Installation Manual

Direct System

Manufactured by The LeverEdge 1423 Gunn Highway, Odessa, FL 33556

INTRODUCTION

CONGRATULATIONS ON YOUR DECISION

You have just invested in one of the finest energy-efficient home appliances available today. Your new Solar Water Heating System uses only the highest quality materials and workmanship, assuring you many years of dependable service. Your benefits are just beginning, so enjoy the comfort of not just knowing that your utility costs will be reduced, but also that you now own your own small utility company- you have hot, hot water "free" from the sun. Your solar water heater is truly "the world's most energy-efficient home appliance," and is a positive statement from you to the whole world that it is time to use products that are environmental friendly, safe and non-polluting. Your system is also a clean energy source which helps reduce our nation's dependence on foreign oil.

We would like to thank you for making a truly positive contribution to our global environment, future posterity, and for placing your confidence in our organization and product.

All questions which arise from this material should be answered before you attempt installation of the system. With a little thought and careful planning your system can be installed quickly and easily by yourself or by a qualified plumber with a minimum of disruption to your business or home.

This manual has been prepared to answer questions about the operation, maintenance and service of your solar system. Should you have any questions, or if we can be of service to you in the future, please feel free to contact us.

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PRE-INSTALLATION/INSTALLATION CHECKLIST

The solar collectors do not add a significant amount of weight to the roof. However, if the collectors are placed at a steeper pitch than the roof itself, the additional exposed flat surfaces could present extreme wind loading forces during sustained high winds. Check local codes for roof load requirements. The mounting hardware supplied with your Direct system has been designed for specific wind loads, but only if adequate support structure is present with sufficiently strong structural members (such as engineered trusses). Most building permit offices may be able to help you with recommended roofing practices for your area.

Obtain all applicable permits. Structural members penetrated by the solar system components must meet local codes. The installer is to run the piping in such a way that the performance of any fire rated assembly is not reduced. This applies to the collector mounting as well as the installation of any other system components.

Inspect the roof. If it is in poor condition, it is advisable to replace all or part of the roof where the system will be attached.

Locate a roof area facing as close to due south as possible for the placement of the solar collectors. The plumbing runs must be planned in advance so that the shortest possible route between the storage tank and collector is made. Make sure you have no low points in the sloped horizontal pipe runs. This could trap water and in freezing weather cause the collector tubing and/or the piping to rupture.

Make sure you have all the necessary plumbing materials, tools, and accessories before beginning work.

Wear gloves when handling the solar collectors! They get extremely hot when left exposed to the sun. The bright orange plastic caps should be removed prior to placing the collectors on the roof otherwise they may get so hot that they melt in place. Also, never try to lift the collectors by the pipe nipples. These bend when hot and would damage the collector. You should have a tarp handy to keep the collectors covered during the entire installation process. This will prevent the collectors becoming too hot to handle as you make your final adjustments and connections.

Use only lead-free solder. Use of 50/50 lead solder is expressly prohibited. Use of galvanized steel, CPVC, PVC, or any other type of plastic pipe is prohibited.

The Direct storage tank module is as easy to install as any normal electric water heater. Any experienced plumber or solar contractor may accomplish this installation. In addition to the normal cold water in, and hot water out connections, there are only two other connections required. Follow the instructions found in the “dream package”.

Dielectric nipples may be used on all connections to the tank. These are used wherever copper and galvanized lines are connected together. This is a requirement of the Uniform Plumbing Code. Typically, galvanized pipe nipples are used for all connections into the tank, which has ferrous female standard pipe thread, 3/4" nominal (3/4" inside diameter). One side of a dielectric union fits a standard galvanized pipe nipple, and the other side is brass or bronze for soldering to a copper pipe. However, most tanks use nipples that are dielectric so dielectric unions may not be required.

With solar tanks, the cold input from the pressurized supply line to the house (either city water or well water) must be fed into the tank inlet. This is marked "Cold Inlet" and is located on top of the tank. A long plastic tube is inserted internally to this connection so that incoming cold water is directed immediately to the bottom of the tank, and therefore does not mix and cool down the hot water. A cold-water shutoff valve must be installed above this connection so that water flow may be completely stopped in the event of a leak, repair, or maintenance.

The hot water output to the house from the tank should be connected to the port labeled "Hot Outlet" on the top of the tank. Again, a dielectric union must be used where a connection is made between galvanized and copper pipes. A mixing valve may be installed at this point to limit the temperature of water delivered to the home. The storage tank temperature can also be limited by the high limit function of the controller which offers an adjustable range (depending on controller) and is based off of the resistance value of the storage tank sensor.

All hot water lines should be insulated with at least 1/2" thick heat resistant rubber tubing insulation such as Halstead K-Flex.

In most instances, the solar collectors can be attached to the roof using the standard mounting hardware provided with the system. Certain types of roofing will require special attention for proper mounting, for example, a clay tile or cement tile roof. Complete roofing attachment methods of solar collectors for these various types of roofs are beyond the scope of this manual. The manual will describe and illustrate some of these approved mounting techniques. A competent contractor should be used to insure that all roof penetrations and attachment points are not a source of rainwater leakage later on. Standard plumbing roof jacks or solar industry copper flashings may be used for plumbing penetrations in most cases.

The collectors should be canted toward the inlet side to ensure that they can be drained manually by use of the system boiler drains.

CAUTION! Solar collectors become very hot when in direct sunlight with no fluid being circulated through them. Extreme caution should be taken when standing near, or handling solar collectors in this state. The circulating pump becomes very hot when running. Do not touch before allowing sufficient time to cool down

BASIC TOOLS AND MATERIALS

Electric Drill
Drill Index (w/ ½" and ¾" Wood Bits)
Hack Saw
Tubing Cutter
Tin Snips
16' Tape Measure
24" Level
Flashlight
Extension Cord
Slip Joint Pliers
Needle Nose Pliers
Pipe Wretches, 10" & 14"
Open End Wrenches, 9/16 & 7/16
Screw Driver 6" Flat Blade
Screw Driver 6" Philips
Wire Stripper or Knife
Wire Cutters

Adjustable Wrenches 8"& 10
Torch and Striker
Putty Knife
High Temperature Pipe Joint Compound
Wire Nuts or Connectors
Miscellaneous Copper Pipe & Fittings (3/4")
Solder & Flux
Emory Cloth
Poly Urethane Caulk & roof mastics
½" I.D. and ¾" I.D. Type M Copper Tubing
5/8", 7/8", 1 1/8", 1 3/8" Halstead rubber insulation only
Angle Iron
Threaded Rod, Nuts, & Washers
Stainless Screw Clamps
Thermal Adhesive
Flashing Sheets
Elastomeric UV inhibited water based paint

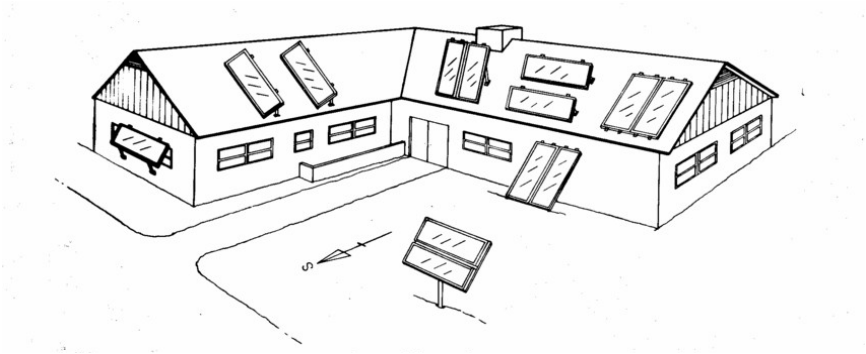
¼", 3/8", 7/16", ½", 9/16", Hand Tools (Wrenches)
Regular hand tools: nails, pencil, chalk line, hand cloths, nut drivers- ¼" thru 9/16"

COLLECTOR LOCATION

The collectors should be located on a south-facing roof, with the collector facing as close to south as possible. The collector should not be shaded from the sun, trees, or other obstructions. It is strongly recommended that the collector be mounted in the portrait orientation with its longest side traveling directly up the roof, if possible.

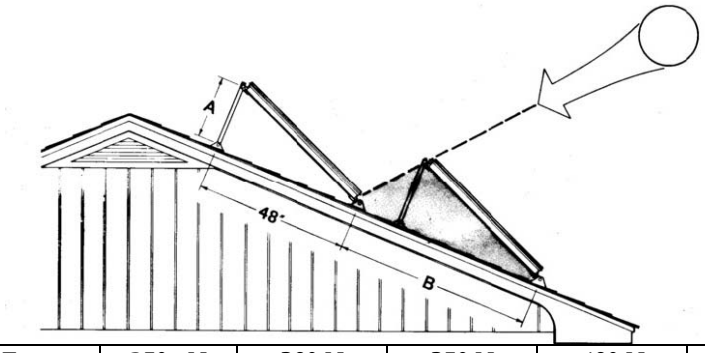
The Collector should be mounted at an elevation angle above the horizontal equal to your latitude +/- 10°. The procedures for determining this angle at your location are explained below.

Proper location and orientation of the solar collectors is important for maximum system efficiency. The collectors should be unshaded for the middle six hours of the day in each month of the year and should be located as close to the storage tank as possible to minimize heat loss in the piping runs. The best orientation is achieved when the collectors are facing due south and tilted at an angle from the horizontal of latitude +/- 10°. The figure below shows many alternatives for collector mounting. When roof mounting, place the collectors as close as possible to the peak of the roof, code permitting. This will make installation easier due to increased attic access.



COLLECTOR ORIENTATION

Proper tilt angle for solar collectors is latitude plus 10°. Plus mounting favors the winter sun because ambient temperatures are lower during the winter and collector efficiency suffers. This 10° additional tilt equalizes year round performance. Adding to the size of the collector array, mounting the collector(s) flush to the roof is most often the best option. Consult with the factors when determining your particular application. Flush mounts are more aesthetically attractive and reduce wind load damaged potential. Spacing can be determined from Table 1 below.
When collectors are mounted one behind the other, they are spaced apart so that in the morning and afternoon on December 21, when the sun is at its lowest altitude, the collectors will not shade each other and cause efficiency loss.



LATITUDE		25° ◦ N		30° N		35° N		40° N		45° N		50° N	
COLLECTOR TILT		35°		40°		45°		50°		55°		60°	
		A	B	A	B	A	B	A	B	A	B	A	B
ROOF PITCH	FLAT	29	96	33	113	37	145	41	145	44	145	48	145
	5 ◦ 1/12	25	83	29	93	33	113	37	132	41	133	44	141
	9 ◦ 2/12	22	74	26	82	30	77	34	110	38	115	41	118
	14 ◦ 3/12	17	66	22	72	26	82	30	92	34	95	38	98
	18 ◦ 4/12	14	61	18	66	22	74	26	81	30	85	34	87
	23 ◦ 5/12	10	58	14	60	18	66	22	72	26	74	30	77
	27 ◦ 6/12	7	58	11	58	15	61	19	66	23	68	27	70
	30 ◦ 7/12	4	58	8	58	13	58	17	58	21	58	25	58
	34 ◦ 8/12	0	58	5	58	9	58	13	58	17	58	22	58
	37 ◦ 9/12	-2	58	3	58	7	58	11	58	15	58	19	58
	40 ◦ 10/12	-4	58	0	58	4	58	8	58	13	58	17	58
	43 ◦ 11/12	-7	58	-3	58	-2	58	6	58	10	58	14	58
	45 ◦ 12/12	-8	58	-4	58	0	58	4	58	8	58	13	58
	VERTICAL	-44		-41		-37		-33		-29		-25	

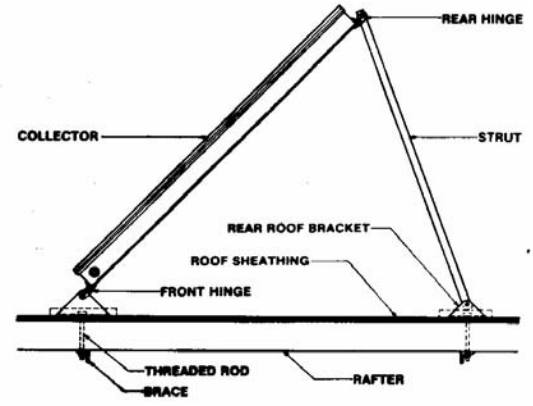
Table: All Lengths in inches

AE-Series			Center Line to Center Line (in.)		
Model	Size (ft)	Outside Box Dim. (in.)	AE -MH	AE -FM	AE -RM
AE-21	3 x 7	35.1875 x 85.1875	88.4375	88.9375	86.9375
AE -24	3 x 8	35.1875 x 97.1875	100.4375	100.9375	98.9375
AE -26	4 x 6.5	47.1875 x 77.1875	80.4375	80.9375	78.9375
AE -28	4 x 7	47.1875 x 85.1875	88.4375	88.9375	86.9375
AE -32	4 x 8	47.1875 x 97.1875	100.4375	100.9375	98.9375
AE -40	4 x 10	47.1875 x 121.1875	124.4375	124.9375	122.9375
MSW-Series			Center Line to Center Line (in.)		
Model	Size (ft)	Outside Box Dim. (in.)	MSC-MH	MSC-FRM	MSC-FM
MSC -21	3 x 7	35.8750 x 86.1250	90.5	87.375	37.125
MSC -24	3 x 8	35.8750 x 98.1250	102.5	99.375	37.125
MSC -26	4 x 6.5	47.8750 x 78.1250	82.5	79.375	49.125
MSC -28	4 x 7	47.8750 x 86.1250	90.5	87.375	49.125
MSC -32	4 x 8	47.8750 x 98.1250	102.5	99.375	49.125
MSC -40	4 x 10	47.8750 x 122.1250	126.5	123.375	49.125

Table: Distance between centerlines of top and bottom mounts for all mounting hardware.

MOUNTING HARDWARE

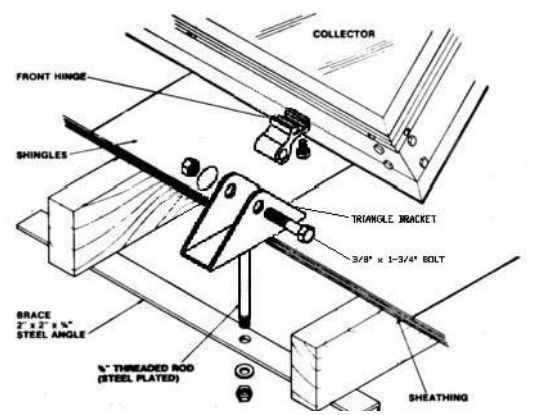
Provided in the "Dream Package" is specially designed mounting hardware to speed collector installation. This hardware consists of LOCK-TIGHT hinge sets, four roof brackets, and bolts for flush mount applications. Aluminum strut (optional) is required for tilt mount applications.

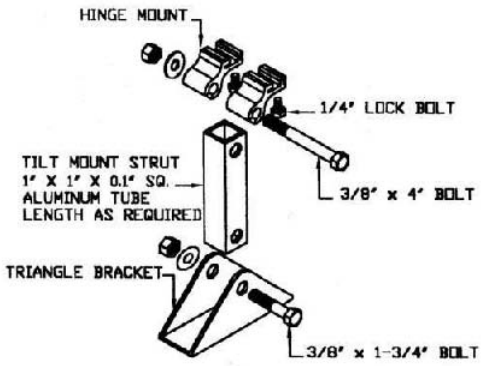


a) After locating the mounting points from Table 1, the mounting bracket holes should be drilled.
b) A heavy coating of sealant should be applied to the bottom of the flashing plate, which should fit flat against the roof. It is necessary for the plate to slide under the above shingles to insure proper drainage of water.
c) The bottom of the roof bracket and the area around the roof penetration should also be thoroughly coated with sealant. When the bracket is set in place, alignment with the collector hinges is necessary before final tightening. This should be completed before the sealant has time to set.
d) If threaded rod is used, fasten it through a 2' x 6" wood or 2" x 2" x ¼" steel angle bracket under the roof as shown.
e) Spacer blocks are required when the threaded rod is 2" or more from the rafter member
f) Consult factory for professionally installed lag bolts.

The rear struts should be cut and drilled to conform to Table 1. All bolts should be tightened securely. A stainless steel washer should be placed where the threaded rod passes through the aluminum bracket.

It is very important that the penetrations through the roof be well sealed. It should be carefully checked that all bolts are coated with tar and that no leaks are possible.





MOUNTING THE COLLECTORS ON THE ROOF

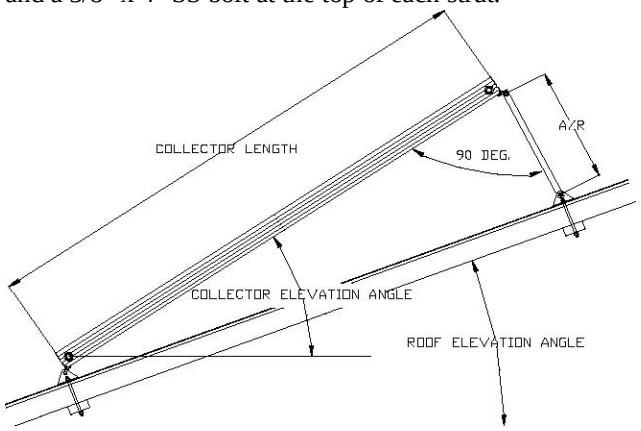
For flush roof mount installation, AE-FM brackets are attached to the bottom of the collector and secured directly to the roof.

1 The 4 x AE-FM mounting brackets should be attached to the collector frame using the 1/4" lock-bolt on the bracket underside. Two brackets should be used at each end, at 6 to 12 inches from the corner of the collector. The 1/4" lock-bolt should be tightened snugly against the collector frame bottom.
2 The AE-FM are now attached directly to the roof with 3/8" SS mounting bolts (not supplied) extending all the way through the roof trusses or 3/8" lag bolts (not supplied) drilled directly into the roof trusses as shown. Thoroughly check the tightness of all bolts and screws.

STANDARD MOUNT (AE-MH)

The AE-MH hardware kit allows the greatest flexibility in collector elevation angle when mounting the collectors on tilt or flat roofs.

1 The 4 x AE-Clips should be attached to the collector frame using the 1/4" lock-bolt on the bracket underside. Two brackets should be used at each end, at 6 to 12 inches from the corner of the collector. The l/4" lock-bolt should be tightened snugly against the collector frame bottom.
2 The two front AE-Clips are attached to the two front Tilt Mount Triangle Roof Mounting Brackets, with two 3/8" x 1-3/4" SS bolts.
3 The two front Tilt Mount Triangle Roof Brackets are now attached to the roof with two 3/8" SS mounting bolts (not supplied) extending through the roof trusses, or two 3/8" lag bolts (not supplied) drilled directly into the roof trusses.
4 The two rear AE-Clips are attached to the rear Tilt Mount Triangle Roof Mounting Brackets via the Tilt Mounting Struts, using a 3/8" x 1-3/4" SS bolt at the bottom and a 3/8" x 4" SS bolt at the top of each strut.



Note: The Tilt mounting Struts should be cut to length to provide the required collector elevation angle as described in the following section.

COLLECTOR ELEVATION ANGLE

Ideally, the collector should be mounted at an elevation angle equal to the latitude of the collator location plus 10 degrees. Estimate your latitude based on your location in the United States.

If your roof elevation is within +/- 10° of the ideal elevation, then it is recommended that the collector be flush mounted with the roof. If not, then you will have to determine the length of the Tilt Mounting Struts required providing the ideal elevation for your roof and location as follows:

CALCULATING THE LENGTH OF STRUT REQUIRED:

a. Determine the correct latitude column for your location.
b. Now locate the correct row for your roof elevation angle.
c. At the intersection of the column and row will be two strut lengths, in inches.
d. Select the appropriate length based on the orientation of the collector on your roof. Use the long column if the collector is mounted portrait style. Use the short column if the collector is mounted landscape style.
e. Cut the struts to length and drill a 7/16" hole at 3/4" from each end of the strut.
f. Assemble the strut bottom to the triangle bracket with the 3/8" x 1-3/4" SS bolt supplied, and the strut top to the base of the collector using the two AE-Clips and the 3/8" x 4” SS bolt supplied. Secure the tilt mount triangle brackets directly to the roof using two 3/8" SS mounting bolts (not supplied) extending through the roof trusses, or two 3/8" SS lag bolts (not supplied) drilled directly into the roof trusses.
g. Thoroughly check the tightness of all bolts and screws.
h. If length is in red, contact your LeverEdge representative.

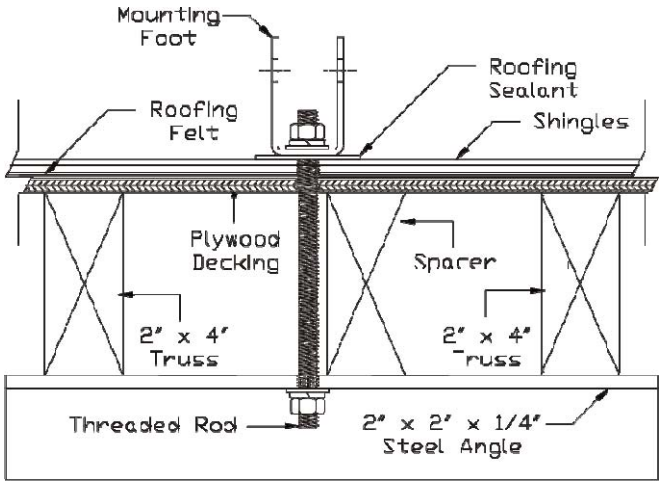
Latitude		25°N		30°N		35°N		40°N		45°N		50°N	
Ideal Collector Tilt Angle		35		40		45		50		55		60	
Collector Orientation		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Roof Pitch	Roof Angle												
Flat	0	59	25	70	30	84	36	100	43	120	51	145	62
1/12	5	48	21	59	25	70	30	84	36	100	43	120	51
2/12	9	41	18	50	22	61	26	73	31	87	37	104	44
3/12	14	32	14	41	18	50	22	61	26	73	31	87	37
4/12	18	26	11	34	15	43	18	52	22	63	27	76	32
5/12	23	18	8	26	11	34	15	43	18	52	22	63	27
6/12	27	12	5	19	8	27	12	36	15	45	19	55	23
7/12	30	7	3	15	6	23	10	31	13	39	17	48	21
8/12	34	1	1	9	4	16	7	24	10	32	14	41	18
9/12	37	N/A	N/A	4	2	12	5	19	8	27	12	36	15
10/12	40	N/A	N/A	0	0	7	3	15	6	23	10	31	13
11/12	43	N/A	N/A	N/A	N/A	3	1	10	4	18	8	26	11
12/12	45	N/A	N/A	N/A	N/A	0	0	7	3	15	6	23	10

Table: Determining the strut length required.

There are three acceptable ways to secure the collector mounting brackets to the roof.

1 Spanner Mounting
2 Lag Bolt Mounting
3 J-Bolt Mounting

In spanner mounting after the brackets are positions on the chalk line, a 3/8” hole is drilled between the rafters. Aluminum/Galvanized flashing is positioned over the hole where the top of the flashing is extended up under the shingle above the 3/8” hole and extends down over it. Caulk is applied between the flashing and the roof. The bracket is then positioned over the 3/8” hole using sealant between the bracket and the flashing. A piece of 3/8” all-thread is then inserted through the hole. A washer and nut secures the all-thread to the bracket (be sure the seal underneath the washer and on top of the nut). The all-thread rod should extend about 4” below the roof rafters. Drill a 3/8” hole in a 2 x 4 and insert the all-thread rod through it. The 2 x 4 should span 2 rafters. With a washer and double nut secure the all-thread to the 2 x 4. After inserting 2-2”x4”X 6” to 12” long spacers on each side of the all-thread, or insert only one sleeper if the all-thread rod is within 4” of the rafter, tighten down until the bracket is tightly secured to the roof. Be careful not to over-tighten.



Spanner Mounting

In lag bolt mounting you must locate the center of the rafters along the top and bottom chalk lines. One way, called “sounding the roof and nail” method, allows one person to do the entire layout from the roof surface. Tap roof with hammer, denser sound indicates general location of rafter. Drive 6 or 8 penny nails into rafter width until nail pushes to one side, on either side of rafter. Centerline of rafter is between these two nails. Move up ½” and mark this centerline. Caulk and place flashing under the shingle, drill ¼” pilot hole a minimum of 3” into rafter. Caulk top of shingle, install mount and finish by caulking over the exposed heads of the lag bolts.

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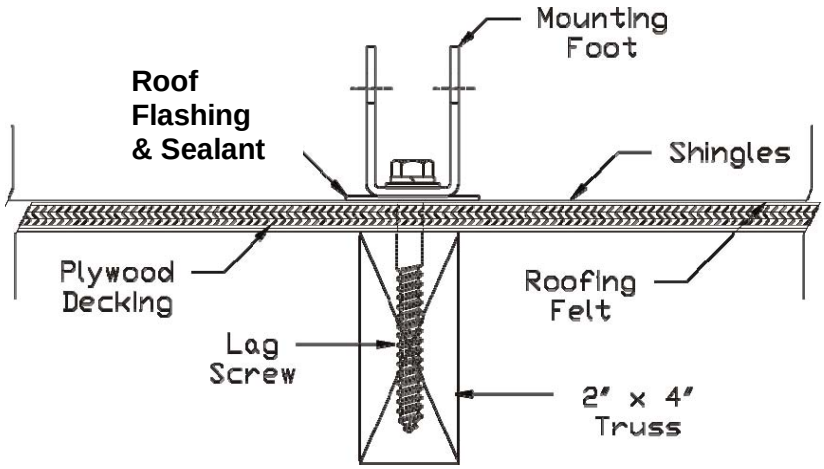
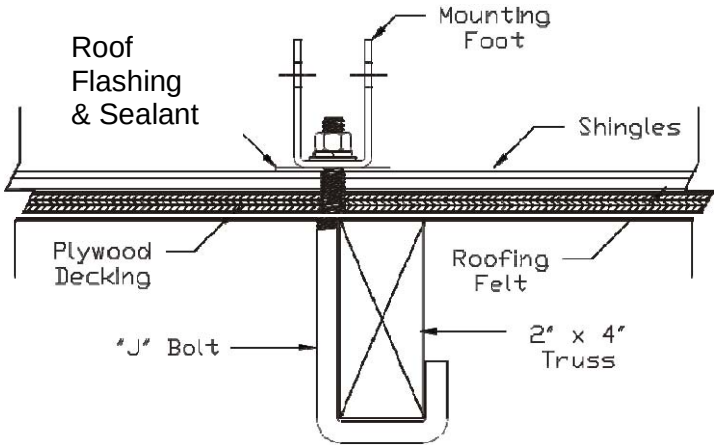


Lag Bolt Mounting

J-bolt mounting is done very similar to lag screw mounting except instead of drilling into the center of a rafter; a hole must be drilled directly beside a rafter. The size of the hole must be slightly larger than the bolt diameter. This is more easily accomplished if the attic man would drill a pilot hole through the roof along side the chosen rafter.

Fit the bolt through the mounting brackets and insert the bolt (J side first) through the hole in the roof. Work the J underneath the rafter. Pull the J-bolt snug against the rafter before tightening the nut. Use double nuts or lock-washers to securely fasten the mounting bracket to the J-bolt.

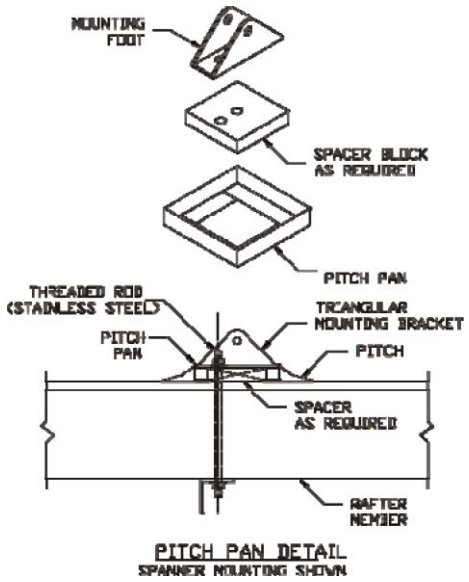


J-Bolt Mounting

PITCH PAN

The pitch pan is necessary any time standing water is encountered. The purpose is to provide an adequate seal around any penetration in the roof. Pitch pans are commonly used on flat roofs.

a. The pitch pan is placed in the proper position and flat on the roof.
b. Its flange is sealed with roofing felt and hot tar.
c. The holes are sealed on the inside with roofing tar to a sufficient level to insure a permanent seal.



Pitch pan

ARRAY MOUNTING

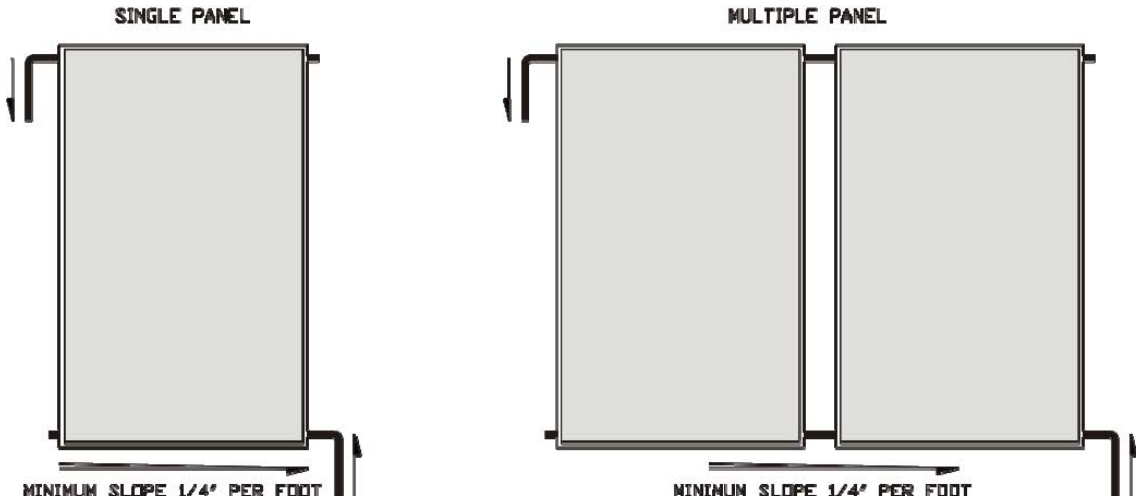
Tile roofs are a little more difficult to mount solar collectors on but following this procedure will render a leak free installation.

The solar panels are mounted on two rails located at the top and bottom of the solar collectors. The collectors Unistruts are secured to the rails using the AE rack mount hardware (AE-RM). The 1 5/8" Aluminum rails are anchored to the roof by using four-inch stainless steel 3/8" diameter hanger bolts for up to two collectors. These bolts are lag screw on the bottom and 3/8 NPT thread on the top. Unistrut, up to ten feet in length, should be manually be anchored at four to eight points, with equally distributed loads, or as code requires.

COLLECTOR PIPING

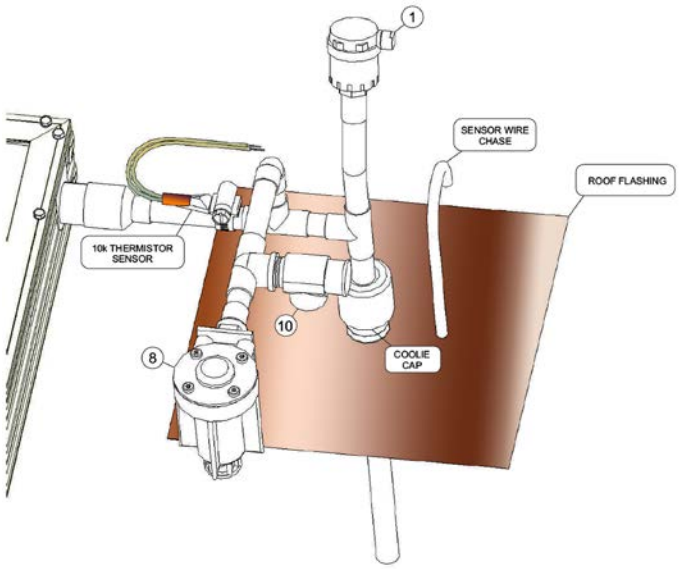
All collectors and piping must be sloped a minimum of ¼" per foot for drainage. All piping must drain without any fluid "traps." Soldered connections should be made with 95/5 solder.

The piping of the system should be considered before a final decision is made on how the collectors are mounted. Piping should be made of not less than ¾" I.D. copper tube of the type meeting local codes, insulated with Armaflex or similar, and painted with exterior latex paint or wrapped with aluminum tape where exposed ultraviolet radiation. Piping is be supported using plumbers strap and should be installed in such a manner as to not crush the insulation.



COLLECTOR PIPING DETAIL

The outlets of the collector are 1" copper nipples. The diagram below illustrates the collector outlet valve assembly and roof flashing detail.

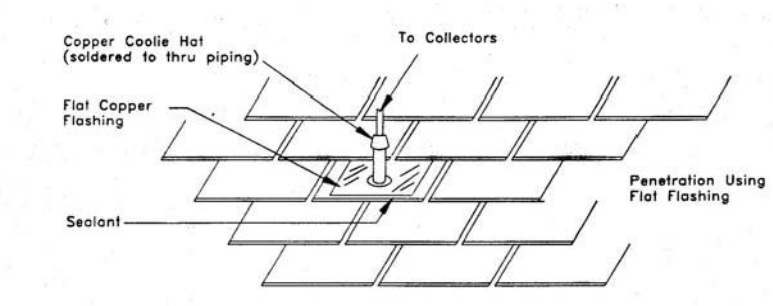


PIPING THROUGH THE ROOF

Piping through the roof should be weatherproofed as shown in Figure below.

a. One inch holes are drilled through the roof on the same plane as the supply and return header nipples. Do not drill the hole above the supply header of the collector. This will prevent the collector from draining. Placing the hole below the supply header is acceptable, but it is more aesthetic if it is located on the same plane. A flashing is placed around the hole with its base cemented to the roof and its upper edges slid under the adjoining shingle. Placing the flashing completely under the shingle is preferred.
b. The copper tube supply and return line is then pushed up through the hole in the flashing.
c. A "coolie cap" is then slid over the copper tube till it meets the flashing. After piping to the collectors is completed, the "coolie cap" is soldered to the copper tube.
d. Polyurethane adhesive is placed on the top and bottom of the flashing, providing a weatherproof seal.
e. The sensor wire should also be run through the return flashing which is equipped with a special wire chase (tube).

NOTE: the sensor wire should not be in direct contact with the return plumbing. Secure the sensor wire to the outside of the return pipe insulation.



Piping through roof

STORAGE TANK PLACEMENT

To minimize expense and heat loss, the tank should be placed near the collectors and central to points of greatest water demand. It should be located in as warm a spot as possible, away from areas which would subject to freezing temperatures. It should be located with adequate ventilation, with a minimum of 6-8 inches of clearance and with ready access to controls and serviceable parts.

Provision should be made to prevent water damage in case of leakage. A catch pan with a minimum of ¾" drain line at least 2" in height may be installed and pitched for proper drainage. Electrical service of 115-120VAC should be available for the pumps and controller.

PLUMBING TO THE COLLECTORS

All pipe runs between the solar collectors must be solidly attached with proper clamping methods and properly insulated with 1/2" minimum K-Flex Insultube, or equal rubber type insulation, pipe insulation (pipe insulation should be rated for 230°F). Insulate all hot water piping, as well as all of the exposed cold water piping at the entrance to the solar tank. Pipe insulation, exposed to the sun, should be painted with the elastomeric UV inhibited paint, provided with "dream package" systems.

A pressure and temperature relief valve must be installed on the storage tank.

All plumbing runs between the tank and the solar collectors should be completely vertical when going up and down vertical wall surfaces. **All horizontal runs should be sloped at a pitch of l/4" inch per foot back down towards the direction of the tank.** Care must be exercised in planning the installation so that no low points are created where water may become trapped. For example, a flat roof with a parapet wall should be penetrated rather than running pipes parallel to the roof surface then go up over the parapet wall before going down again. This would create a rather long horizontal low point in the pipe run where water gets trapped, and it would be unable to properly drain.

All plumbing connections to the solar panels should be made with copper pipe only. CVPC may not be attached to the solar collectors, as very high temperatures may be reached on hot summer days.

Multiple collectors must always be connected in parallel as shown in the plumbing schematic.

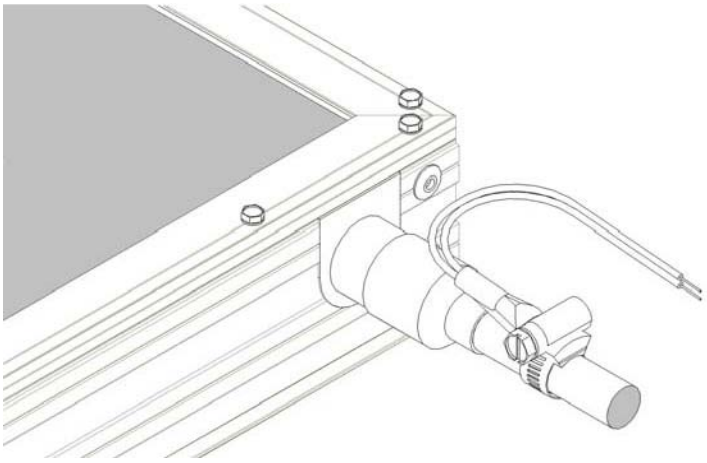
Installation of an anti-scald valve may be required. This is an automatic cold water mixer on the hot water side of the tank, which supplies hot water to the house. Refer to the system drawing in this document, for the installation location of this valve. Only ASSE 1016 and 1017 certified valves are to be used with this system.

SENSOR INSTALLATION

The hot collector sensor should be mounted on the solar collector header pipe as described below. The storage tank sensor should be mounted at the bottom of the storage tank.

SENSOR MOUNTING AT THE COLLECTOR

1 The hot collector temperature sensor should be mounted directly on the output or return collector header using a stainless steel band clamp as shown in the figure below.



Installing the Collector Sensor

2 Run the sensor wire outside the pipe insulation to the collector.
3 Connect the collector sensor to the sensor wire using the connectors supplied, after cleaning and heat sinking both contact points. Seal wire connectors with a polyurethane-based sealant.
4 All wire that is exposed to the sun should be protected from UV degradation using UV paint supplied. Also, properly secure the sensor wire runs.
5 Cover the sensor with pipe insulation to protect it from the elements.

SENSOR MOUNTING AT STORAGE TANK

On many of the solar tanks, the heat sensor is located behind the bottom front cover.

1 Remove screw that secures the bottom cover to the tank.
2 Remove the cover insulation until the shell of the tank is visible.
3 Locate the ¼" threaded stud and nut and the two sensor wires that were factory run from the top of the tank.
4 Remove the ¼" nut from the stud and place the sensor on the stud after cleaning and applying heat sink compound to sensor and tank contact points, secure sensor to tank by tightening nut.
5 Attach the wires on the sensor to the factory run wires with the supplied connectors, caulk connectors, turn wire nut tops up which prevents condensate from shorting sensor. Note: it does not matter which wire is attached to the other.
6 Replace the insulation and bottom cover.

Note that some water heaters will have factory installed sensors in the tank or just female plugs. In these cases installers will use sensor installation information provided and standard industry practices in mounting the tank sensor.

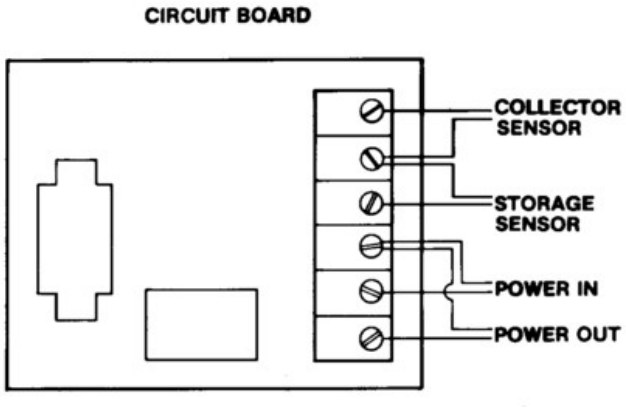
ELECTRICAL INSTALLATION

All connections should be made in accordance with local electrical codes. A qualified electrician or contractor is required to install a 115-120VAC duplex receptacle adjacent to the solar storage tank. This receptacle is used to supply power to the differential controller which provides electrical service the pumps.

THE DIRECT STORAGE TANK

This system is comprised of the following components:

- Collector(s)
- Storage Tank
- Differential Controller
- Pump
- Balance of system valve, fittings and insulation



ALL CONNECTORS SHOULD BE MADE IN ACCORDANCE WITH LOCAL ELECTRICAL CODES!

DIFFERENTIAL TEMPERATURE CONTROLLER

See instructions provided with controller in box for proper installation. Specifications for controller:

Operating Voltage 105 to 125 vac, 60 Hertz
Control Relay Contact Rating One third HP inductive load.
Turn-On Differential 10°F (+1°F) for Storage Sensor at 135°F
Turn-Off Differential 5°F (+1°F) for Storage Sensor at 135°F
Sensor Matching Accuracy 1°F Or Less At 135°F
Maximum Sensor Temperature 300°F
High Limit Setting Variable – see controller instructions

ATTENTION INSTALLERS

PREFABRICATION OF SOLAR STORAGE TANK

1. Check tank (13) dip tubes for proper length at nipple (A), (B), (C) and (D). There should be no dip tube in nipple (B) as this is the hot water supply to the house. Nipple (D) or Solar return dip tube should have a closed bottom with 12 drilled holes up about 1' from tank bottom. Nipple (C), the solar supply dip tube should extend to within 0'-6" of tank bottom, with no sidewall holes, (plain dip tube). Nipple (A) or the cold water dip tube should have one, 1/16" hole, in its sidewall, approximately 8" from the top.

2. Wrap all male threads with teflon tape. There are four nipples coming out of the tank, (A), (B), (C) and (D), a temperature and pressure relief valve and one male adapter (field fabricated onto ¾" pipe) to be wrapped.

3. Screw hot to house and cold to tank (¾" CF w/ 4" copper pipe) onto nipple (A) & (B) respectively.

4. Screw the T&P valve into the proper place, exit pointing in direction of choice but never block anode rod removal. Never apply heat at or near T&P's. Remove first, then solder as necessary.

5. Screw ball valve with pump assembly onto nipple C (solar supply) and face front of ball valve (8) toward front of tank. Insulate from tank to bottom of pump with 7/8" insulation. Split, punch valve stem hole, glue.

6. Screw the collector return assembly onto nipple (D) and tighten with red ball valve (13) facing front of tank. Insulate from tank to bottom of motorized ball valve with 7/8" insulation. Split, punch valve stem hole, glue.

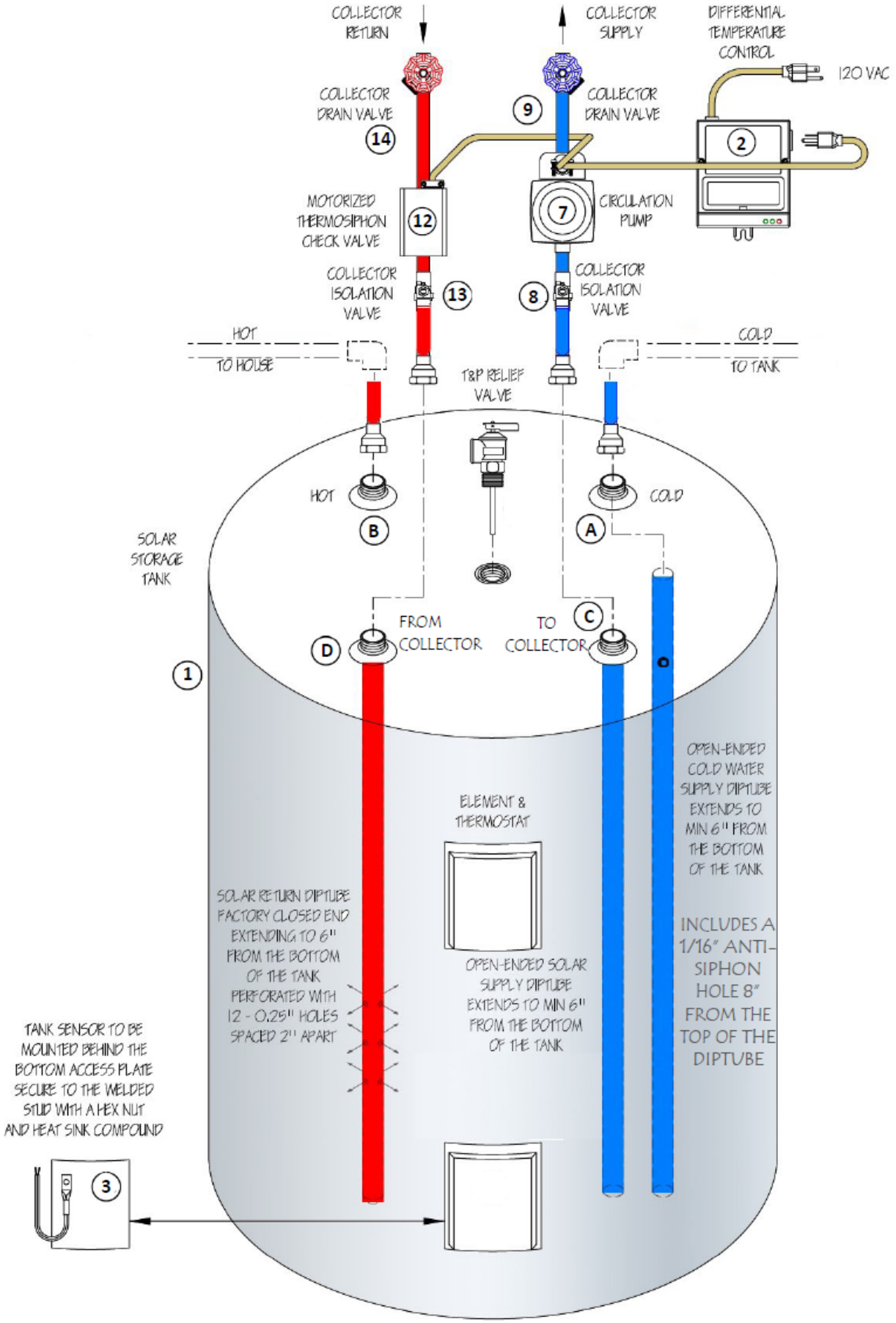
7. Complete tank top installation, hot, cold and T&P lines. Insulate ALL per directions in # 8 below. Remember to comply with all local codes, especially for over pressurization, and install those items as required.

8. Pipe insulation for the prefabricated tank (field cut)
    i. Cold to Tank - 7/8" x 6" minimum
    ii. Hot to House - 7/8" x 10" minimum
    iii. Solar Return - 7/8" x 6 to reach bottom of motorized ball valve
    iv. Solar Supply - 7/8" x 6 to reach bottom of pump
    v. T&P Valve - 1-1 3/8" x 3 + 1 - 7/8" x 6" (never cover T&P lever)

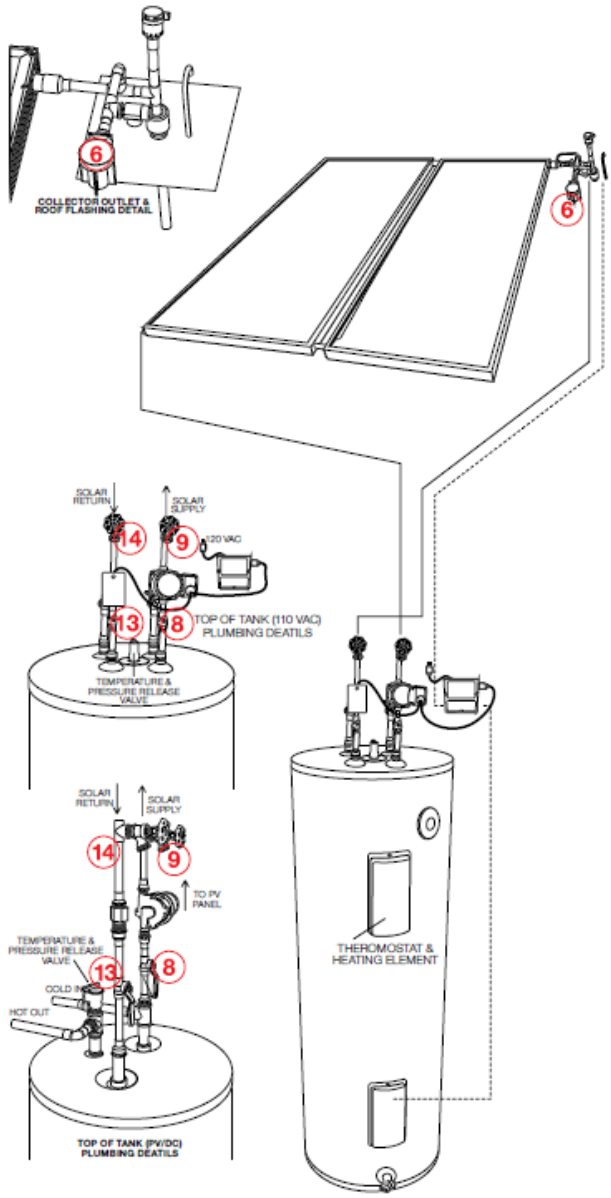
9. To install sensor (3), remove bottom plate, and locate sensor nut. Remove the nut, clean contact surfaces, apply heat sink compound, replace nut, insulate sensor thoroughly and replace cover.

10. Hook up electrical wires off pump to motor ball valve (12) on the solar return line by removing cover of ball valve – insert Romex connector – attach wires with nuts – replace valve cover.

PREFABRICATED TANK KIT DIAGRAM



SYSTEM INSTRUCTIONS STICKER (TANK)



WARNING

(IN THE EVENT OF FREEZING CONDITIONS, READ HOW YOU CAN REDUCE THE PROBABILITY OF A FROZEN SYSTEM.)

FREEZE PROTECTION VALVE:

a. Some systems are equipped with a Freeze Protection Valve (6) designed to open at temperatures above freezing. This valve will release water on the roof and operates similar to the old method of slightly opening a faucet to prevent freezing – a practice often used in northern climates.

b. The homeowner should not be unduly alarmed if this valve releases water on the roof at temperatures not considered cold enough for water to freeze. The collector absorbs cold as well as heat and it can, under certain conditions, be as much as 20 degrees cooler than the ambient temperature, which in turn will activate the valve.

c. If the water is dribbling from this valve off the roof, **DO NOT** isolate the system unless you also drain it.

RECIRCULATORY FREEZE PROTECTION:

When control is on "Auto" position and freeze conditions occur, the system is designed to function as follows:

a. A freeze sensor located on the collector outlet will "sense" freeze condition at collector. Freeze information is transmitted via sensor wire to Control

b. After receiving this information, Control will turn on pump to circulate water through the collector(s).

NOTE: If electricity is not supplied to the solar system, this method of freeze protection will not function.

c. Not available with some Utility Rebate Programs and on some systems

MANUAL DRAINDOWN:

a. Turn pump off – any of the following ways:

1. Unplug Control from 110 Volt Outlet
2. Unplug Pump from Control
3. Turn Control switch to "OFF" position, if available. (This procedure shuts down electrical portion of the solar system.)

b. Close Valve (8) and (13) if a leak or freezing conditions occur affecting the solar system. Attach hose to drain valve (9) and place container under drain valve (14). Open both valves (9 & 14) to allow the system to drain and leave the valves open.

TO RESTART SYSTEM AFTER DRAINDOWN:

a. Attach a hose to drain valve (14) with opposite end going to the outside or to a sewer drain.

b. Close drain valve (9)

c. Open valve (8)

d. Wait one minute, or until all air has been purged from the system, close valve (14) and remove hose.

e. Open valve (13)

f. START UP electrical portion of solar system by reversing STEP a. under MANUAL DRAINDOWN procedure above, making sure the Control switch is in the "Auto" position.

FOR ADDITIONAL INFORMATION PLEASE REFER TO OWNER'S MANUAL

Dealer:

Phone:

SYSTEM DIAGRAM