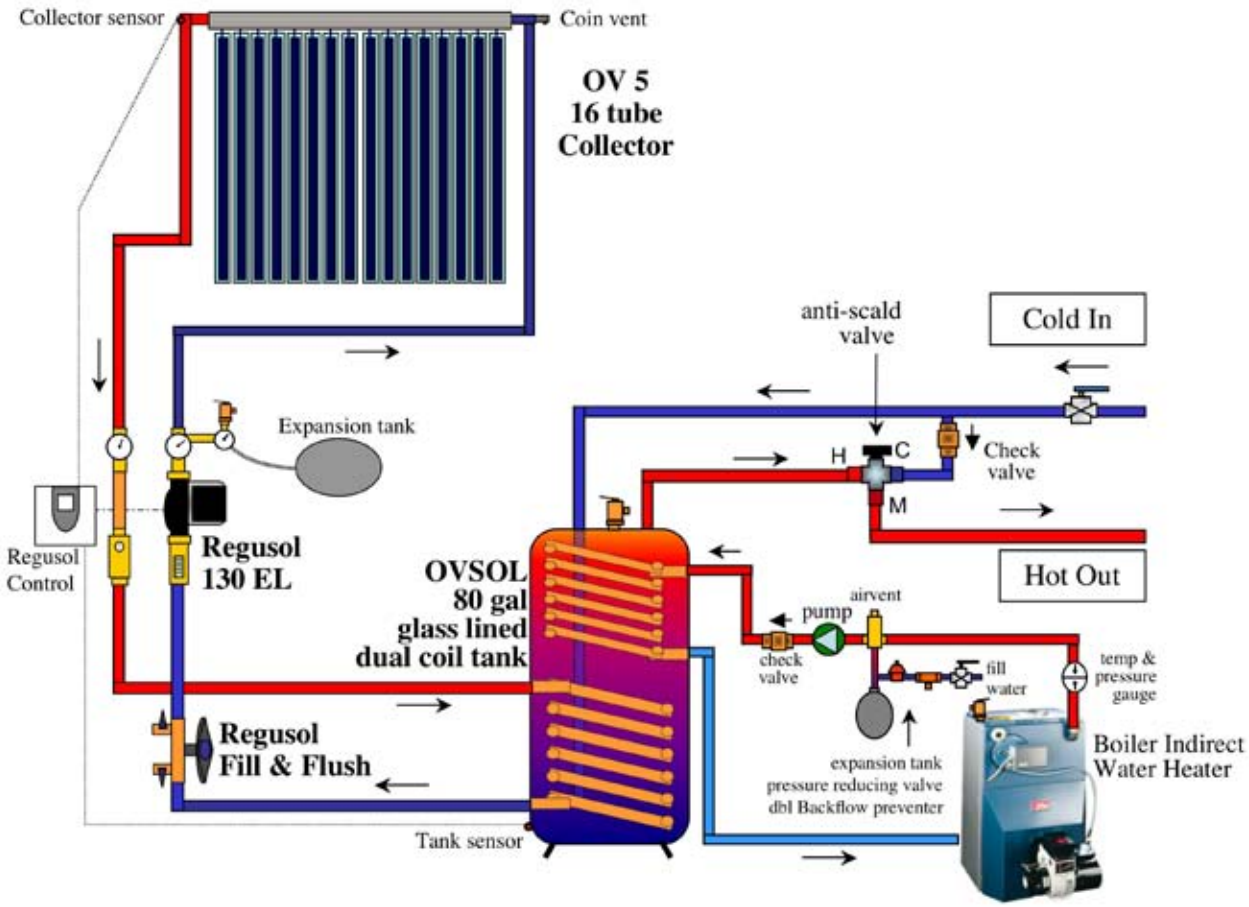
Oventrop Components

OVSOL 5 -16 Evacuated Tube Collector	filled weight: 225 lbs.
Regusol 130 EL Solar Transmission Station	filled weight: 20 lbs.
80 Gallon OVSOL glass lined Tank.	filled weight: 970 lbs.
Regusol Fill and Flush Valve	
Oventrop NT Propelyne Glycol Antifreeze	

System Design Description

The solar closed-loop heating system consists of the Oventrop Regusol 130 EL pump and control station, one OV-5 evacuated tube collector, and an 80 gallon glass lined tank with two internal coils. An expansion tank is installed at the Regusol on the safety group. Oventrop NT propylene glycol antifreeze is filled into the closed loop system through the Regusol fill and flush valve.

Cold water is piped to the solar tank. An anti-scald valve must be installed for hot water mixing to hot water fixtures if the solar tank high limit in the Regusol controller is set above 120 ^{o}F. The top coil is piped to the boiler in the manner of a standard indirect water heater.



OVSOL System 5-16-DCE / 80 gallon, Evacuated tube, Dual coil electric tank

System Assembly

Installing OVSOL System 5-16-DCE
Model Number 540 00 16K-DCE
Solar Closed-Loop Domestic Hot Water System

Oventrop Components

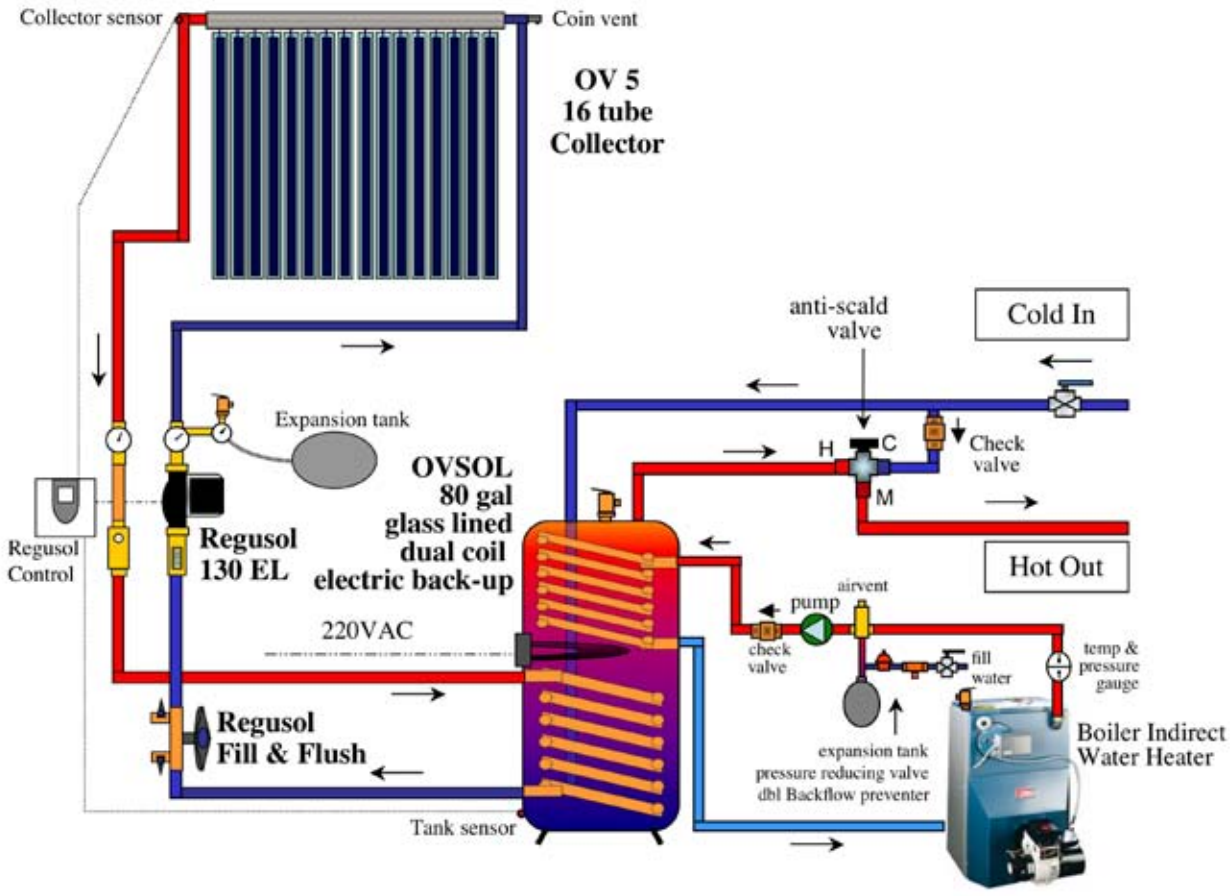
OVSOL 5 -16 Evacuated Tube Collector	filled weight: 225 lbs.
Regusol 130 EL Solar Transmission Station	filled weight: 20 lbs.
80 Gallon OVSOL glass lined Tank.	filled weight: 970 lbs.

Regusol Fill and Flush Valve
Oventrop NT Propelyne Glycol Antifreeze

System Design Description

The solar closed-loop heating system consists of the Oventrop Regusol 130 EL pump and control station, one OV-5 evacuated tube collector, and an 80 gallon glass lined tank with two internal coils and an electric backup element. An expansion tank is installed at the Regusol on the safety group. Oventrop NT propylene glycol antifreeze is filled into the closed loop system through the Regusol fill and flush valve.

Cold water is piped to the solar tank. An anti-scald valve must be installed for hot water mixing to hot water fixtures if the solar tank high limit in the Regusol controller is set above 120 ^{o}F. The top coil is piped to the boiler in the manner of a standard indirect water heater.



OVSOL System 5-24-SC / 119 gallon, Evacuated tube, Single coil tank

System Assembly

Installing OVSOL System 5-24-SC
Model Number 540 00 17K-SC
Solar Closed-Loop Domestic Hot Water System

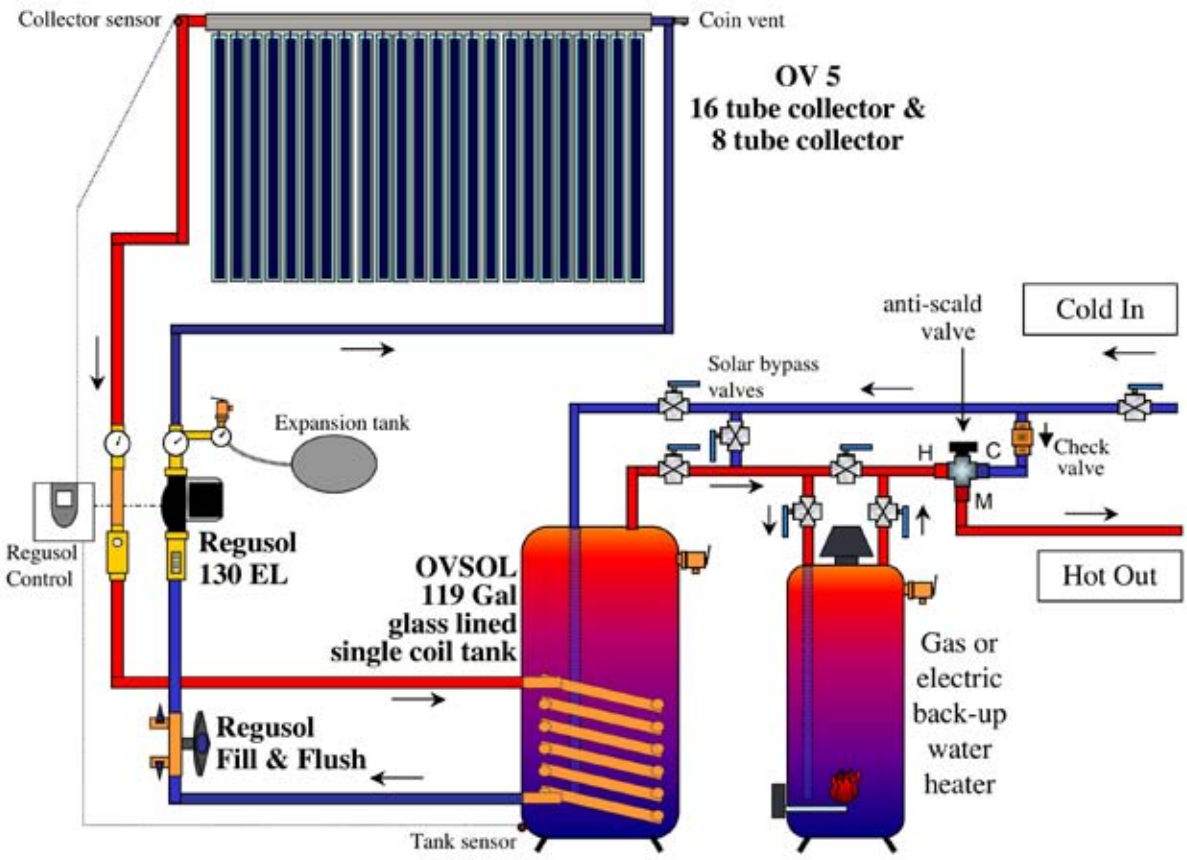
Oventrop Components

OVSOL 5 -16 and 5-8 Evacuated Tube Collector	filled weight: 337 lbs.
Regusol 130 EL Solar Transmission Station	filled weight: 20 lbs.
119 Gallon OVSOL glass lined Tank.	filled weight:1315 lbs.
Regusol Fill and Flush Valve	
Oventrop NT Propelyne Glycol Antifreeze	

System Design Description

The solar closed-loop heating system consists of the Oventrop Regusol 130 EL pump and control station, one OV-5 evacuated tube collector, and an 80 gallon glass lined tank with one internal coil. An expansion tank is installed at the Regusol on the safety group. Oventrop NT propelyne glycol antifreeze is filled into the closed loop system through the Regusol fill and flush valve.

Cold water is piped to the solar tank and in series with the back-up hot water heater. Solar bypass valves are installed for servicing the solar tank. Back-up hot water heater bypass valves may be installed to bypass the hot water heater. An anti-scald valve must be installed for hot water mixing to hot water fixtures if the solar tank high limit in the Regusol controller is set above 120 ^{o}F.



OVSOL System 5-24-SCE / 119 gallon, Evacuated tube, Single coil electric tank

System Assembly

Installing OVSOL System 5-24-SCE
Model Number 540 00 17K-SCE
Solar Closed-Loop Domestic Hot Water System

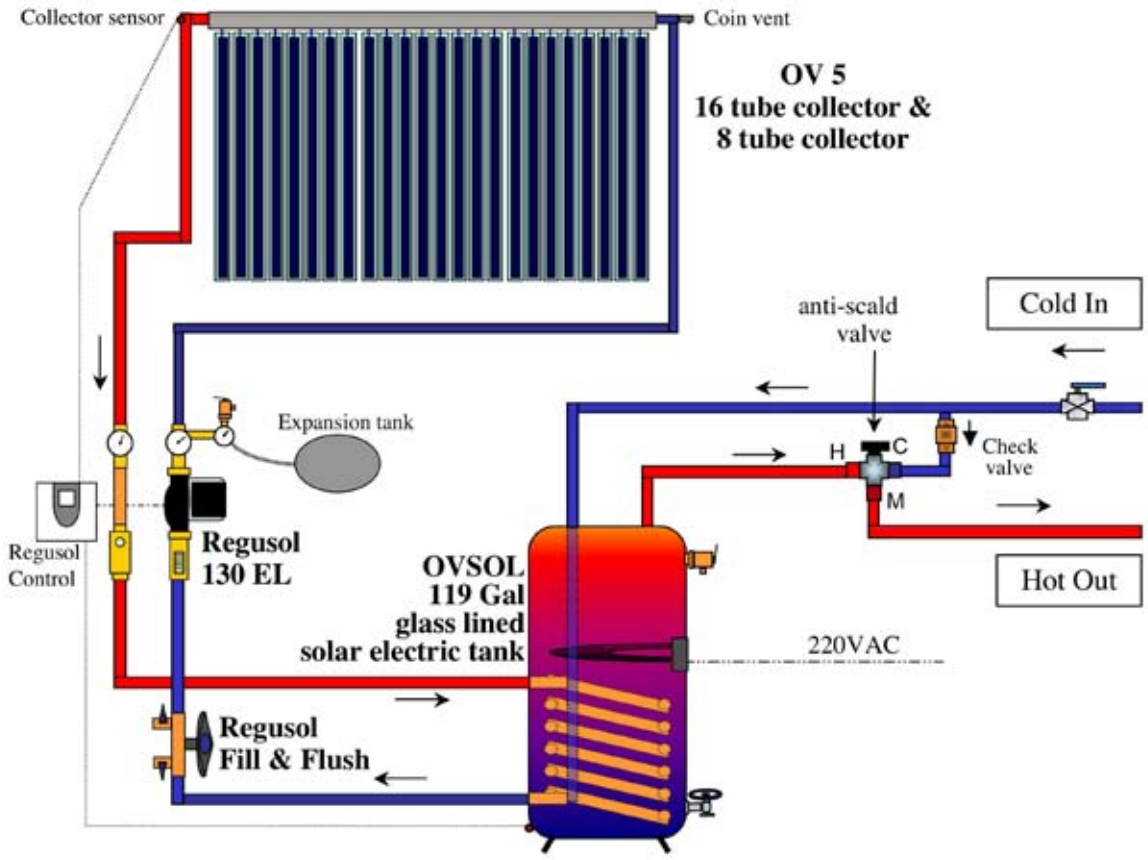
Oventrop Components

OVSOL 5 -16 and 5-8 Evacuated Tube Collector	filled weight: 337 lbs.
Regusol 130 EL Solar Transmission Station	filled weight: 20 lbs.
119 Gallon OVSOL glass lined Tank.	filled weight: 1315 lbs.
Regusol Fill and Flush Valve	
Oventrop NT Propelyne Glycol Antifreeze	

System Design Description

The solar closed-loop heating system consists of the Oventrop Regusol 130 EL pump and control station, one OV-5 evacuated tube collector, and an 80 gallon glass lined tank with one internal coil and an electric backup element. An expansion tank is installed at the Regusol on the safety group. Oventrop NT propelyne glycol antifreeze is filled into the closed loop system through the Regusol fill and flush valve.

Cold water is piped to the solar tank. An anti-scald valve must be installed for hot water mixing to hot water fixtures if the solar tank high limit in the Regusol controller is set above 120 ºF.



OVSOL System 5-24-DC / 119 gallon, Evacuated tube, Dual coil tank

System Assembly

Installing OVSOL System 5-24-DC
Model Number 540 00 17K-DC
Solar Closed-Loop Domestic Hot Water System

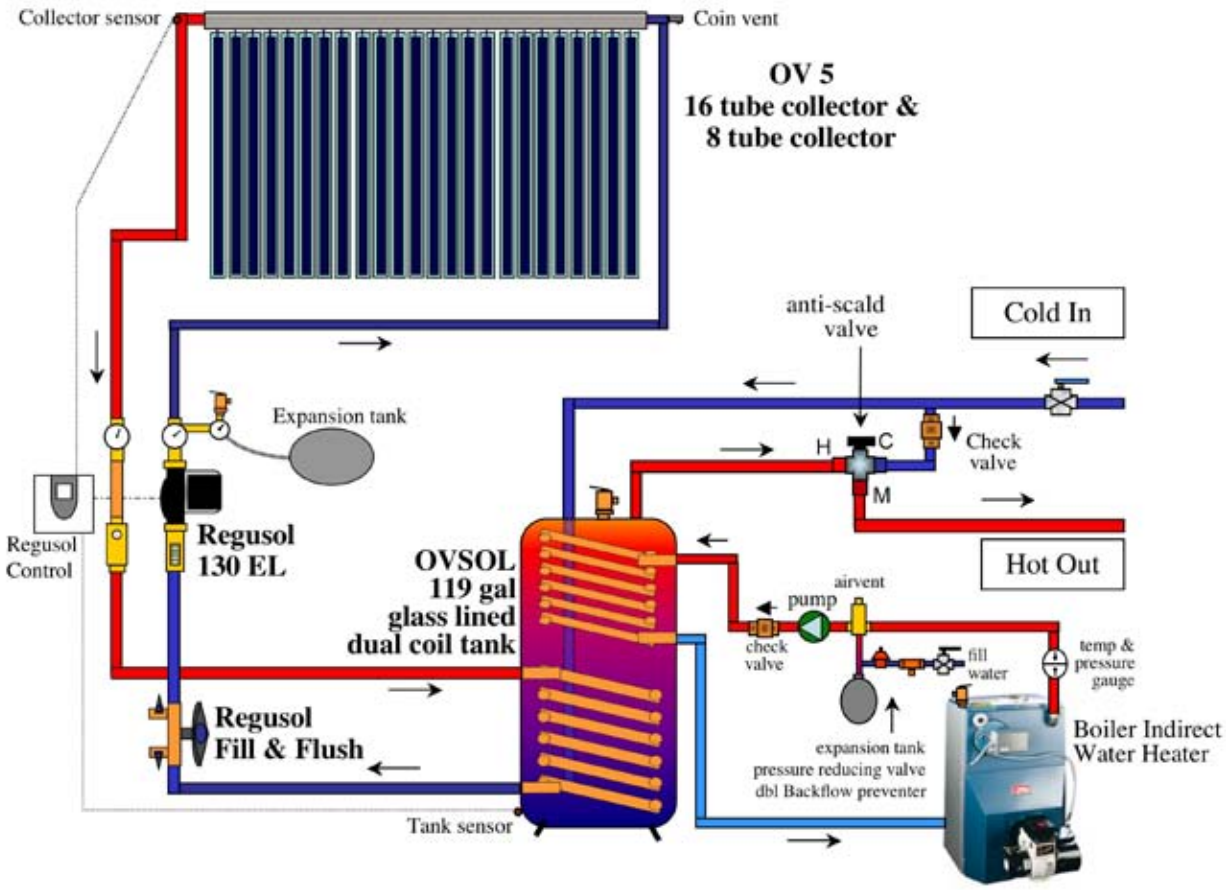
Oventrop Components

OVSOL 5 -16 and 5-8 Evacuated Tube Collector	filled weight: 337 lbs.
Regusol 130 EL Solar Transmission Station	filled weight: 20 lbs.
119 Gallon OVSOL glass lined Tank.	filled weight: 1340 lbs.
Regusol Fill and Flush Valve	
Oventrop NT Propelyne Glycol Antifreeze	

System Design Description

The solar closed-loop heating system consists of the Oventrop Regusol 130 EL pump and control station, one OV-5 evacuated tube collector, and an 80 gallon glass lined tank with two internal coils. An expansion tank is installed at the Regusol on the safety group. Oventrop NT propelyne glycol antifreeze is filled into the closed loop system through the Regusol fill and flush valve.

Cold water is piped to the solar tank. An anti-scald valve must be installed for hot water mixing to hot water fixtures if the solar tank high limit in the Regusol controller is set above 120 ^{o}F. The top coil is piped to the boiler in the manner of a standard indirect water heater.



OVSOL System 5-24-DCE / 119 gallon, Evacuated tube, Dual coil electric tank

System Assembly

Installing OVSOL System 5-24-DCE
Model Number 540 00 17K-DCE
Solar Closed-Loop Domestic Hot Water System

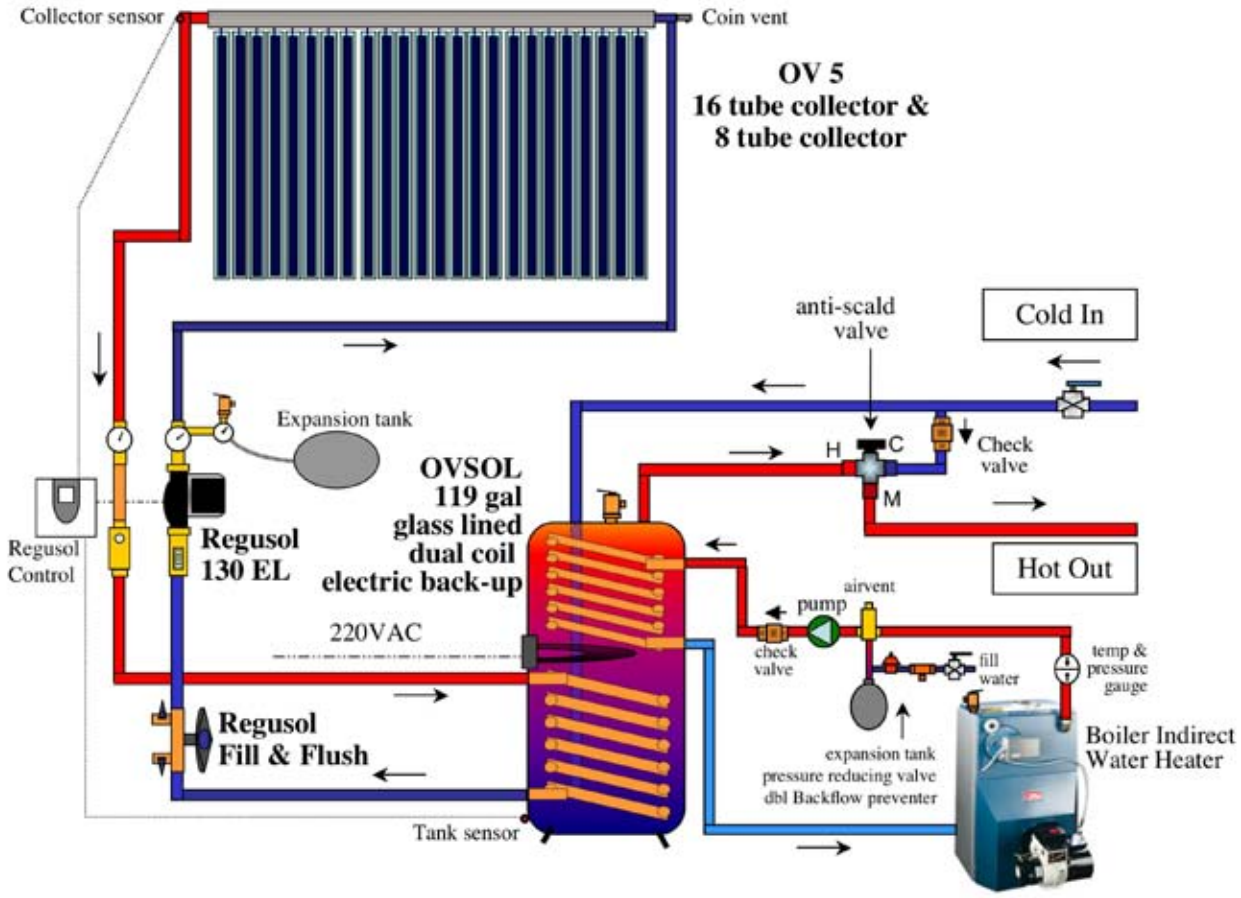
Oventrop Components

OVSOL 5 -16 and 5-8 Evacuated Tube Collector	filled weight: 337 lbs.
Regusol 130 EL Solar Transmission Station	filled weight: 20 lbs.
119 Gallon OVSOL glass lined Tank.	filled weight: 1340 lbs.
Regusol Fill and Flush Valve	
Oventrop NT Propelyne Glycol Antifreeze	

System Design Description

The solar closed-loop heating system consists of the Oventrop Regusol 130 EL pump and control station, one OV-5 evacuated tube collector, and an 80 gallon glass lined tank with two internal coils and an electric backup element. An expansion tank is installed at the Regusol on the safety group. Oventrop NT propelyne glycol antifreeze is filled into the closed loop system through the Regusol fill and flush valve.

Cold water is piped to the solar tank. An anti-scald valve must be installed for hot water mixing to hot water fixtures if the solar tank high limit in the Regusol controller is set above 120 ºF. The top coil is piped to the boiler in the manner of a standard indirect water heater.

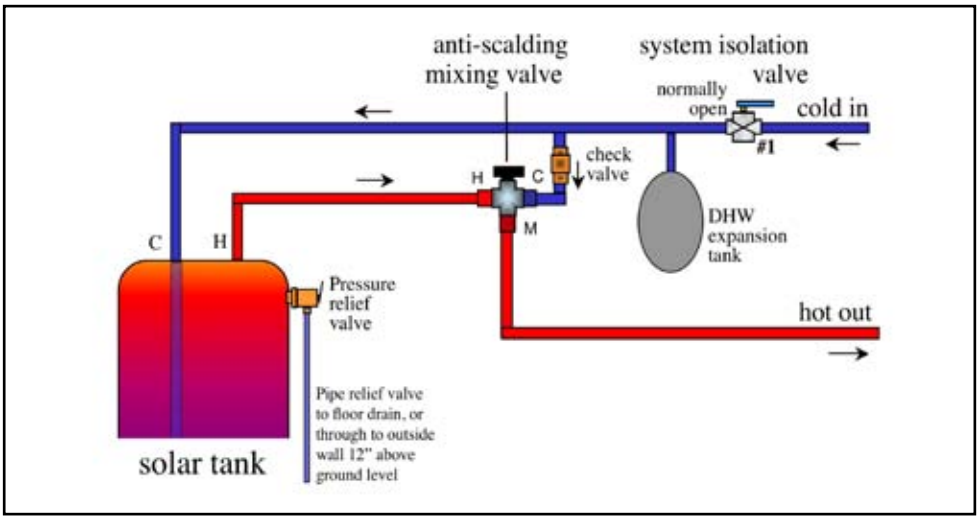


Piping the Solar Tank with Integrated Back-up as a One Tank System
Use 3/4" copper pipe for plumbing the tanks. To prevent heat loss through the copper tubing, insulate all tubing with at least 1/2" wall tube insulation. This should include the cold water feed to the solar storage tank up to 6 feet from the tank. A check valve should be installed on the cold water feed line to the mixing valve to prevent hot water migration into the cold water piping.

The solar tank should include valves and piping for service.
A domestic hot water expansion tank can be installed on the cold water feed to the tanks. The expansion tank should be installed downstream from a back flow preventer, for cold water feed to the tanks.

Service Valves and Instructions for Emergency
To isolate or service the hot water system in an emergency, turn system isolation valve #1 off.

To leave the system in an unoccupied house when hot water will not be drawn, the solar system should be drained of antifreeze and the controller turned to "off" or unplugged. You may also turn the system isolation valve #1 off if no hot water flow to the fixtures is desired.



Piping the Solar Tank and the Auxiliary Hot Water Service for Two Tank System
Use 3/4" copper pipe for plumbing the tanks. To prevent heat loss through the copper tubing, insulate all tubing with at least 1/2" wall tube insulation. This should include the cold water feed to the solar storage tank up to 6 feet from the tank. A check valve should be installed on the cold water feed line to the mixing valve to prevent hot water migration into the cold water piping.

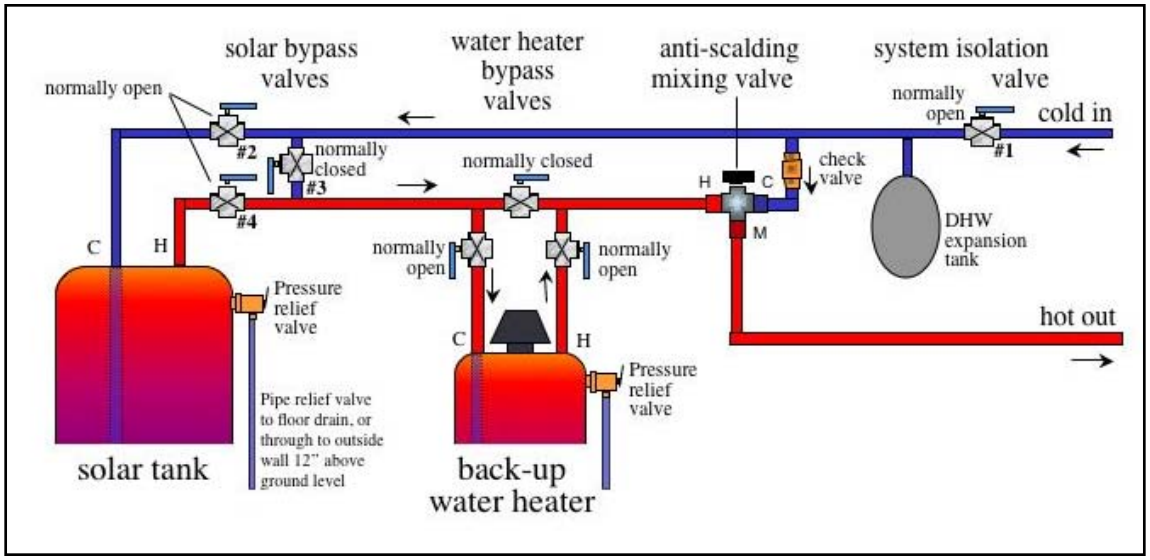
The solar tank should include valves and piping for service. In addition, the back-up water heater can have valves installed for solar hot water bypass.

A domestic hot water expansion tank can be installed on the cold water feed to the tanks. The expansion tank should be installed downstream from a back flow preventer, for cold water feed to the tanks.

Service Valves and Instructions for Emergency
To isolate or service the hot water system in an emergency, turn system isolation valve #1 off.

To isolate the solar tank from the auxiliary water heater, the normally open solar bypass valves #2 and #4 are shut off, isolating the solar tank from the supply of water. The normally closed valve #3 is then opened for bypass. Under no circumstances are valves number 1, 2 & 3 to be left open during solar operation.

To leave the system in an unoccupied house when hot water will not be drawn, the solar system should be drained of antifreeze and the controller turned to "off" or unplugged. You may also turn the system isolation valve #1 off if no hot water flow to the fixtures is desired.



Piping and Insulating the Solar Loop
When piping collectors, use 3/4" copper for one to four 16-tube collector arrays. Preferably use type L. **Never use PEX plastic tubing. PEX tubing cannot withstand temperatures above 200°F, and fail in solar loops.**

Always insulate solar loops with at least a high temperature elastomeric insulation. This flexible rubber foam insulation may be protected against UV degradation with a mastic or a 15-year latex paint applied to the surface. High temperature fiberglass, urethane, and isocyanurates are also used on solar loops and have jackets that enclose and protect the insulation. Use insulation with at least a 3/4" wall thickness for all outdoor piping. Always insulate completely around pipe fittings and at the collector fittings. Pay particular attention to insulation detail at the collector sensor. Copper pipework must be supported by pipe hangers, split ring hangers or Unistrut clamps. Check your local codes for pipe sizes and support distances for vertical and horizontal runs. The supports must not hold onto and compress the insulation. Pipe support hangers should be secured directly to the pipe.

Section Seven

Oventrop Glass-lined Indirect Solar Hot Water Tanks

Indirect single and dual coil domestic hot water storage tanks are made in 80-, and 119-gallon models. Each tank has bottom heat exchanger coil connection for solar heat transfer with optional upper coil and electric backup elements.

Please read the Installation, Operating and Service Instructions Manual, placed with the tank.

Quality Design and Construction

Tanks and coils are all glass lined.
Includes over 2" of urethane insulation, R-14.
All tanks have a metal jacket over the insulation.
Electric Elements are 4500W, 240VAC.

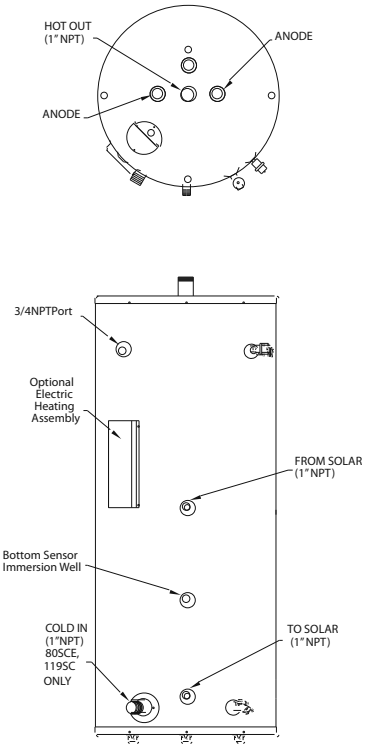


Figure 1: 80SC/SCE, 119SC/SCE

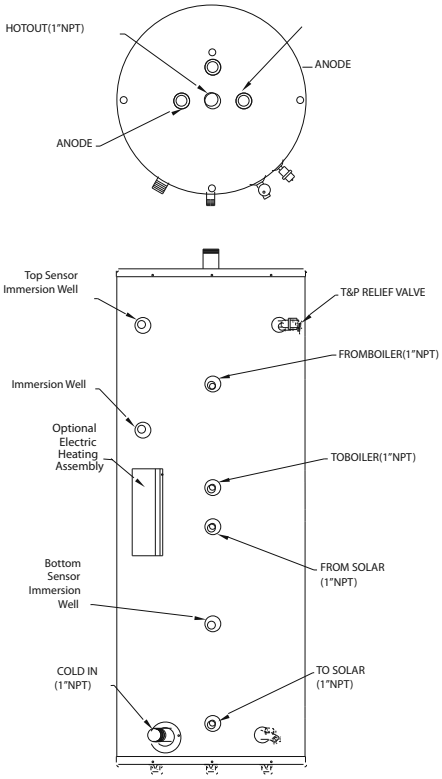


Figure 2: 80DC/DCE, 119DC/DCE

Locating the Water Heater

The water heater should be located in an area where water leakage from the tank or connections will not result in damage to areas adjacent to the water heater or to lower floors of the structure. When such a location cannot be avoided, a suitable drain pan must be installed under the water heater, and the drain pan must be connected to a drain.
The water heater should be installed as close to the back-up hot water heater or boiler as is practical for easy access for service.

The minimum clearances from combustible surfaces are:

Bottom----------0"
Sides (non-piping) ----------0"
Front----------0"
Top----------0"

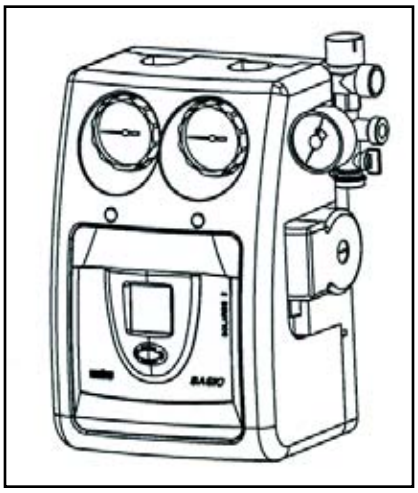
The minimum clearances for service are:

Side (T&P Relief) ---------- 6"
Sides (non-piping) ---------- 4"
Front---------- 16"
Top---------- 12"

Tank Dimensions:

	Dimensions (inches)	
	Height	Diameter
80 gallon	64	24
119 gallon	65	28

Transmission station
with deaerator
“Regusol EL-130”
Installation instructions



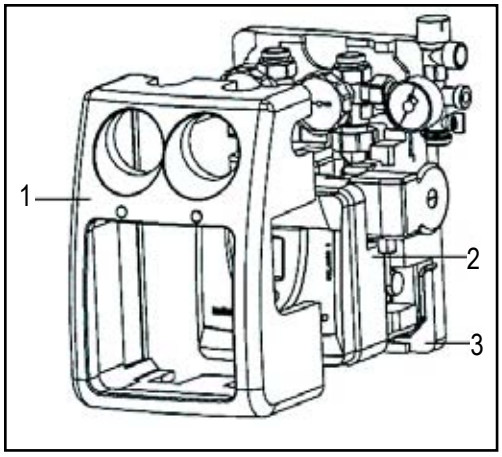
Transmission station “Regusol EL-130” with pre-assembled, integrated microprocessor-driven control.

The transmission station is supplied with a detailed instruction manual of the control.

The “Regusol EL-130” is equipped with a deaerator for air elimination from the heat transfer medium.

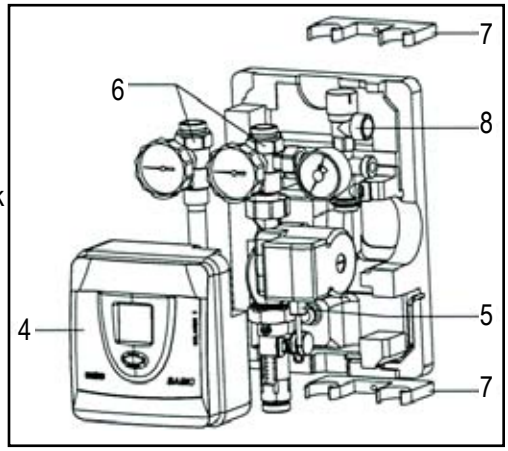
Safety notes
The safety notes are to be observed.
Installation, initial operation, maintenance and repairs have to be carried out by authorized and qualified trade persons.

Installation notes
The transmission station is supplied pre-assembled.
Pump wiring (5) is necessary.
Compression fittings for 3/4” copper pipe are included.
The transmission station always has to be mounted at a lower level than the collectors.



Assembly notes
Remove transmission station from the packaging.
Pull the front insulation (1) from the control retainer (2) while pushing the control retainer against the back insulation (3).
Now the control retainer can be pulled off the back insulation together with the control (4).
Remove transmission station (6).

For each wall-mounting device (7), drill 5/16-inch holes at a distance of 10 $^{5}/_{16}$ inches.
Fix mounting device by screwing it onto the wall and engage back insulation. Now push transmission station onto the fixing clips of the wall mounting device.



Connect the Regusol to the collectors (top connectors) and the tank (bottom connectors) through the Regusol compression fittings. See diagram 1 for details. Use 3/4” hard copper to pipe. The pipe ends must be cut at right angles and be free of burrs. Apply clear plumber’s grease on the compression nut thread and rings. Slide in pipe until stop and firmly tighten the compression fittings. Hold firm while tightening.
(Continued on next page)

Screw safety group (8) onto the ball valve.
Install discharging pipe from the pressure relief valve to the floor or through exterior wall to 12” from ground level.
If there is no floor drain, a bucket may be placed under discharge pipe.
Connect piping of 1/2” male pipe thread on the safety group to an expansion tank.
Connect cable to the pump (diagram 2) and push control retainer with the control onto the back insulation.

Now the front insulation can be slipped over the control retainer and be pushed onto the back insulation until it clicks into position.

Air test all pipework on solar closed loop. Flush solar installation thoroughly, then fill the system with Oventrop solar fluid. Adjust the flow rate with the screw slot in the flow measuring device.

Open vent with radiator vent key on deaerator to remove any air separated from solar transfer fluid.

Make sure thermometers are left in their vertical position, as valve handles must be left open. Check that the screw slot on the supply side check valve is left in the horizontal position.

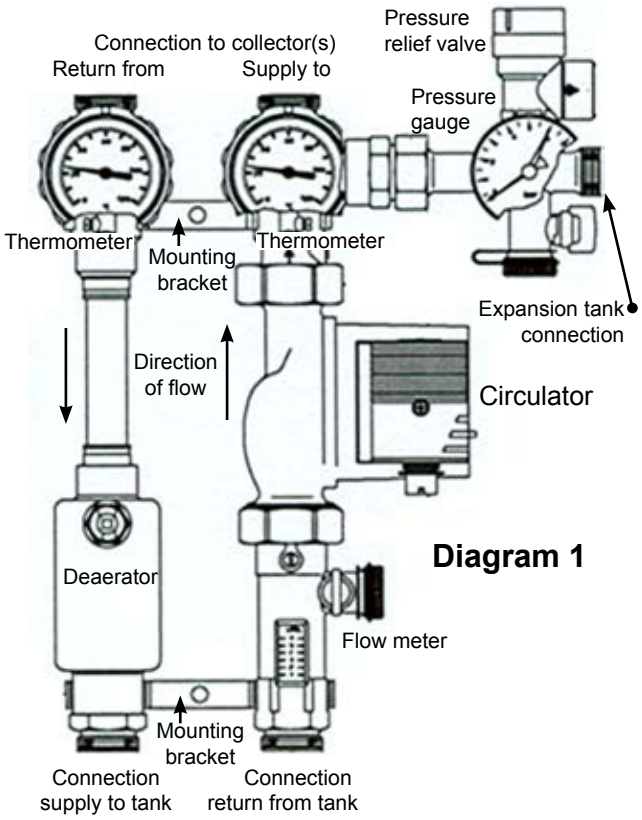
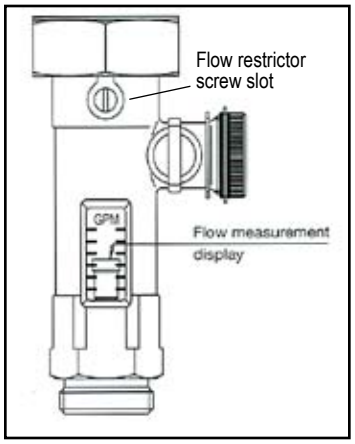
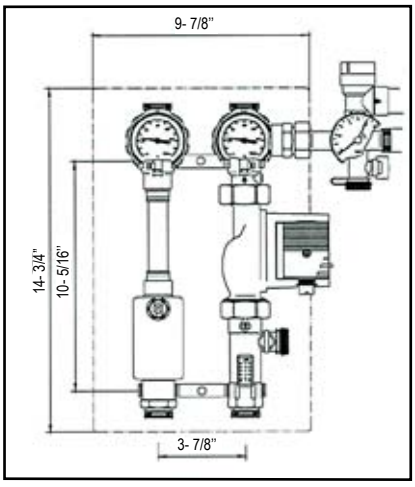
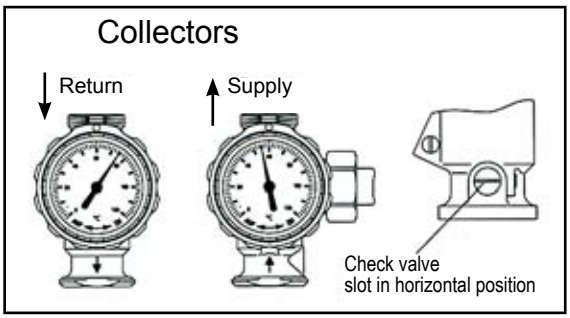


Diagram 1

Typical flow rates are set to 3/4 to 1 gpm per collector*
*16 tube model collector







Thermometers in solar collection mode (displayed on the controller) will indicate a temperature rise on the return side of an average of 10 - 25° F. This temperature rise indicates that the collectors are collecting and transferring solar energy.

All air must be purged from the system. If there is air in the system the pump will cease.

Oventrop Regusol 130 EL Controller
Standard Solar Domestic Hot Water System
Wiring

Warning!
Do not plug in Deltasol controller until all wiring connections are made.

The unit must only be located internally. It is not suitable for installation in wet or hazardous locations and should not be sited near any electromagnetic field.
Sensor wires are installed separately from any 120 VAC power chords.
The type of wire installed from the sensors to the controller should be sunlight-resistant shielded copper wire with at least two conductors at 18 AWG.

1. Unscrew the cross-recessed screw of the cover and remove it from the housing.
2. Wire the collector sensor and tank sensor wires (S1 & S2).
3. Wire the Regusol Wilo pump as follows:
   yellow with green strip wire – ground
   blue wire – neutral N #17
   brown wire – hot R1 #18
4. Wire the outlet plug as follows:
   green wire – ground
   white wire – neutral N #19
   black wire – load L #20
5. Replace cover.

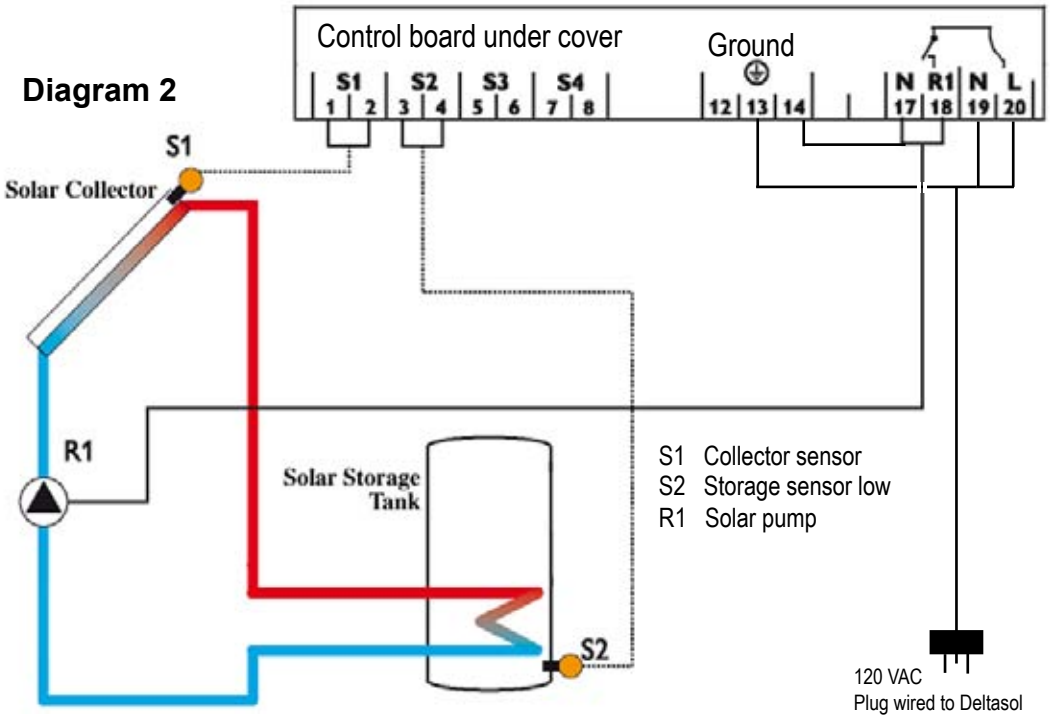
The power supply to the controller must be made last.

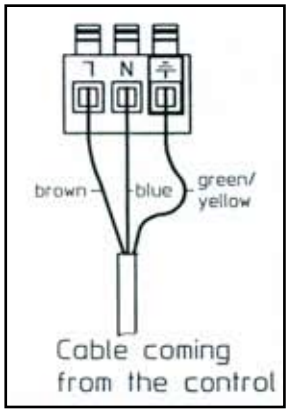
Operating instructions are included with the solar controller.

- **single relay differential controller**
- **sensor monitoring**
- **on/off/autocontrol**
- **operations hour counter**

Wiring and operation instructions are included with the Regusol

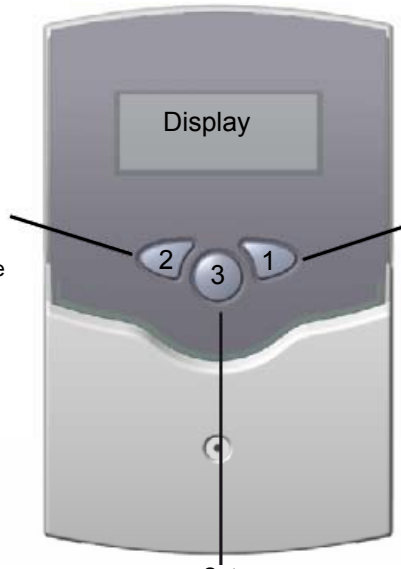
Diagram 2





Regusol EL 130 Pump Wiring Guide

Operation and Programming the Regusol Controller



Backward
Used for scrolling backward through the menu or to decrease the adjustment value

Forward
Used for scrolling forward through the menu or to decrease the adjustment value

Operating Mode and Display

Forward or backward buttons will indicate following information:
COL: Collector sensor temperature
TST: Tank temperature
hP: Operating hours counter

Press “Set” key for programming mode

Programming Mode

To begin programming mode, press forward key to hP display.

Press and hold forward key 1 in “hP” mode for 2 seconds.

Menu mode displays next indicator (DT 0) and may now be scrolled through rest of programmable settings using keys 1 or 2 (forward or backward through the entire menu).

Values in display settings may be changed by pressing “Set” (key 3). The “Set” icon will blink while in programming mode. Raise or lower values with keys 1 or 2. Press set button once more to complete change. “Set” icon will stop blinking.

Program Changes

“DT 0” differential turn on set point
The first program display will be “DT 0” differential turn on set point. DT 0 is set at 12 ºF. This indicates what turn on temperature the collectors must be above the tank to begin solar circulation. No change is necessary.

“DT F” differential turn off set point
The second indicator will be “DT F” differential turn off set point. DT F is set at 5 ºF. This indicates what turn-off temperature the collectors must be above the tank for solar circulation to end. No change is necessary.

Program Changes

Mode of Operation ON / OFF / AUTO
“HND 1”

Scroll through menu to “HND 1” display, near the end of the program menu. This is for the setting switch ON, OFF, or AUTO that allows the controller the function of operation. It is a service operation switch.

ON position energizes the pump to circulate at all times.
OFF position keeps the pump from circulating.
AUTO allows the controller to operate the pump based on the differential temperatures (normal operation).

Default setting is AUTO. To change press “Set” (key 3). Press key 1 or 2 to change into ON, OFF or AUTO mode. Press set key 3 again to complete change and before moving into the next menu.

Always leave the controller in AUTO for normal solar collection cycling.

“S MX” storage maximum set point
“S MX” is set at 140 ºF. This setting can be turned up only if there is a anti-scald valve installed on the DHW system.

To change press “Set” (key 3). Press key 1 to increase or 2 to decrease the storage maximum temperature. Press set key again to set change.

Operating and Programming the Regusol Controller

Program Changes

The factory settings for the following displays are suitable for all solar domestic hot water heating. For more information on these settings, read the control manual included with the Regusol 130.

“EM” limit collector temperature
Factory setting: 285^{o} F

“OCX” system cooling
Factory setting: OFF

“OCN” Minimum collector limitation
Factory setting: OFF

“OCF” antifreeze function
Factory setting: OFF

“OREC” option recooling
Factory setting: OFF

“O TC” tube collector special function
Factory setting: OFF

“OHQM” heat quantity balancing
Factory setting: OFF

The settings for the following displays are as follows.

“LANG” language
Factory setting: En (english)

“UNIT” Temperature in degrees
Factory setting: FAH (fahrenheit)

“PROG”
Controllers program

“VERS”
This indicates the program version

Section Eight

Collector Flush, Leak Check, and Fill Procedure

Before proceeding with the instructions outlined in this section, the solar storage tank should be filled with water. The collector loop then should be leak checked, flushed, and filled. A Regusol "fill and flush" valve should be installed for system charge-up. Filling or "charging up" a solar closed loop incorporates a **1/2 HP utility pump** available through most Oventrop dealers.

Leak Check and Flush

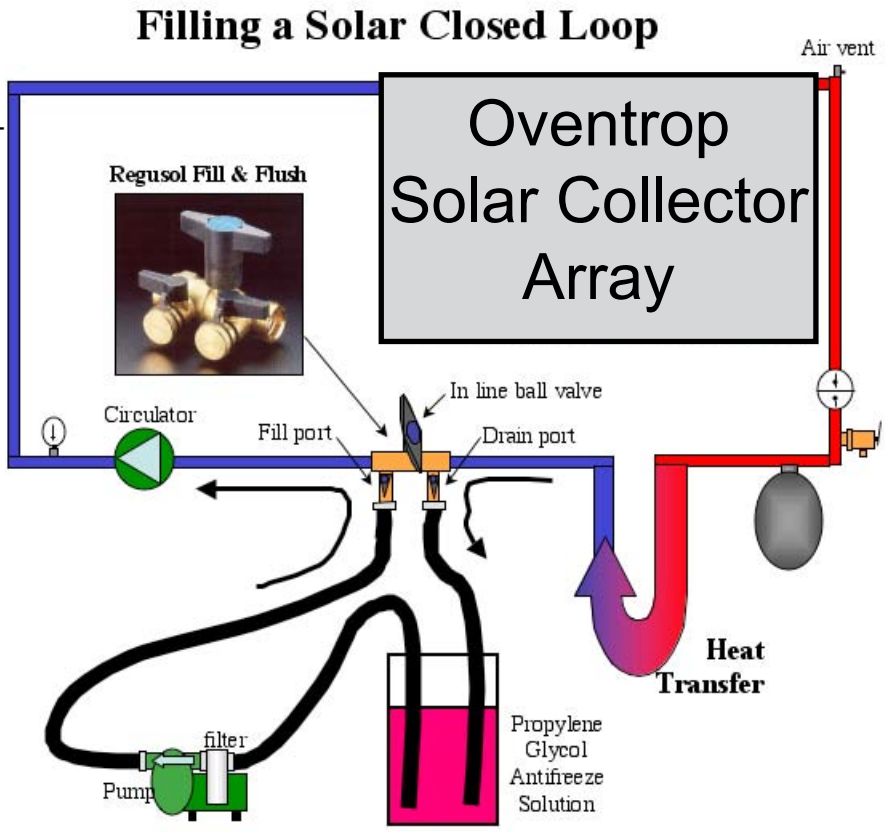
1. To ensure there are no leaks, air test the system to approximately 60 PSI. Check and repair any leaks. When the solar loop is leak-free, release air and flush system with tap water.
2. Before filling the collector loop with antifreeze solution, it must be flushed free of any flux, copper filings, or debris. Straight tap water may be used for this purpose.
3. To perform this step, hook up a hose from tap faucet to the fill port and run another hose from the drain port to a drain or outdoors. Close center ball valve on "flush and fill." Open water tap to begin flushing. Flush the system with tap water for approximately 10 minutes to assure there is no solder, flux, or debris left within the collector loop piping.

This step may also be used to cool the collectors before filling the system with propylene glycol.

Fill Procedure

Charging the collector loop will require approximately 3 - 8 gallons of Oventrop NT-40 antifreeze (provided). It is a premixed water-propylene glycol solution of 40% propylene glycol to 60% water and will provide freeze protection to -6 ^{o}F. **No mixing is necessary.**

If collector loop is to be charged during the sunlight hours, collectors should be covered for at least one hour before beginning; or the collector may be cooled with water using procedure in step 3 (above).



1/2 HP utility pump

Connect pressure side of charge pump with washing machine hoses to the fill port. From suction side of charge pump, attach another hose to the bucket of the propylene glycol solution. Attach another hose from the drain port to an empty bucket. If the system was just flushed with water, drain down the water pressure to prime the charge pump. Drain water pressure into empty buckets.

Set up for filling with solar heat transfer fluid. Turn center ball valve of "Regusol fill and flush" perpendicular to have propylene glycol flow throughout solar closed loop.

Turn on fill rig and pump propylene glycol. If pumping out water, have an empty bucket on the drain port hose to collect water until the color of antifreeze returns. Then put drain port hose into antifreeze bucket for circulating antifreeze. Run the charge pump until no air bubbles are seen returning to the bucket. Periodically close drain port to allow pressure to build, then reopen to purge any air that may be trapped. Watch for air escape. Repeat this procedure until air is no longer returning to the fill rig pail.

To complete system fill and charge, close the drain port and fill system to pressure of 30 to 35 psi. Close fill port and turn off charge pump. Turn center ball valve of “Regusol fill and flush” parallel to direction of flow to have propylene glycol flow throughout solar closed loop installation with the system pump in operation. Cover fill and drain ports with hose caps.

Open air vent atop solar collector to eliminate any air trapped at the high point of the system. Next open the air vent to remove air from the deaerator at the Regusol 130 EL.

Commissioning the System

Before activating system the following checks should be made:
- System filled with water (tank).
- Appropriate cold and hot water bypass valves are set for series water flow through tank(s).
- Collector and tank sensors connected.
- Regusol is wired and solar loop is air-tested for leaks.

The collector loop can now be filled with the recommended anti-freeze.
Once the solar loop is filled, place Regusol thermometer handles in the fully open position and the fill and flush valve in fully open position.
Plug in the Regusol controller for operation.

Controller will start and be in automatic mode of operation.
Digital display and indicator light should illuminate.
If the collector temperature is above the tank temperature by 12º F, the circulator should start and run. Flow meter will indicate circulation. If there is noise of air circulating through the pump, the system must be recharged to remove air bubbles. Solar closed loops must be free of air bubbles.

If the collector temperature is below the tank temperature, circulator should not run.
If circulator is not running, set the controller to the “On” position (see Operation and Controlling the Regusol Controller) to check circulator operation and indication of flow. Remember to leave the solar controller set in the “Auto” mode of operation when completed.

If circulator fails to operate, refer to Troubleshooting checks on the following pages.

It is unlikely that system malfunctions will develop within the Regusol. Should they occur, however, the following procedures will prove helpful. Several of the procedures indicated require the use of test equipment, such as a volt-ohmeter with 10K scale. If this equipment is not available to you, contact your authorized Oventrop dealer or distributor for service.

Section Nine

Trouble Shooting

1. Controller does not come on.	A. Controller is not plugged in B. Breaker tripped to off C. Blown fuse in controller D. Inoperative controller	A. Check to see if plug is in outlet B. Reset breaker C. Replace fuse D Replace controller
2. Circulator does not start or run in “on” position.	A. Shaft bound B. Blown fuse or breaker C. Bad electrical connection D. Inoperative controller	A. Remove plug at rear of circulators and insert screw driver into slotted end of shaft; turn to loosen shaft B. Replace fuse; or reset breaker C. Tighten connections D Replace controller
3. Circulators will not run with switch in “auto”	A. Same as A through D indicated above B. Inoperative sensor circuits C. Poorly attached or insulated sensors D. Inadequate temperature differential	A. Same as A through D indicated above B. Check sensor circuits and wiring C. Reattach or reinsulate D. System will not operate until preset conditions are met
4. Circulator runs constantly in “auto”	A. Inoperative sensors or sensor wire circuits B. Inoperative controller	A. Check sensor circuits and wiring, check for short in collector sensor circuit or open in tank sensor circuit Replace sensor wire or sensors B. Replace controller
5. Inadequate solar loop temperature.	A. Recent heavy usage of hot water C. Inoperative circulator D. Collector shading E. Ambient conditions F. Steam lock at solar collector	A. Wait until system temperature is replenished C. Remove plug at rear of circulator and insert screwdriver into slotted end of shaft, turn to loosen shaft D. Remove shading obstacles E. Wait until preset conditions are met F. Recharge solar closed loop to remove air from antifreeze solution
6. System losing temperature at night.	A. Inoperative check valve(s) B. Inoperative controller C. Inoperative sensor circuits	A. Make sure check valves in Regusol are not stuck open B. Replace controller C. Check sensor circuits and wiring

Trouble Shooting

Trouble	Probable Cause	Remedy
7. Inadequate hot water delivery temperature.	A. Recent heavy usage of hot water	A. Wait until system temperature is replenished
	B. Inoperative mixing valve	B. Adjust or replace mixing valve
	C. Ambient conditions	C. Wait until preset conditions are met
	D. Inoperative back-up hot water heater	D. Replace back-up tank or service thermostat or element in electric hot water heater (this should be done by licensed electrician)
	E. Inoperative existing system during periods of low solar insulation	E. Contact appropriate service
8. Tank pressure temperature relief valve blowing off.	A. Inoperative P/T relief valve	A. Replace P/T valve
	B. Hot water storage tanks building too much pressure	B. Install hot water expansion tank
	C. Water main pressure too high	C. Install Pressure regulator on cold water supply

Sensor Test

Use an Ohm meter to measure the resistance of the sensor circuit. If an open circuit or a short circuit situation is detected, then inspect the sensor wiring before suspecting the sensor. Measure the sensor resistance without the interconnecting wire before removing the sensor.
The resistance should match the chart for a given temperature.

°F	Ω	°F	Ω
14	961	131	1213
23	980	140	1232
32	1000	149	1252
41	1019	158	1271
50	1039	167	1290
59	1058	176	1309
68	1078	185	1328
77	1097	194	1347
86	1117	203	1366
95	1136	212	1385
104	1155	221	1404
113	1175	230	1423
122	1194	239	1442

Resistance values of the Pt1000-sensors

Maintenance Procedures

Cleaning. The solar collectors will not require cleaning in a climate in which there is periodic rainfall. A light coating of dust will not seriously affect performance. In dry, dusty climates, collectors should be cleaned occasionally.

Circulators and Controller. No scheduled maintenance is required for the fluid lubricated circulators or controller system. In the event of a circulator or controller malfunction, refer to troubleshooting Checks.

Collector Loop Fluid. Collector loop fluid must be changed in order to maintain adequate freeze and corrosion protection. Antifeeze checks should be performed annually. Collector loop fluid should be replaced every 5 - 7 years. To prevent elevated temperatures from developing at the collectors, do not turn the system off while absent from premises for extended periods.

Solar Storage Tank. Periodically drain a small amount of water from the bottom of tank to prevent sludge or sediment buildup in the solar storage tank.

Scaling. If your water supply contains a large percentage of minerals (hard water), we strongly recommend that a water softening device be installed to protect not only the stainless steel solar storage tank and coils but also the existing hot water heater and its plumbing as well.

Projections for various components average life cycle

OVSOL 5 evacuated tubes: expected lifetime against vacuum loss . . . . . 15 - 20 years
Dual or single coil indirect glass lined tanks: good water quality . . . . . 20+ years
Regusol 130 EL: Oventrop PE Controller and sensors, Wilo circulator . . . . . 10 - 15 years

All inquiries should be made to the product manufacturer:

Oventrop Corporation
PO Box 789
29 Kripes Road
East Granby, CT 06026
Ph. (860)413-9173
www.oventrop-us.com

Section Ten

Oventrop Corporation - Limited Warranty

Oventrop Corporation warrants to its “Customers” that all Oventrop products, used for heating and plumbing applications and sold in accordance with these warranty provisions, shall be free from defects in material and workmanship. “Customer” as used herein shall mean an end-user of Oventrop products.

Five (5) years for all solar components from the date of purchase, unless otherwise specified in writing.
Ten (10) years for evacuated tube collector from date of purchase, unless otherwise specified in writing.
Limited Lifetime for solar indirect water heater three (3) years from date of purchase, unless otherwise specified in writing.
In order to be eligible for a warranty claim, products sold
(1) must be installed and maintained professionally according to the relevant assembly instructions and the product manual,
(2) must only be used for purposes provided in the Oventrop Corporation’s product description or assembly instructions,
(3) must be exposed only to gaseous or liquid media approved for the product by Oventrop Corporation, and
(4) shall not be combined with products of other manufacturers unless otherwise stated in the product manual.

Oventrop Corporation’s sole obligation hereunder shall be, at its option, to issue credit, repair or replace any component or part thereof which is proved to be defective. The limited warranty does not cover cost for transportation or labor charges (including installation and removal) unless such charges are authorized in writing in advance by the Oventrop Corporation. Any repairs without the express written consent of Oventrop Corporation shall render this limited warranty invalid. Oventrop Corporation disclaims allowances for dismounting and consequential losses and damages.

Warranty claims must be received by Oventrop Corporation within the applicable warranty period and within thirty (30) days from when the cause for the claim occurred or was discovered. Upon receipt of prompt notice of a warranty claim, Oventrop Corporation shall have ten (10) business days in which to determine whether it acknowledges responsibility for any asserted defects in material or workmanship and the appropriate action to be taken.

This limited warranty and any claims arising from the breach of warranty, or any other claim arising hereunder, shall be governed and construed under the laws of the State of New York. No other persons than Oventrop Corporation employees have any expressed or implied authority to bind Oventrop Corporation to any agreement or warranty of any kind without the express written consent of Oventrop Corporation.

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THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE FACE HEREOF.