



FAFCO[®]

SOLAR WATER HEATING

500 Series Closed Loop Solar Hot Water System

Installation Manual

Note: This manual provides a detailed, step-by-step procedure for installing the Solar Water-Heating System. The directions should be followed properly, and only recommended components and hardware should be used. This will ensure a trouble-free system that will maintain the warranty while providing solar energy and savings.

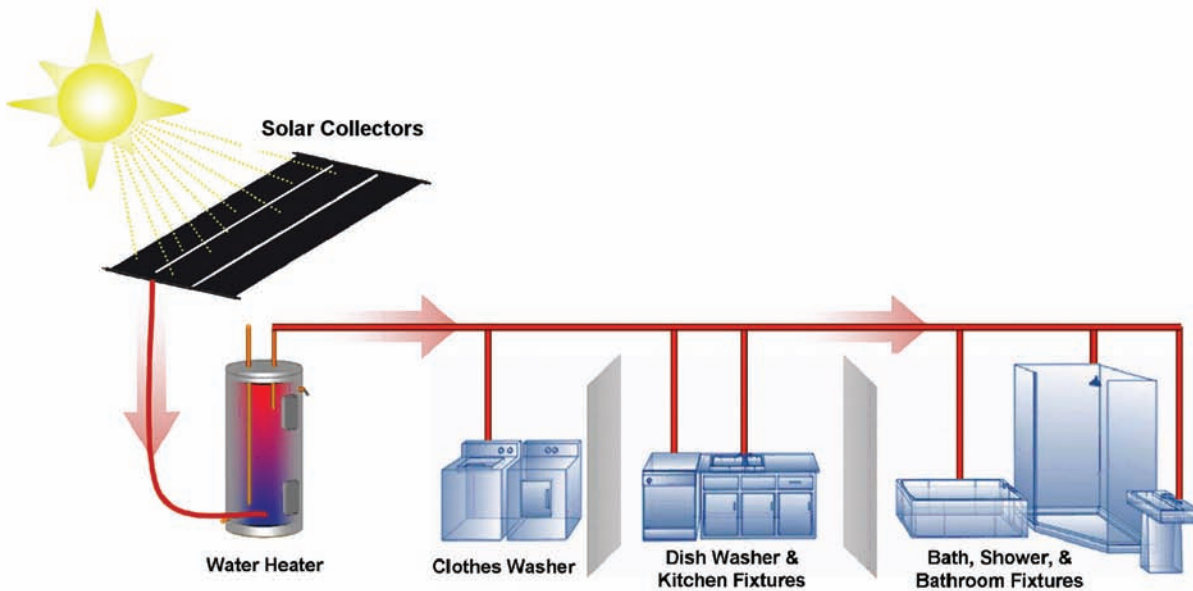
Made in the U.S.A.

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Introduction

The Solar Water Heating System is designed to provide a significant portion of the water-heating energy required in a typical home. Solar energy is absorbed by the solar collectors, and heated water is circulated through the water heater. Heated water is drawn from the water heater by various household fixtures and appliances, such as a clothes washer, dishwasher, bath, shower, and other fixtures.



System performance is affected by available solar energy, the solar collectors' installed pitch and orientation, groundwater and ambient air temperatures, and the daily household hot water demand comprised of bath, kitchen, and laundry use. These conditions, which may vary from home to home even in the same neighborhood, determine how much energy your solar system will save.

⚠️ WARNING ⚠️

Dangerous Heights

Solar collector(s) are often installed on the roof of a building. Unless you're familiar with working on roofs and have the proper ladders and safety equipment for such work, you should hire someone with the necessary experience to do the installation. Failure to observe safe practices on a roof or other elevated structures may result in falling and serious injury. Working alone increases the chance of an accident happening. Be sure to have help or someone nearby to assist you.

High Voltage

Some aspects of installation involve working around and with high voltage. Electrical connections to the hot water heater (if electric) are typically 240 VAC and CAN KILL YOU. Use precautions and ensure that all electricity is shut off to the area in which you're working. Use the breaker box and remove the breaker if you have to. Check with a voltmeter to verify the voltage is off before contacting any electrical connections. Consult with a licensed electrician if you have any doubts about the process. Check your local building codes.

High Water Pressure and Temperature

Electric and gas water heaters operate at high water pressure and temperature. Be sure to turn off your water supply and open drain valves to depressurize the system before unthreading or cutting into any part of the water heater plumbing. Consult a licensed plumber if you have any doubts. Check your local building codes.

WATER TEMPERATURE REGULATION

Hot water is dangerous. Water temperature to the home can be regulated by adjusting the temperature control valve. The recommended set point is 120° F. There is a scald potential if the temperature control valve is set too high.

Hot water can produce first degree burns within:

- 120° F (49°C) more than 5 minutes
- 130° F (54°C) at 20 seconds
- 140° F (60°C) at 3 seconds
- 150° F (66°C) at 1-1/2 seconds
- 160° F (71°C) at less than 1 second



HEAT TRANSFER FLUID AND FREEZE PROTECTION

Page 21 of this manual contains instructions to mix a minimum 35% FAFCO HTF with potable water. Use of any other heat-transfer fluid will void warranty, and may result in poor performance and/or equipment damage. This mixture is sufficient for any freezing conditions per Section 21.5 of the ASHRAE Handbook, Fundamentals which states, "If the fluid is being used to prevent equipment damage during idle periods in cold weather, such as winterizing coils in an HVAC system, 35% propylene glycol is sufficient. These concentrations will allow the fluid to freeze. As the fluid freezes, it forms a slush that expands and flows into any available space. Expansion volume must be included with this type of protection. If the application requires that the fluid remain entirely liquid, use a concentration with a freezing point 5°F below the lowest expected temperature. Avoid excessive glycol concentration because it increases initial cost and adversely affects the fluid's physical properties." Freeze protection is conservatively estimated down to -20°F. **Freeze tolerance limits are based upon an assumed set of environmental conditions.** MSDS is available at www.fafco.com for information on disposal and First Aid. FAFCO system is overheat protected and has little metal in contact with fluid. It therefore does not promote deposits, corrosion, or degradation of fluid mixture.

Code and Certification Requirements

Code requirements

Refer to the local authority having jurisdiction, such as the local building department or utility, to ensure all installation work meets applicable requirements. Use the FAFCO permit package, available for download at www.fafco.com, to submit to the local authority having jurisdiction for permitting. All installation work should be performed by a properly licensed contractor. Backup water heater and/or storage tank must be listed and labeled by an accredited listing organization, meet national standards, be labeled with maximum temperature and pressure, and have minimum R-12 insulation. Do not remove, bypass, or alter temperature pressure relief valve from backup water heater and/or storage tank.

Certification requirements

Refer to the local authority having jurisdiction and incentive providers for certification requirements.

FAFCO solar collectors and systems listed in Specifications, page 25, are certified by the Solar Rating and Certification Corporation (SRCC), a nationally recognized certification for solar water heating collectors and systems. The solar energy system described in this manual, when properly installed and maintained, meets the minimum standards established by SRCC. This certification does not imply endorsement or warranty of this product by SRCC. Specific minimum SRCC installation requirements are listed below:

1. Building penetrations do not impair enclosure function.
2. Building penetrations do not allow insect or vermin intrusion.
3. Building penetrations meet applicable codes and National Roofing Contractors Assoc. practices.
4. Structural members penetrated by solar system components meet code.
5. Building materials adjacent to solar components are not exposed to elevated temperatures.
6. Collector mounting is capable of maintaining tilt and azimuth.
7. No excessive shading of collectors.
8. Hangers provide correct tube support.
9. Hangers provide correct tube pitch.
10. Hangers do not compress insulation.
11. Control sensors and wiring are protected.
12. Penetrations through fire-rated assemblies do not reduce fire resistance below code.

SRCC model numbers

Up to date model numbers can be found at SRCC's website, www.solar-rating.org.

OG-100:

- 2'X12' COLLECTOR: SRCC MODEL 2007030A AND 2'X8' COLLECTOR: SRCC MODEL 2007030B



OG-300:

Solar Collector Area (sq-ft)	Solar Tank Volume (gal)	2'x12' Collectors				2'x8' Collectors			
		Electric Water Heater		Gas Water Heater		Electric Water Heater		Gas Water Heater	
		Dual Tank	Single Tank	Dual Tank	On-Demand	Dual Tank	Single Tank	Dual Tank	On-Demand
A/C									
48	50	AC24UX2-50E-50S	AC24UX2-50E	AC24UX2-50G-50S	AC24UX2-TG-50S	AC16UX3-50E-50S	AC16UX3-50E	AC16UX3-50G-50S	AC16UX3-TG-50S
48	80	AC24UX2-50E-80S	AC24UX2-80E	AC24UX2-50G-80S	AC24UX2-TG-80S	AC16UX3-50E-80S	AC16UX3-80E	AC16UX3-50G-80S	AC16UX3-TG-80S
48	120	-	AC24UX2-120E	-	AC24UX2-TG-120S	-	AC16UX3-120E	-	AC16UX3-TG-120S
96	50	AC24UX4-50E-50S	AC24UX4-50E	AC24UX4-50G-50S	AC24UX4-TG-50S	AC16UX6-50E-50S	AC16UX6-50E	AC16UX6-50G-50S	AC16UX6-TG-50S
96	80	AC24UX4-50E-80S	AC24UX4-80E	AC24UX4-50G-80S	AC24UX4-TG-80S	AC16UX6-50E-80S	AC16UX6-80E	AC16UX6-50G-80S	AC16UX6-TG-80S
96	120	-	AC24UX4-120E	-	AC24UX4-TG-120S	-	AC16UX6-120E	-	AC16UX6-TG-120S
144	50	AC24UX6-50E-50S	AC24UX6-50E	AC24UX6-50G-50S	AC24UX6-TG-50S	AC16UX9-50E-50S	AC16UX9-50E	AC16UX9-50G-50S	AC16UX9-TG-50S
144	80	AC24UX6-50E-80S	AC24UX6-80E	AC24UX6-50G-80S	AC24UX6-TG-80S	AC24UX6-50E-80S	AC16UX9-80E	AC16UX9-50G-80S	AC16UX9-TG-80S
144	120	-	AC24UX6-120E	-	AC24UX6-TG-120S	-	AC16UX9-120E	-	AC16UX9-TG-120S
PV									
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48	120	-	PV24UX2-120E	-	PV24UX2-TG-120S	-	PV16UX3-120E	-	PV16UX3-TG-120S
96	50	PV24UX4-50E-50S	PV24UX4-50E	PV24UX4-50G-50S	PV24UX4-TG-50S	PV16UX6-50E-50S	PV16UX6-50E	PV16UX6-50G-50S	PV16UX6-TG-50S
96	80	PV24UX4-50E-80S	PV24UX4-80E	PV24UX4-50G-80S	PV24UX4-TG-80S	PV16UX6-50E-80S	PV16UX6-80E	PV16UX6-50G-80S	PV16UX6-TG-80S
96	120	-	PV24UX4-120E	-	PV24UX4-TG-120S	-	PV16UX6-120E	-	PV16UX6-TG-120S
144	50	PV24UX6-50E-50S	PV24UX6-50E	PV24UX6-50G-50S	PV24UX6-TG-50S	PV24UX6-50E-50S	PV16UX9-50E	PV16UX9-50G-50S	PV16UX9-TG-50S
144	80	PV24UX6-50E-80S	PV24UX6-80E	PV24UX6-50G-80S	PV24UX6-TG-80S	PV24UX6-50E-80S	PV16UX9-80E	PV16UX9-50G-80S	PV16UX9-TG-80S
144	120	-	PV24UX6-120E	-	PV24UX6-TG-120S	-	PV16UX9-120E	-	PV16UX9-TG-120S

Expected operating conditions

MEASUREMENT	SYSTEM ACCESS POINT	EXPECTED VALUE
Temperature	Controller display	DT greater than 10°F when operating
Pressure	Expansion reservoir	Less than 1 psi
Flowrate	Solar or Potable Loop	1 to 2 gpm

* All brand and product names appearing in this manual are registered trademarks of their respective companies.

Parts list

COMPONENT	BRAND	MODEL	Image	QTY.
Solar collector (2'x8') or	FAFCO	08890		3
Solar collector (2'x12')	FAFCO	08840		2
Integrated Circulation Module (ICM)	FAFCO	08790		1
- Differential controller	FAFCO	08783		1
- Heat exchanger	FAFCO	08782		1
- Pump	FAFCO	08795		2
Heat Transfer Fluid	FAFCO	08897		3 gallons
Expansion reservoir	FAFCO	08797		1
Solar Storage tank (not provided)	A.O. Smith or equivalent	Conservationist, Promax Plus, or equivalent		1
PV Panel Kit (For PV System Only)	FAFCO	08844		1
- PV Panel	FAFCO	08845		1

Roof Kit: Two 2' x 12' Collectors PN 08881 or Three 2' x 8' Collectors PN 08911

Mounting bases PN 06918		13 18*	Mounting Strap, 40' roll, PN 08907		1	Wire connector PN 08359		2
Mounting caps PN 06919		13 18*	Elbow fittings PN 08441		6	Roof jack PN 08211		1
Collet clips PN 08819		20 28*	Panel plug PN 08837		2	Rubber grommet Roof Jack, PN 08190		2
Support liner PN 08520		20 24*	Roof Sensor PN 08380		1	Roof sealant, 10 oz. tube PN 08229		1
Collector connectors 3-1/2" L, PN 08883		2 4*	Roof sensor sleeve PN 08910		1	Reservoir Fender washer, PN 08884		2

* Quantities in upper left denote 2'x12' collectors and lower right denote 2'x8' collectors

Ground Kit PN 08882







Teflon tape roll PN 07581		1	Tee, brass, 3/4" PN 08872		2	Support liner PN 08520		12
Flexible hoses 3' - PN 08834 5' - PN 08835		1 EA	Check valve, PN 09003		1	Filter, self-clean PN 08833		1
Plastic tubing, 80 ft. PN 08613		1	Fill and drain valves PN 08836		2	Screw, self tapping, 2-1/2" PN 08830		3
Tube support clips PN 08609		20	Nipple, brass, hex, 3/4" PN 08869		1	Elbow, swivel PN 08305		1
Power Supply PN 08784		1	Reducer, brass, 3/4" x 1/2" PN 08862		2	Cable ties PN 08184		4
Sensor PN 08380		2	Nipple, brass, 3/4" x 3" PN 08863		1	Collet clips PN 08819		12
Sensor cable, 50' PN 08208		1	Escutcheon PN 08462		2			

Parts list (Continued)

Information Kit

Installation Manual - PN 08905	1
Cold Water Valve Position Label - PN 08371	1
Freeze Protection And Fluid Safety Label - PN 08904	1
Label attachment zip-ties - PN 08307	2

Parts NOT Provided

Collector Lag screw, stainless steel, 1/4" x 2"		18	Pipe Insulation, R-2.6 min, 3/4" thick min		-
Reservoir Lag screw, stainless steel, 1/4" x 3-1/2"		2	Tube Insulation, R-2.6 min, 3/4" thick min, 5/8" ID		-
Roofing nails, 1"		8	Tube Insulation Support		-

Optional Kits

Kit Name	Kit Number	Description
Collector Add-On Kit	758 (Two 2'x12') or 759 (Three 2'x8')	48 square feet of collectors with 1 gallon HTF. See pg. 33
Tile Roof Installation Kit (TRIK)	767 (Two 2'x12') or 769 (Three 2'x8')	Anchors and supports collectors on tile roofs. See pg. 36
Solar Storage Tank Kit (Low lead)	730-1	Connects water heater to solar storage tank, See pg. 19
Temperature Control Valve Kit (Low lead)	733	Valve required by code. See pg. 18
Coaxial Tank Adapter Conversion Kit	776	Enables both connections at tank drainport. See pg. 34
Electric Fill Kit	777	Pumps HTF into system. See pg. 22
Tubing Extension Kit, 80 ft.	734	80 foot of additional tubing for long runs
Tube Repair Kit	162-1	Rubber plugs for repairing solar collector tubes

Tools Required

Channel lock pliers	Caulking gun	3/4" masonry bit (For tile roof)
Two or more ladders	1/4" drill bit	3/4" male thread tap
Wire cutters	Tape measure	Adjustable wrench
Cordless power drill	5/16" & 7/16" socket driver	Tubing cutter
Wire strippers	Stud finder	Safety glasses
Hammer	#2 & #3 Phillips screw driver	1/8" flat blade screw driver
3/4" & 1-1/4" paddle bit	Level	

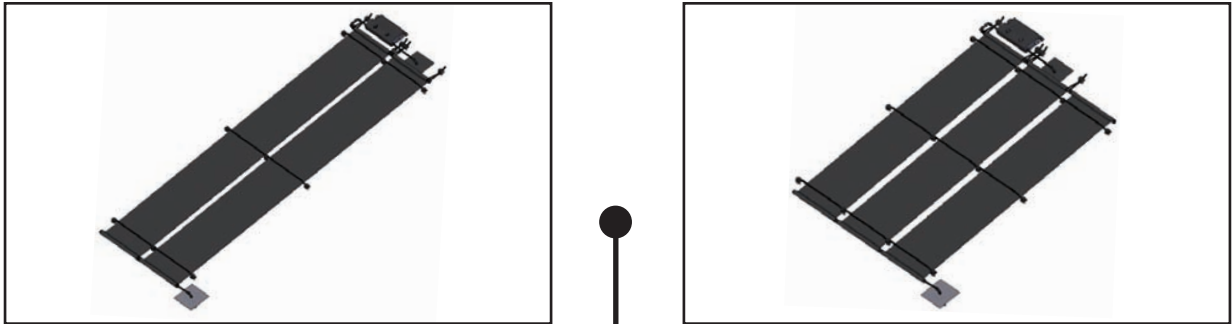
There are three basic solar water heating system configurations:

- Dual-tank gas or electric
- Single-tank electric
- Single-tank with on-demand gas heater

Components vary based on configuration. Refer to the schematics on the following pages for further details.

Two 2' x 12' Solar Collectors

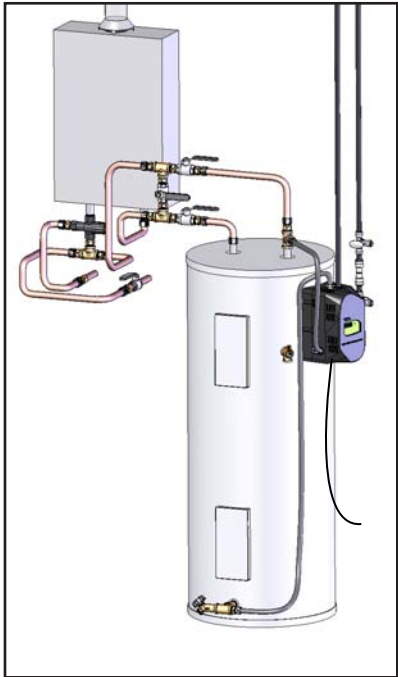
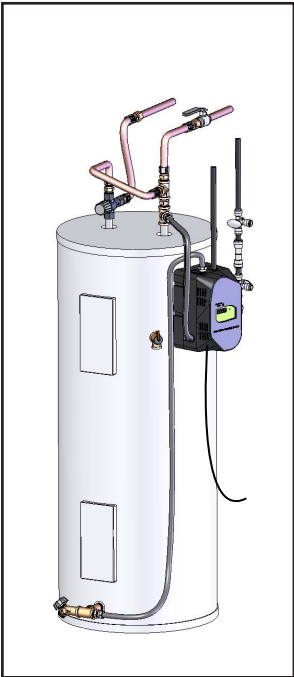
Three 2' x 8' Solar Collectors



Dual-Tank

Single-Tank

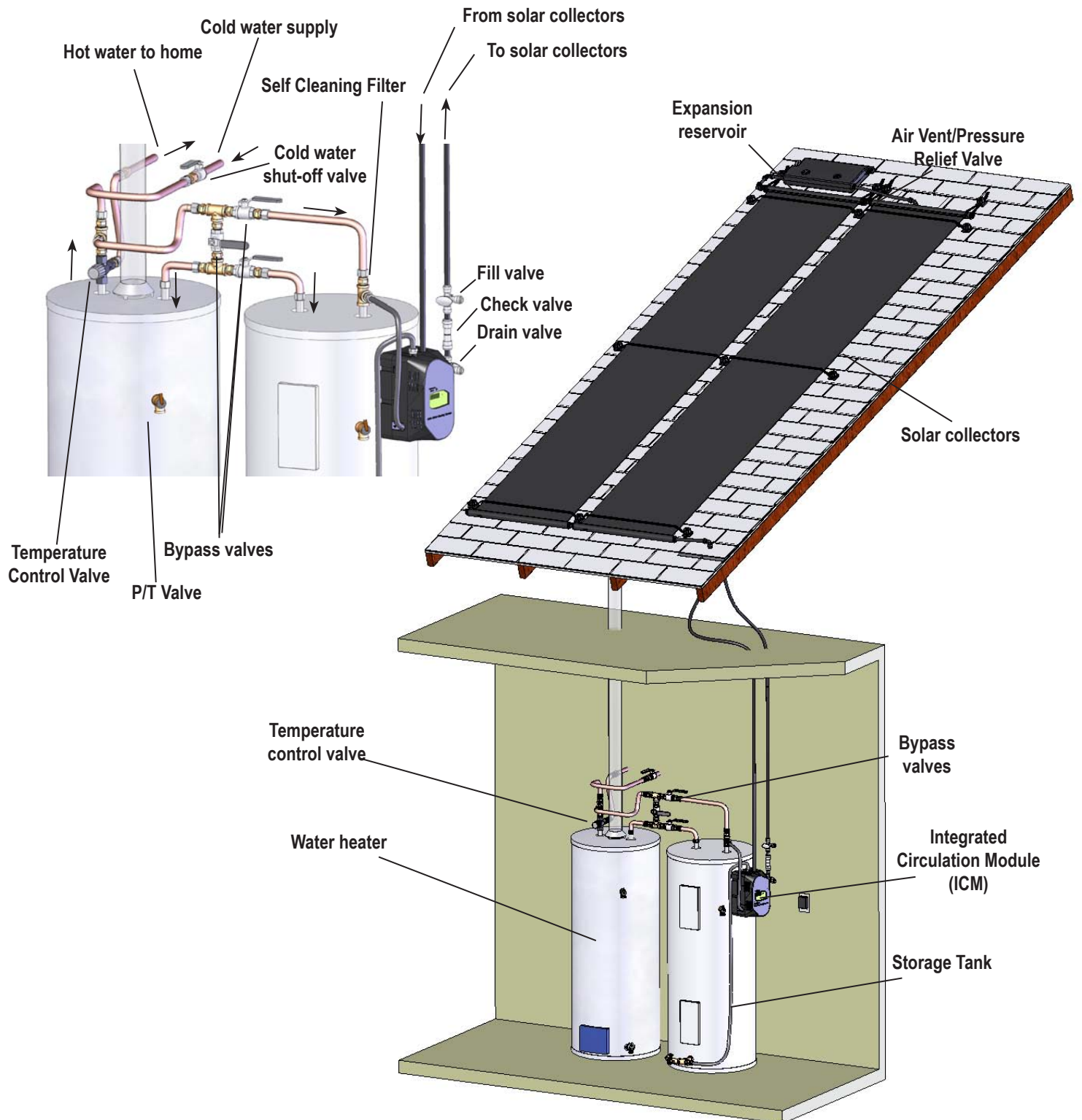
Single-tank with on-demand Heater



Overview (continued)

DUAL TANK SYSTEM

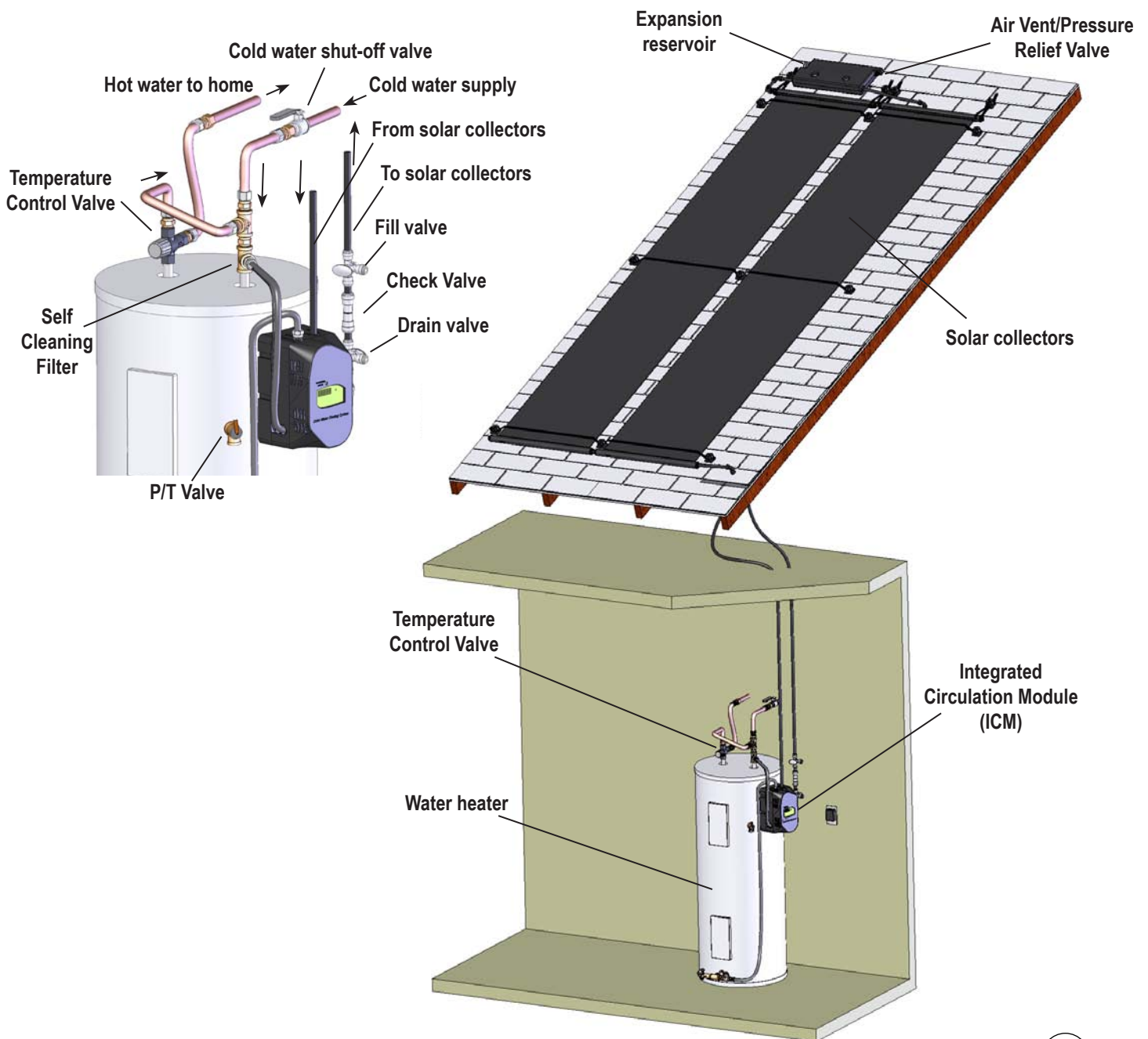
Solar-heated water in the solar storage tank preheats the water to the electric or gas water heater. A solar storage tank connection kit (PN 730-1) is available from your supplier to connect the solar storage tank to the electric or gas water heater.



SINGLE TANK SYSTEM

Solar-heated water is stored directly in an electric water heater with a single active upper element, rather than a separate storage tank.

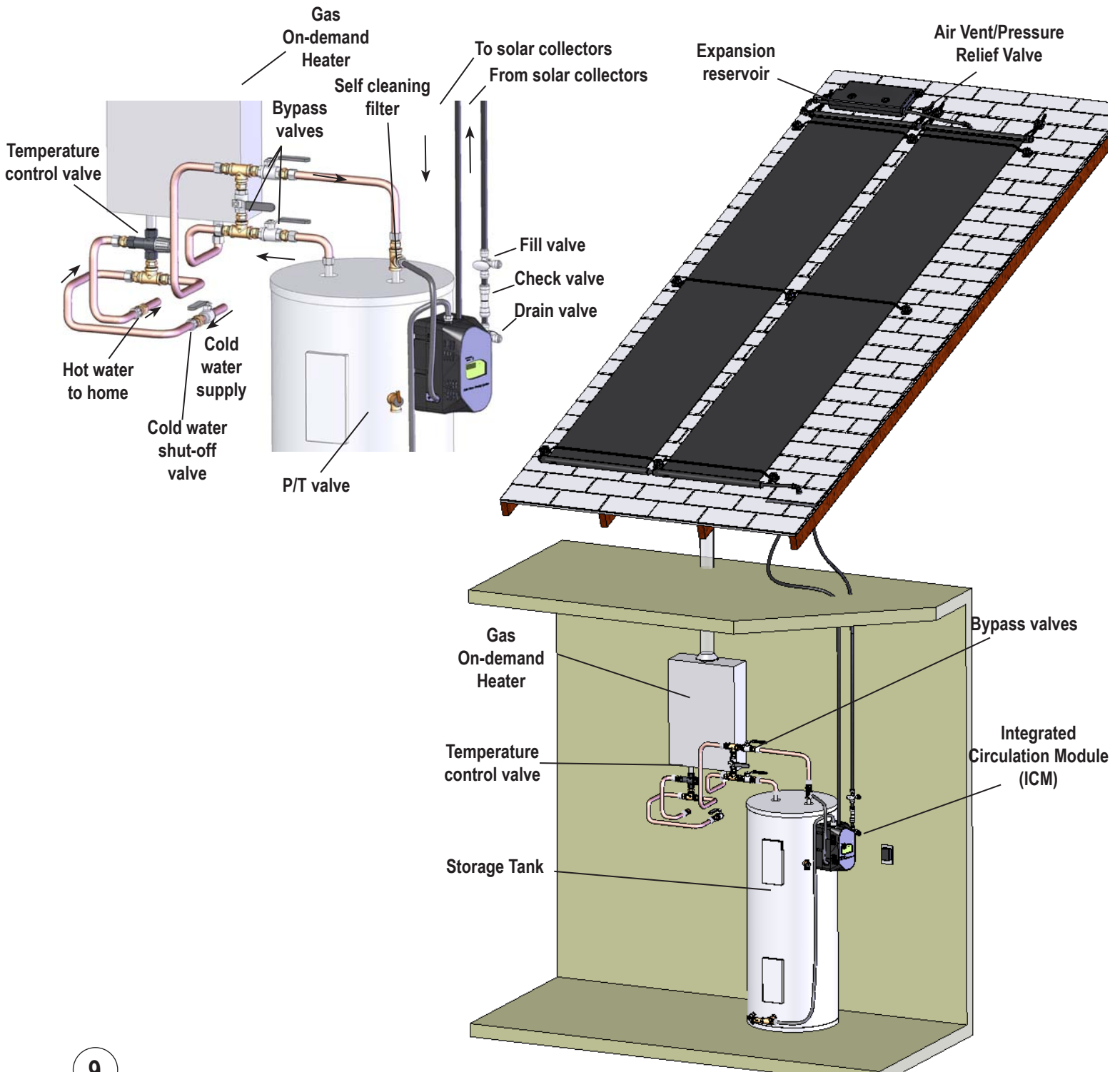
Electric water heater: An electric water heater can be either be one that is manufactured with only one element, or an electric water heater manufactured with two elements with the bottom element disconnected. Single element electric water heaters replenish hot water slower than dual element water heaters. Refer to the local plumbing code for minimum water heater size requirements. Code typically requires that water heaters be sized to meet a minimum "First Hour Rating" based on the number of bedrooms and bathrooms in a home. For single element water heaters that don't have published First Hour Ratings, GAMA/AHRI recommends using 0.75 times the water volume which would require that an 80 gallon tank be used in homes as large as 2 bedroom, 2 bath and that a 120 gallon tank be used in larger homes. It is also recommended to install low flow shower heads which can significantly reduce hot water demand and save water. Raising the thermostat setting on water heater element can also increase hot water capacity, but doing so may decrease realized energy savings.



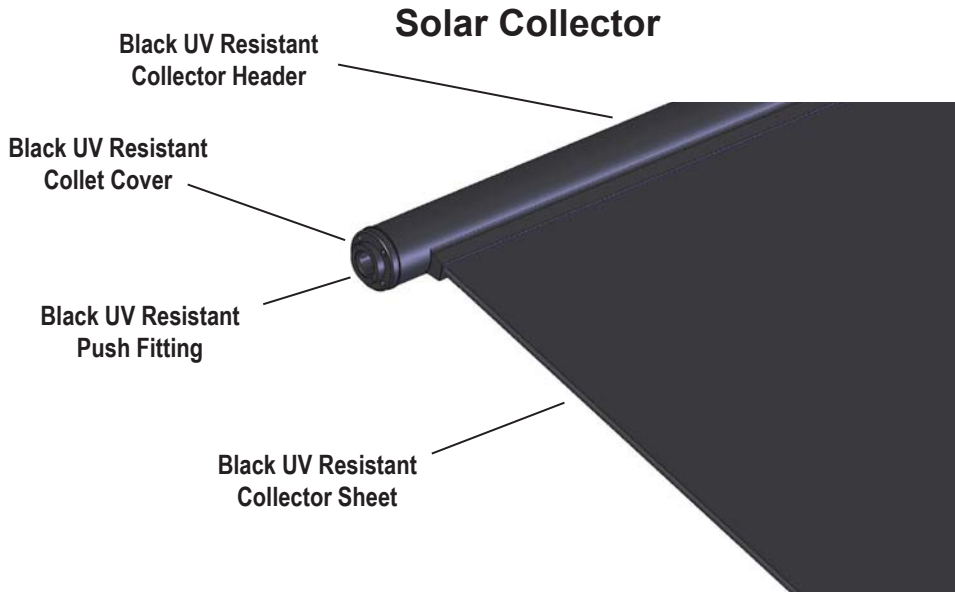
Overview (continued)

SINGLE TANK WITH ON-DEMAND HEATER

Solar-heated water in the solar storage tank preheats the water to the gas on-demand water heater. A solar storage tank connection kit (PN 730-1) is available from your supplier to connect the solar storage tank to the gas on-demand water heater. For an on-demand water heater to properly work with a solar water heating system, it must have a temperature-modulating gas burner. A temperature control valve is required for this configuration, but depending on the brand and model of on-demand heater, the valve placement may vary. Refer to the manufacturer's instructions for compatibility with solar water heating systems and proper placement of the temperature control valve.

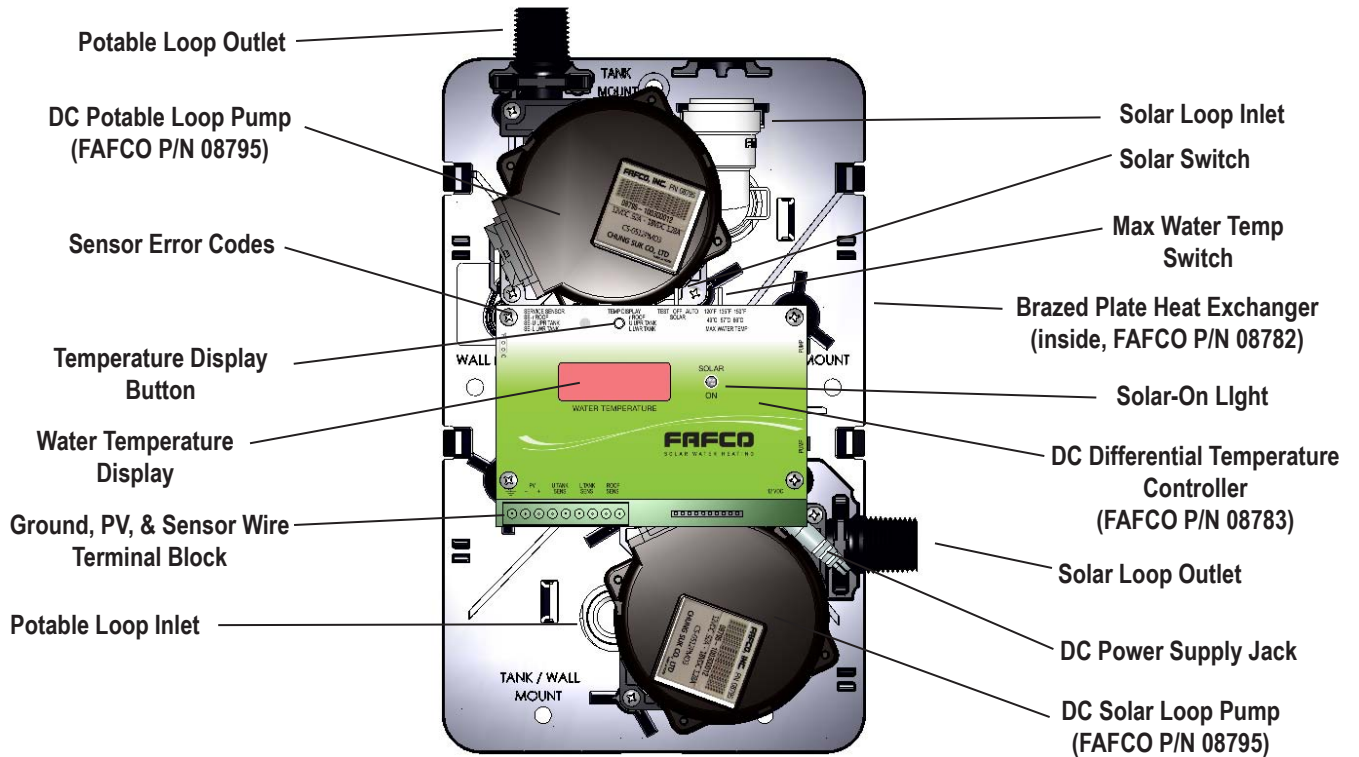


COMPONENT OVERVIEW



Function: Absorbs the energy from the sun to heat the solar loop fluid. Push fittings allow for quick, leak-free tubing connections sealed with internal rubber o-ring.

Integrated Circulation Module (ICM)
(cover removed)

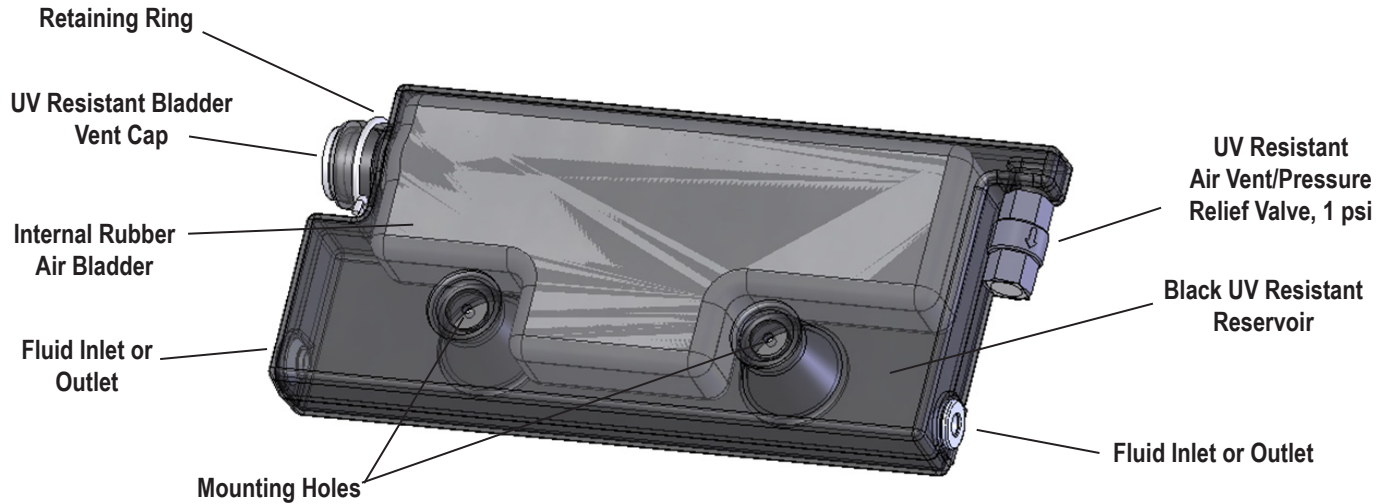


Function: Controls the Solar Water Heating System; circulates the potable water and the solar loop fluid. The heat exchanger transfers the solar heat to the potable water.

Overview (continued)

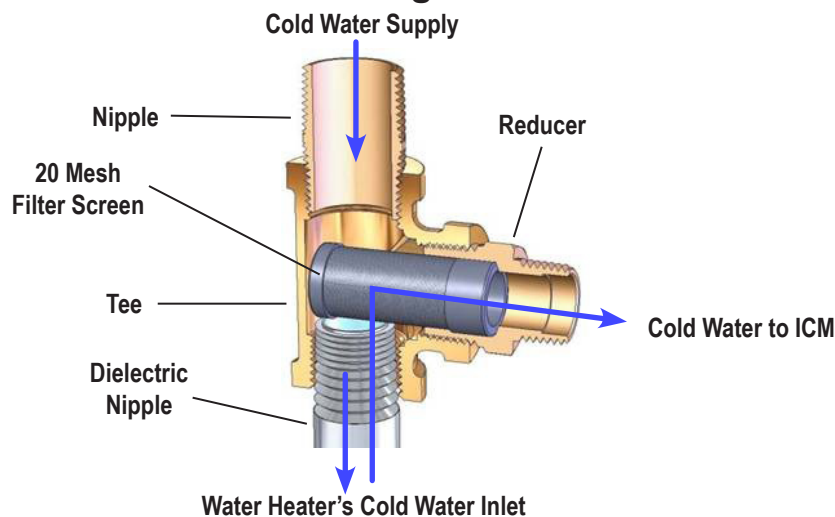
COMPONENT OVERVIEW

Expansion Reservoir



Function: Installed at the highest point of the system, it serves as expansion tank, air vent and pressure relief valve. It allows for thermal expansion/contraction of the fluid without increasing pressure/vacuum in the system. The air in the internal bladder inflates and deflates freely through the bladder vent cap. When initially filled, the bladder fully deflates and air is purged through the air vent/pressure relief valve. When not in operation, the cool fluid thermally contracts and the bladder inflates to accommodate the reduction in fluid volume. During operation, the heated fluid thermally expands and the bladder deflates to allow for the increase in fluid volume. On the hottest day at maximum fluid thermal expansion, the bladder will be fully deflated and any excess fluid will expel through the one-way air vent/pressure relief valve. After this happens, all fluid expansion/contraction will be handled by the bladder.

Self-Cleaning Filter



Function: Cold water to ICM is connected to the storage tank using a tee with internal filter. During normal operation, cold water is drawn into the ICM from the water heater's cold water inlet or cold water supply during hot water use. Whenever hot water is used in the home, fresh cold water back flushes filter putting any buildup back into the water heater. The self-cleaning feature prevents debris, sediment or scale build-up from reducing system performance and potentially damaging the circulation pump. Reducer and filter can be removed for cleaning if necessary.

COMPONENT OVERVIEW

Tubing and Fittings

FAILURE TO PROPERLY CONNECT FITTINGS CAN RESULT IN LEAKS.

Plastic Tubing

- Provided FAFCO tubing is weather resistant.
- PEX (Cross-Linked Polyethylene) tubing approved for use with push fittings may be used, but must not be exposed to sunlight.
- Plastic tubing will expand and contract at different temperatures.
- Tubing should be supported at a minimum of 36" to prevent excessive load to the connectors.
- Do not install tubing supports closer than 3" from the connector ends.
- The tube edges must be smooth and free of rough edges and burrs before inserting into push fittings.

Push Fittings Assembly

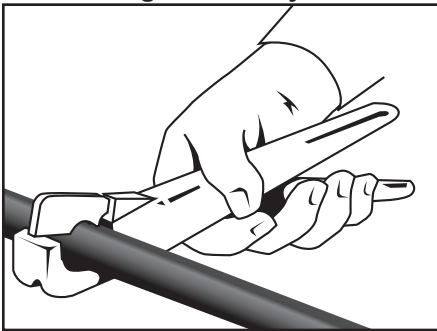


Figure 1 - Tubing Cutter

Cut the tubing to length using a tubing cutter. Inspect the outside diameter of the tubing. It must be free of damage, smooth, and clean. (See Figure 1.) Measure the insertion depth on the tubing end. Push fittings have an insertion depth line molded onto the outside of the connector bodies. Make certain to push the tubing

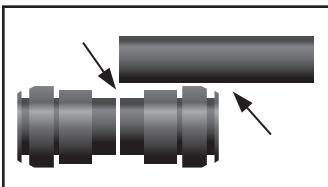


Figure 2 - Insertion Depth

completely into the fitting until it comes into contact with the internal tubing stop. (See Figure 2.) To disconnect, ensure the system is depressurized before removing fittings. Fittings are reusable and easy to connect and disconnect. Push the collet in squarely against the face of the fitting. With the collet held in this position, the tubing can be removed.

Tube Installation

- A support liner and collet clip must be used on every tube fitting to prevent tube disengagement. (See Figure 3.)

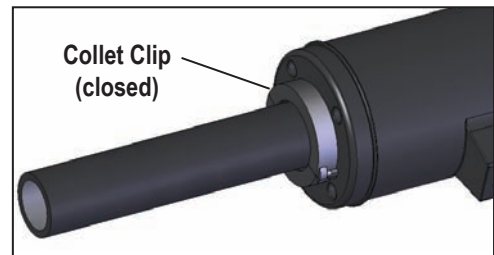
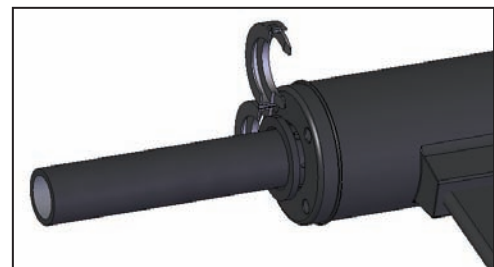
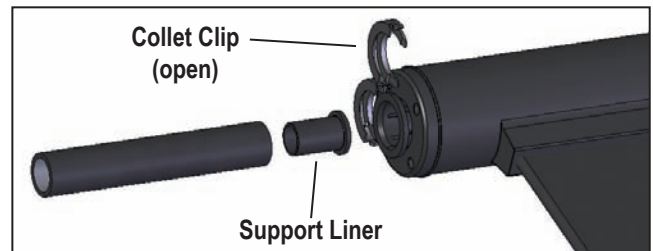


Figure 3 - Tube Installation

Push Fittings Cannot be Exposed to the Following Chemicals:

- Pipe dopes (e.g., liquid thread sealant), leak-check compounds, bug sprays, lubricants, cleaners, paints, bleaches, acids, solder fluxes, plastic piping primers and cements, oxidizing agents, alkaline solutions, thinners, fuels, oil-based caulk, hydrocarbons, spray foam, or foaming agents

Caution: Galvanized piping and fittings are not compatible with heat transfer fluid and cannot be used in collector loop plumbing.

Installation Checklist

10-STEP INSTALLATION PROCESS

- 1: SITE SELECTION AND PLANNING
- 2: ROOF MOUNTING
- 3: TANK PLUMBING
- 4: ICM INSTALLATION
- 5: TUBING & SENSOR INSTALLATION—BELOW ROOF
- 6: TUBING & SENSOR INSTALLATION—ROOF
- 7: SYSTEM FILL
- 8: SYSTEM START-UP
- 9: SYSTEM OPERATION
- 10: TROUBLESHOOTING

1: Site Selection and Planning

It's important to choose the best roof location to install the solar collectors, based on the considerations below:

Roof Direction

For homes in the northern hemisphere, the best installation site is a roof facing true south. (See Figure 4.) If a south-facing roof isn't available, then choose a site based on the following:

- Second choice, a roof facing between southeast and southwest
- Third choice, a roof facing West or East

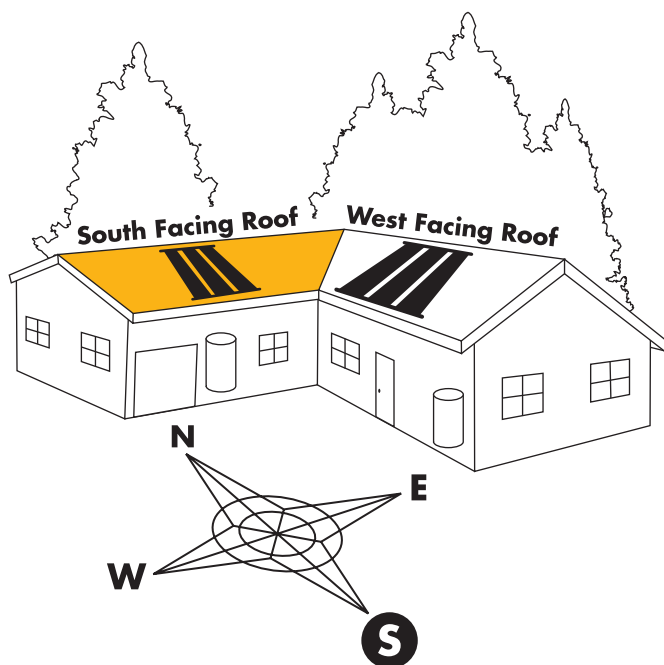


Figure 4 - Roof Direction

Shading from trees or other buildings should be avoided between 10am to 3pm. Keep in mind that as the seasons change, the sun changes its trajectory in the sky. The sun appears higher during the summer months and lower in the southern sky during winter months. Areas that are clear in the summer may be shaded by tree and shrub growth in the winter.

Roof Size

Collectors must be mounted vertically, perpendicular to the shingle rows, as shown in Figure 5.

- One set of (3) 2' x 8' solar collectors will need a clear roof area measuring at least 7.5' wide x 9' tall.
- One set of (2) 2' x 12' solar collectors will need a clear roof area measuring at least 5.5' wide x 13' tall.

Distance From Water Heater

The solar collectors should be as close as possible to the water heater. The closer the collectors are to the water heater, the shorter the tubing run will be. The maximum allowable vertical height of the collectors from the ICM is 50'. The maximum required tubing length each way to the solar collectors is 100'. The Solar Water Heating System comes with 80' of tubing. Additional tubing may be ordered from your dealer.

Mounting Methods by Roof Type

The following are recommendations for mounting to various roof types. Consult a roofing professional regarding the correct method for installing solar panels on a roof.

Inspect the condition of the roof. Contact a roofing professional to determine the remaining life of the roof before recommended replacement.

Important: The solar collectors are flexible and must be installed on a smooth, flat surface. Any uneven or very rough roof surface will require a flat support surface underneath the solar collectors.

Composition asphalt

This is a common roof type, and solar collectors can be mounted directly to the roof. Refer to the instructions on the following pages detailing mounting on composition asphalt. (See Figure 5.)

Shake

A substrate must be used on shake roofs. Mount solar collectors directly on top of the substrate. Lay substrate on roof and proceed with the standard mounting procedures on the following pages. UV resistant, dark color, 2' wide by 8' or 12' long, corrugated (wavy) sheet with ribs no more than 2" apart and 1" high, fiberglass or polycarbonate

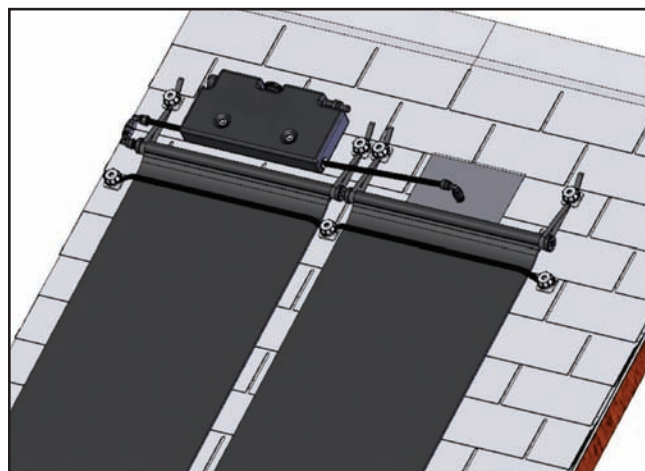


Figure 5 - Composition Asphalt Roof

1: Site Selection and Planning (Continued)

sheets are available from a FAFCO distributor or local home improvement store.

Tile

A **Tile Roof Installation Kit (TRIK)** should be used on tile roofs. TRIK is available from your supplier. The kit includes specialized tile roof mounting hardware, substrate, and complete installation instructions. (See Figure 6.)

Metal roofs

A substrate with structural rack must be used on metal roofs. UV resistant, dark color, 2' wide by 8' or 12' long, corrugated (wavy) sheet with ribs no more than 2" apart and 1" high, fiberglass or polycarbonate sheets are available from a FAFCO distributor or local home improvement store. Standing seam roofs have commercially available clips, referred to as "S5 clips," to fasten to the seams. These can be purchased through S5 distributors. Alternatively, drive lag screws through the roof to a truss and use roof sealant at the penetration to ensure a good seal in a manner acceptable to the metal roof manufacturer. Fasten down stringers and substrate to support the collectors.

Other roof types (e.g., membrane, foam, tar-and-gravel, slate):

For any roofing material not covered here, check with a roofing contractor for the best method to attach the solar collectors.

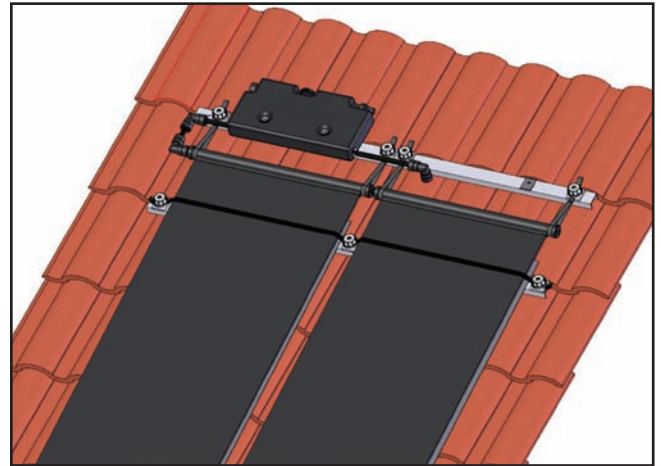
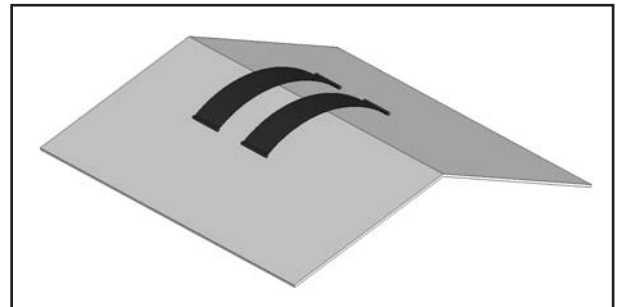


Figure 6 - Tile Roof With TRIK

2: Roof Mounting

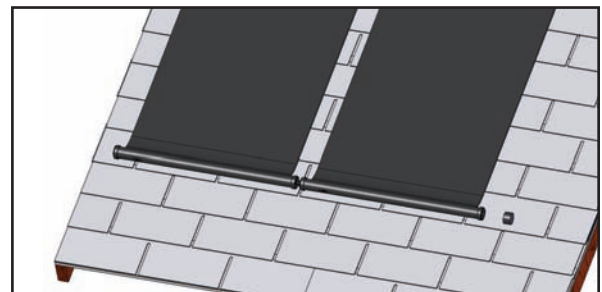
STEP 1: UNROLL SOLAR COLLECTORS

Carry the rolled up solar collectors onto the roof. Carry additional collectors onto the roof if using a collector add-on kit. Do not drag solar collectors over a surface that could damage them. Unroll the collectors over the ridge of the roof allowing them to relax and flatten out. On windy days, be careful during this step! Hold the collectors down if necessary.



STEP 2: REMOVE PROTECTIVE COVERS AND CONNECT COLLECTORS

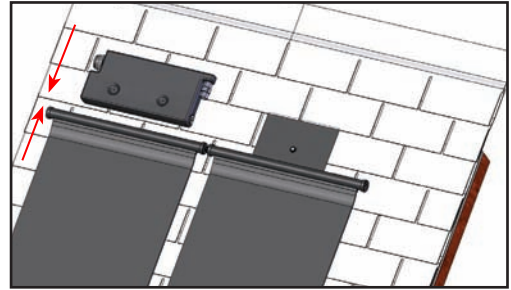
Remove protective caps and discard. Connect the collectors together with the provided 3-1/2" connectors, using support liners, and collet clips.



2: Roof Mounting (Continued)

STEP 3: CHOOSE MOUNTING LOCATION AND LAYOUT

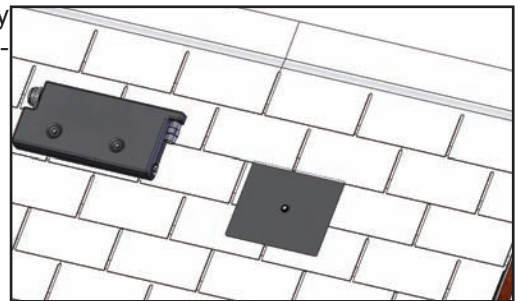
Collectors must be installed vertically, side-by-side, allowing at least 10 inches above the top headers for mounting of the reservoir and upper roof jack. Place the collectors, reservoir, and upper roof jack in chosen location as shown. Reservoir must be centered above outlet collector header. Bottom of reservoir must be at least 2 to 6 inches above collector header as shown. Roof jack installs black side up, with hole located near the bottom edge of a shingle. The reservoir rubber grommet must be higher than the roof jack rubber grommet. Mark the four collector corners with chalk and temporarily move the collectors out of the way.



STEP 4: MOUNT RESERVOIR

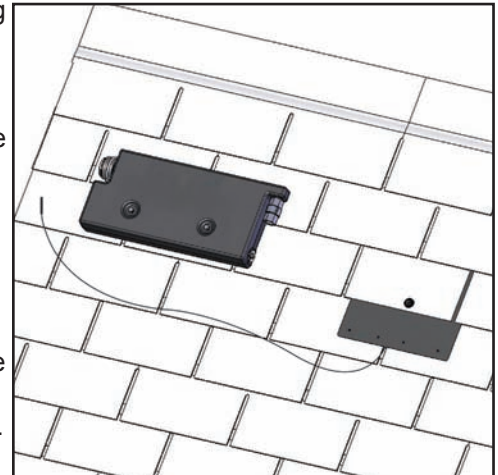
Mark locations of the two expansion reservoir mounting screws and apply two quarter-sized dabs of roof sealant. Mount the reservoir with two stainless steel 3-1/2" lag screws (not provided) and two stainless steel fender washers (provided). Snug down, but do not over tighten.

Note: Penetrations of the building through which piping or wiring is passed shall not reduce or impair the function of the enclosure. Penetrations through walls or other surfaces shall not allow intrusion by insects and/or vermin. Required roof penetrations shall be made in accordance with applicable codes and also by practices recommended by the National Roofing Contractors Association.



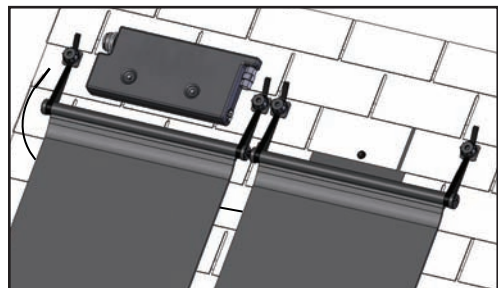
STEP 5: INSTALL UPPER ROOF JACK

Note: If installing a PV Panel, see Appendix on page 28 before proceeding with this step. Chalk mark the location of the upper roof jack hole. Break the glue line between the shingles by sliding a large putty knife between the shingles. Loosen just enough to fit the roof jack underneath. Insert rubber grommet into roof jack from underside and slide roof jack into place to check the fit and the chalk mark. At the mark, drill a 1-1/4" roof penetration. Attach the provided wire connector to the roof sensor lead wire and feed the lead through the hole. Leave enough lead for the sensor to reach 4" beyond the outlet end of the collector. Lift shingle and apply a large bead of roof sealant completely around the hole and the lead wire. Slide roof jack into place under the shingle, with lead wire protruding out under lower edge of jack. Press down into sealant to ensure a good seal. Secure roof jack using galvanized roofing nails (not provided). Be careful not to put nails through the roof sensor wire. Apply roof sealant to the nail heads. Apply roof sealant under the overlapping shingle and press flat.



STEP 6: INSTALL COLLECTOR HEADER STRAPS

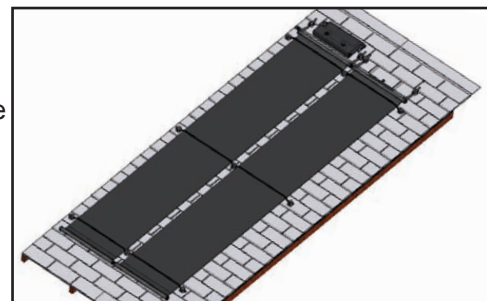
Replace the collectors in the chalk marked location. String the sensor lead wire underneath the collectors with the sensor protruding at upper collector outlet end. Apply a quarter-sized dab of roof sealant 3" above the end of one of the top headers. Place mounting base over sealant and drive a 2" lag screw (not provided) through the base, securing so that strap can run vertically through the slot. Wrap a short header strap around header and lay into the slot in the base. Screw on a cap until tight. Be careful not to cross thread. Continue with the installation of remaining header straps at both ends of each header.



2: Roof Mounting (Continued)

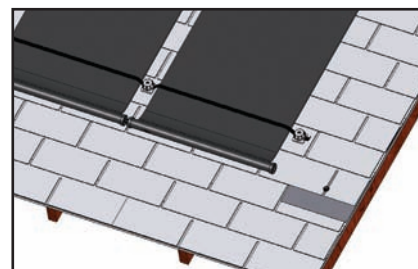
STEP 7: INSTALL BODY STRAPS

Apply roof sealant at lag screw location, 1" from collector edge, 4" down from the top header. Drive a lag screw through the base. Orient the slot for the strap horizontally and tighten lag screw. Lay the strap in the slot of the base and screw down the cap until tight. Install base on opposite side of the three panels 1" from the collector edge. Stretch strap across panels and screw down with cap until tight. Install another base and cap between panels. Measure to center of collectors and install a center body strap following previous procedure. Install the third collector body strap 4" above the bottom header. Straps will allow for expansion and contraction of the solar collectors.



STEP 8: INSTALL LOWER ROOF JACK

At the lower header end, diagonally opposite the upper outlet header end, install the lower inlet header roof jack 4-6 inches out from the header, as detailed in Steps 5 & 6 above. Note: This jack does not get a sensor.



3: Tank Plumbing - Single Tank

Note: Install a new water heater at this point if the existing water heater will not be used. Follow the water heater manufacturer's installation instructions. A drip pan with a drain line to the outside of the building is required whenever water storage tanks are located above living space.

STEP 1: TURN OFF WATER HEATER

For electric water heaters: turn off the circuit breaker and verify with a volt meter at the top of the water heater.

STEP 2: SHUT OFF WATER SUPPLY

Shut the cold water inlet valve to the water heater. This is usually a ball or gate valve located near the top of the water heater. Shut off water to the home at the main water shutoff.

STEP 3: CONNECT HOSE TO DRAIN BIBB

Connect a garden hose to the drain connection at the bottom of your water heater. Make sure discharge end of the hose is in a safe place for hot water to flow. Open the drain bibb.

STEP 4: OPEN PRESSURE-RELIEF VALVE

As water heater is draining, open the pressure-relief valve on the side or top of the heater. When heater is empty, remove hose, close drain bibb and relief valve.

3: Tank Plumbing—Single Tank

STEP 1: DISCONNECT WATER HEATER PIPING

Disconnect the water heater hoses. Replace if needed. Check that the water heater has dielectric nipples.

STEP 2: CONNECT TEMPERATURE CONTROL VALVE

Apply thread sealant and connect temperature control valve to the water heater port labeled “H” for hot. Connect a flexible hose to the temperature control valve port labeled “MIX” and connect the other end to the hot water pipe to the house.

STEP 3: INSTALL SELF-CLEANING FILTER TEE

Apply thread sealant and install 3/4" tee in the upright position onto the water heater port labeled “C” for cold. Insert the screen filter, open end first, into the 3/4" x 1/2" reducer. Apply thread sealant to reducer, and install into the side of 3/4" tee as shown.

STEP 4: CONNECT 3/4" TEE

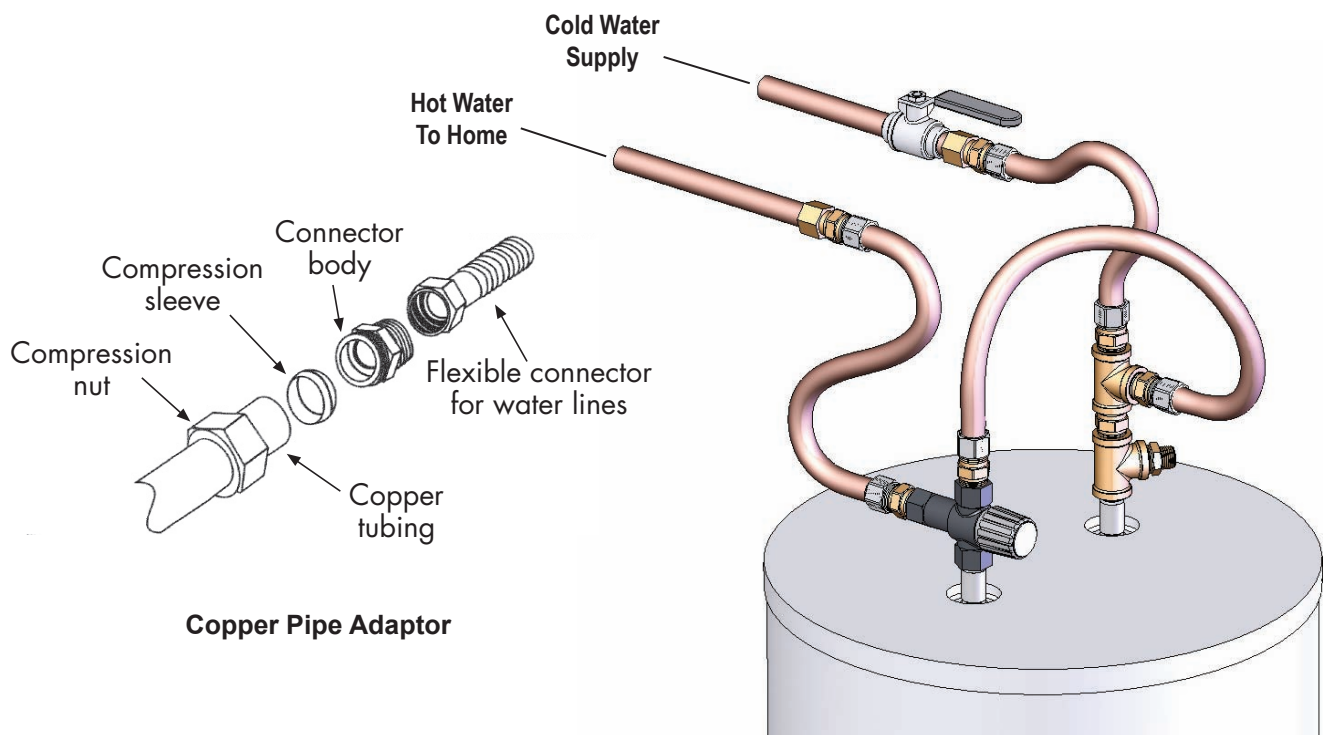
Apply thread sealant and using a 3/4" nipple, connect another 3/4" tee in the upright position above the first tee. Connect upper tee to cold water valve and temperature control valve port labeled “C” using flexible hoses and nipples as shown.

STEP 5: INSULATE PIPES AND ATTACH LABEL

All interconnecting hot water piping and the final 5 feet of cold water supply pipe shall be insulated with R-2.6 or greater insulation. Attach provided Cold Water Shut-Off Valve label to the cold water shut off valve.

STEP 6: REPLACE HEATER VENT (GAS ONLY)

Replace heater vent and vent cap.



3: Tank Plumbing—Dual Tank

Note: A Solar Storage Tank Add-On Kit can be used for this installation configuration. This kit is available through your distributor. The tank is plumbed as shown.

STEP 1: RE-DIRECT WATER SUPPLY

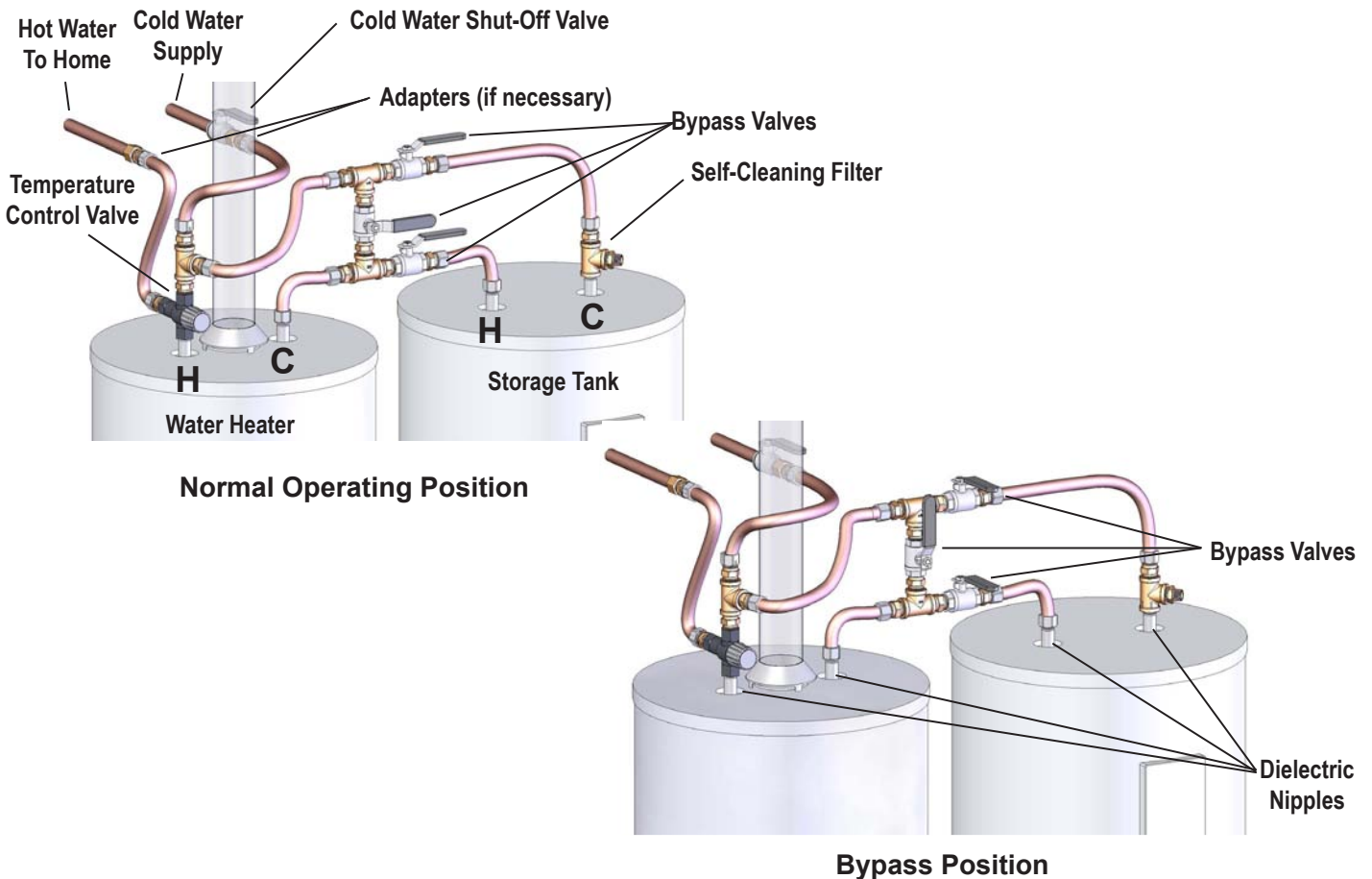
Re-direct the cold water supply line from the water heater cold inlet, to the tee above the temperature control valve as shown. Use one of the new flexible hoses unless you prefer to use the existing hose. When attaching to the cold water supply line, connect directly to threads. If no threads are present use the provided adapter, 3/4" compression X 3/4" MPT. For 1" copper tubing, purchase a 1" compression adapter.

STEP 2: INSTALL SELF CLEANING FILTER TEE AND BYPASS VALVES

Apply thread sealant and install 3/4" tee in the upright position onto the storage tank port labeled "C" for cold. Insert the screen filter, open end first, into the 3/4" x 1/2" reducer. Apply thread sealant to reducer, and install into the side of 3/4" tee as shown. Assemble the other 4 provided flexible hoses, remaining fittings and bypass valves as shown. Important: Before turning on the electricity or gas supply, be certain that the tank is full of water. Do not use thread sealant on flexible hose connections.

STEP 3: FILL TANK & ACTIVATE ELECTRICAL/GAS SUPPLY

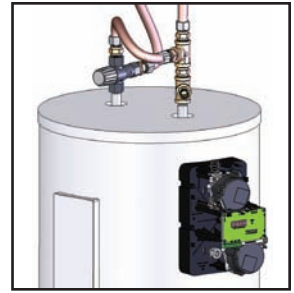
With the system in normal operating position, and a hot water faucet still open, turn the cold water shut off valve on to allow water to enter the tanks. The open hot water faucet will permit air to be purged from the tank. Close the faucet when the water becomes a constant flow and all air is purged. Inspect for leaks and tighten connections where necessary. Reconnect and activate electrical or gas supply. Open or close the isolation valves as shown to switch between normal operating position and bypass position. All interconnecting hot water piping and the final 5 feet of cold water supply pipe shall be insulated with R-2.6 or greater insulation. Attach provided valve position label to the cold water shut off valve. Attach Storage Tank Bypass label to one of the 2-way valves. Attach Cold Water Shut-Off Valve label to cold water shut-off valve.



4: ICM Installation

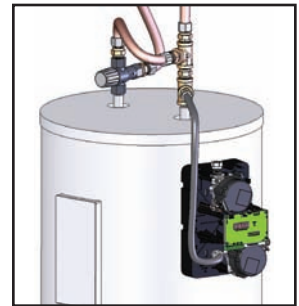
STEP 1: MOUNTING ICM

The Integrated Circulation Module (ICM) is mounted directly onto the water heater or solar storage tank sheet metal outer skin. Remove the ICM cover and place the module against the water heater in a convenient location about 3" down from the top. Using the three 2-1/2" self-tapping screws provided, attach through the mounting hole at the top and the two at the bottom. Note: The two provided washers may be used as spacers under the head of the top mounting screw, if you have less than one inch of tank insulation.



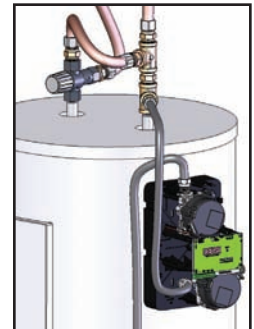
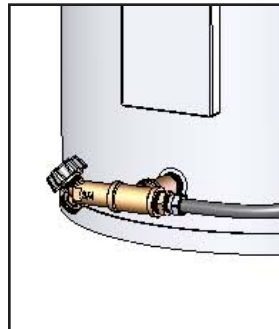
STEP 2: ICM INLET PLUMBING

Note: If using Coaxial Adapter Conversion Kit, proceed to Appendix. Apply thread sealant and install 3/4" tee in the upright position onto the cold water port dielectric fitting on top of the water heater. Insert the screen filter, open end first, into the 3/4" x 1/2" reducer. Apply thread sealant to reducer, and install into the side of 3/4" tee as shown. Attach the 3' flexible hose to the reducer. Form the hose as needed and attach to the ICM at the threaded metal fitting inside the ICM next to the lower pump. Note: Flexible hose does not require thread sealant.



STEP 3: ICM OUTLET PLUMBING

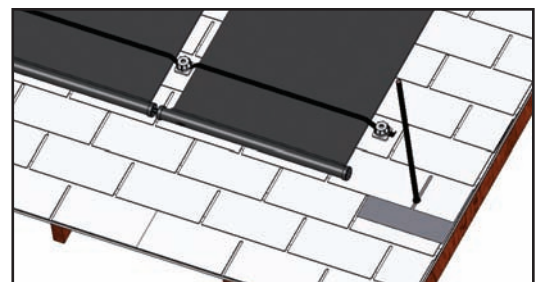
Remove water heater drain bibb and save for reuse. Apply thread sealant to the 3" nipple and install finger tight into side of 3/4" tee. Install nipple and tee assembly into drain port at the bottom of the water heater, stopping with tee oriented horizontally. Apply thread sealant to water heater drain bibb and install into tee on side most convenient for future water heater flushing. Apply sealant and install 3/4" x 1/2" reducer to remaining side of tee. Attach the 5' flexible hose to the reducer. Attach the other end of the 5' flexible hose to the threaded fitting on top of the ICM by carefully forming hose so as to not apply a side load to the fitting. Note: Flexible hose does not require thread sealant. All interconnecting hot water piping shall be insulated with R-2.6 or greater insulation.



5: Tubing & Sensor Installation—Below Roof

STEP 1: DRILL HOLES IN CEILING AND PULL LOWER ROOF JACK TUBING

Drill two 3/4" holes through the ceiling directly above the ICM, 4" apart. Drill a 1/4" hole 2" behind the left hole. Place tape over the end of the UV Resistant Solar Tubing and push up through the hole on the right. In the attic, pull enough tubing through hole to reach the lower roof jack. Remove the tape and lubricate tubing with water or silicon. With a helper standing on the lower roof jack, push about 18" of tubing up through the rubber grommet.



Penetrations shall maintain the function of the enclosure for code required fire resistance and to prevent intrusion of insects and/or vermin. Penetrations shall meet code and practices recommended by the National Roofing Contractors Association.

5: Tubing & Sensor Installation—Below Roof (Continued)

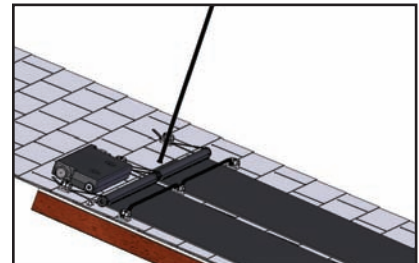
STEP 2: CONNECT LOWER ROOF JACK TUBING TO ICM

At the ICM cut the tubing to reach top of water heater. Slide on an escutcheon up to the ceiling. Screw swivel elbow fitting of valve assembly (fill valve, check valve, drain valve, and swivel elbow) onto lower right side port of ICM as shown. Cut tubing to length, insert support liner and push tubing into upper fill valve of valve assembly. Face valve ports forward with handles to the left and right as shown. Attach provided Freeze Protection and Fluid Safety label to the fill valve.



STEP 3: PULL UPPER ROOF JACK TUBING

Place tape over the end of the remaining tubing and push up through the left ceiling hole. Push the end of the 50' roll of roof sensor wire up through the 1/4" hole. In the attic, pull enough tubing and wire to reach the upper roof jack. Note: Avoid routing sensor wire near any A/C power cables. Connect the sensor wire to the sensor lead with the provided waterproof wire connector. Note: There is no positive or negative. Remove the tape and lubricate tubing with water or silicon. With a helper standing on the roof jack, push about 4' of tubing up through the rubber grommet. Tubing shall be insulated with R-2.6 or greater insulation. Use tube supports every 36" to maintain minimum 1/4" per foot slope for draining, without compressing insulation.



STEP 4: CONNECT UPPER ROOF JACK TUBING TO ICM & ROUTE WIRE

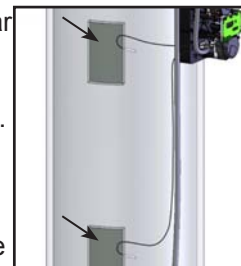
At the ICM cut the tubing to reach the push fitting on the top of the module and slide on an escutcheon up to the ceiling. Insert a support liner, attach tubing to the push fitting, and install a collet clip. All interconnecting hot water piping, tubing, and the final 5 feet of cold water supply pipe shall be insulated with R-2.6 or greater insulation.

Route the roof sensor wire down from the ceiling to the right side of the ICM. Secure wire with provided zip ties, out of sight behind left tubing.

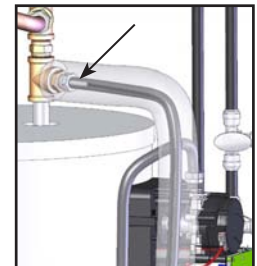


STEP 5: UPPER AND LOWER TANK SENSORS INSTALLATION

Remove both top and bottom element covers from water heater or solar storage tank. In both locations, securely insert a sensor behind the insulation, against the inner tank wall. Replace both covers with the sensor leads protruding. Use caution not to cut the wire on the sharp edge. For single tank systems, insert the top tank sensor inside the piping insulation on the hot outlet piping to the upper left of the ICM. Ensure the sensor is properly contacting the metal tubing and is well insulated for proper temperature readings. This is necessary to readily determine the system is operating properly and providing solar heated water.



Dual Tank

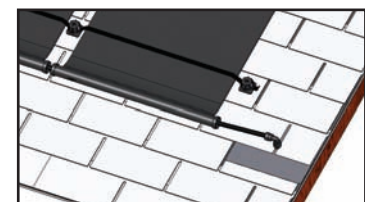


Single Tank

6: Tubing & Sensor Installation—Roof

STEP 1: LOWER ROOF JACK CONNECTION

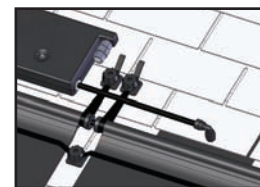
At the lower roof jack, cut off the tubing 3" above the rubber grommet and insert a support liner. Firmly hold the tubing just above the grommet and push on an elbow fitting until completely seated. Install a collet clip and push the tubing down until the fitting is against the grommet. Insert a support liner into the cut off tubing, insert tubing into collector header fitting, and install a collet clip. Cut tubing to length and using a support liner and collet connect to elbow fitting. NOTE: Black UV resistant tubing, fittings, and expansion reservoir on roof do not require insulation.



6: Tubing & Sensor Installation—Roof (Continued)

STEP 2: UPPER ROOF JACK CONNECTION

At the upper roof jack, cut off tubing and install elbow fitting. Lubricate the cut off tubing with water or silicon and insert 3" into reservoir rubber grommet. Cut tubing to length and connect to elbow fitting. Use tube supports and collet clips.



STEP 3: COLLECTOR CONNECTION TO RESERVOIR

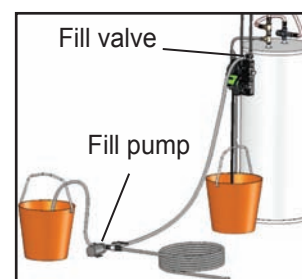
Connect an elbow fitting to the collector header fitting, allowing 1/2" gap between for collet clip installation. Connect a second elbow to the first, allowing 1/2" gap between. Lubricate one end of remaining tubing and insert 3" into reservoir rubber grommet. Slide the roof sensor sleeve over tubing, cut tubing to length, and connect to elbow fitting. Insert sensor fully into sensor sleeve pocket. Note: Optionally, the sleeve can be installed between the collector and the first elbow.



7: System Fill

STEP 1: FILL SYSTEM WITH WATER AND PURGE AIR

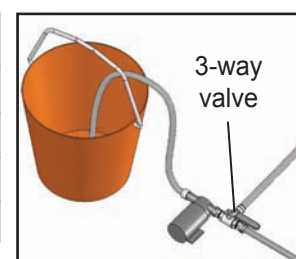
Ensure relief valve is not installed on reservoir. This is installed at the final step. Attach garden hose to solar system fill port using garden hose adapter. Attach piece of solar tubing to solar system drain port and put end of tubing into an appropriate location to drain. Open drain and fill ports. Turn on garden hose to fill system with potable water. Monitor water coming from drain line and reservoir on roof until it is returning as a solid stream with no bubbles. Shut valves in the following order: (1) Drain Line, (2) Fill Line, then (3) Hose bibb. **IMPORTANT: ENSURE THERE IS NO AIR IN THE LINES BEFORE PROCEEDING. COMPONENTS CAN BE DAMAGED IF AIR IS NOT FULLY PURGED.** Check for any leaks. Check all fittings and components for leaks and correct as required. Check that all push fittings are tight.



STEP 2: ADD FAFCO HEAT TRANSFER FLUID (HTF) TO SYSTEM

Fill bucket with required amount of FAFCO HTF. Flip 3-way valve to allow flow from bucket. Pump FAFCO HTF into system. As glycol is pumped into the system an equal amount of water will purge from the reservoir onto the roof. This is normal. The fluid will evaporate without staining the roof. **TAKE CARE TO SHUT PUMP OFF BEFORE IT STARTS SUCKING AIR INTO THE SYSTEM!!** Verify a

FAFCO Heat Transfer Fluid (HTF) Required	
Collectors	FAFCO Heat Transfer Fluid
48 sq. ft	3 gallons
96 sq. ft	4 gallons
144 sq. ft	5 gallons



minimum 35% HTF concentration with a refractometer (provided in fill kit). The corresponding freeze point on the refractometer is +2F (-17C). Note: FAFCO HTF is the only acceptable fluid for mixing and filling of the system. "Under no conditions shall pure unmixed Fafco HTF or any other pure glycol mixture be left in the collector loop. Such a fluid might be flammable under certain conditions and would immediately render the warranty void."

8: System Start-up

STEP 1: FILL WATER HEATER & ACTIVATE

Open hot water faucet & Main Water. Remove the aerator screen from a faucet in the home and turn on the hot water. Alternatively, open the hot water on a bathtub faucet. Open main water valve to house. Open water valve to water heater. Check plumbing for leaks and repair as needed. **Turn off faucet and re-install aerator screen after air is purged.** Turn on water heater. For electric water heater, turn circuit breaker on. For gas water heater, turn on gas and follow the instructions on your water heater to light pilot. Inspect tank fittings for leaks and tighten if needed.

8: System Start-up (Continued)

STEP 2: ATTACH POWER CORD

Before ICM power cord attachment using the toggle switches on the top of the circuit board, set the SOLAR switch to OFF and the MAX WATER TEMP switch to 120 °F. Route the power/ground cord into the ICM next to the lower left flexible hose. Attach the ground wire to the terminal marked ground in the lower left corner of the circuit board. This grounding wire also provides lightning protection for the system. Route the power cord behind the lower pump from left to right and plug the power cord into the jack in the lower right corner on the back of the circuit board.



STEP 3: ATTACH SENSOR WIRES TO ICM

Route the three sensor wire pairs into the ICM next to the lower left flexible hose. Connect the three sensor wire pairs to their respective terminals: Upper Tank Sensor, Lower Tank Sensor, and Roof Sensor. Note: There is no positive or negative. Use cable ties to secure the ground, power and sensor wires to the circuit board standoff post. Plug the power supply into the wall outlet. The water temperature in the water heater or solar storage tank will be displayed. If any of the sensor wires is not securely fastened in the terminal, a fault code will be displayed instead of the temperature. Note: The fault codes are SE-r (Sensor Error) for the roof, SE-U for the upper tank sensor and SE-L for the lower tank sensor.



STEP 4: TEST THE SYSTEM

Move the SOLAR switch to the TEST position to turn the pumps on. The green SOLAR ON light will illuminate. Verify both pumps are operating. If the pumps are not flowing, ensure there is no air trapped in the lines. Raise the outlet side of the solar collector off the roof to allow any trapped air to escape. Ensure the reservoir is installed at the highest point in the system and there are no other high spots that can trap air in the system. The TEST mode has a 4 hour time-out feature that shuts the pumps off and the display will flash tEST. The pumps can be restarted by moving the switch to the OFF position until the display stops flashing tEST, then move the switch back to the TEST position.



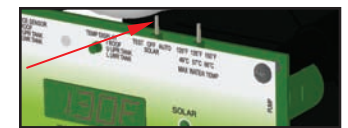
STEP 5: VERIFY TEMPERATURES

The upper tank temperature is continuously displayed. View other temperatures by pressing the TEMP DISPLAY push button. "U", "L" or "r" will be displayed representing the upper tank, lower tank or roof, followed by the temperature. In TEST mode the last temperature viewed will continue to be displayed until the TEMP DISPLAY button is pressed.



STEP 6: ACTIVATE SYSTEM

Move the switch to the AUTO position to put the system into automatic operation mode. The upper tank temperature will display continuously, lower tank or roof temperature can be viewed by pressing the TEMP DISPLAY button. Display will revert back to upper tank temperature after a short time period.

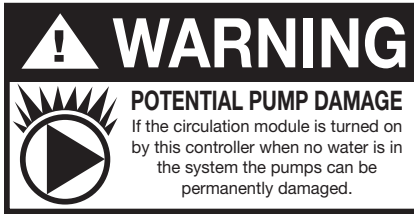


STEP 7: REPLACE ICM COVER

Gently place the cover on the ICM. Route all sensor and power wires through the opening on the left side of the cover behind the flexible hose. Push the cover on until the four side tabs engage.



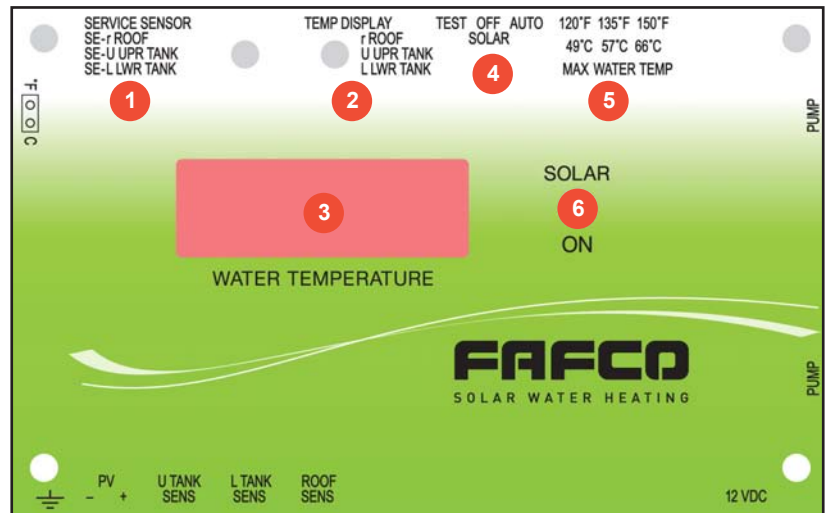
9: System Operation



Controller Features:

1. Sensor Error Codes
2. Temperature Display Button
3. Continuous Digital Display of Water Storage Tank Temperature
4. Solar Switch
5. Max Water Temp Switch
6. Solar On Light

The control component of your FAFCO solar water heating system features state-of-the-art microprocessor technology and many flexible features to maximize the effectiveness and utility of your solar water heating system, with special emphasis on “user friendliness” and reliability for years to come.



Controller Operation:

The system operates automatically, continuously displaying the upper tank WATER TEMPERATURE. The system will activate whenever the roof temperature is at least 10 hotter than the lower tank temperature. The system will continue to operate automatically until the tank reaches the selected MAX WATER TEMP or the roof temperature is only 4 degrees hotter than the lower tank temperature. At that time, the system will shut-off automatically, the green SOLAR ON light will go off, and the WATER TEMPERATURE will continue to be displayed. The system will reactivate whenever the roof temperature is at least 10 hotter than the lower tank temperature.

Solar Setting:

The SOLAR switch is normally set in the AUTO position, and should remain set this way for automatic operation. The TEST position is normally for installation and maintenance purposes only and should only be used to test the system. The OFF position is for maintenance only.

Maximum Tank Temp Setting:

This switch permits the user to set a maximum storage tank water temperature. This will depend on household requirements or safety concerns. If the water reaches the set maximum temperature during solar operation, the solar system will shut off automatically. Optional maximum temperature settings are 120° F, 135° F and 150° F.

Temperature Display:

The upper tank temperature is continuously displayed. View other temperatures by pressing the TEMP DISPLAY push button. “U”, “L” or “r” will be displayed representing the upper tank, lower tank or roof, followed by the temperature. Display will revert back to upper tank temperature after a short time period.

Sensor Monitoring:

A faulty or disconnected UPPER TANK, LOWER TANK or ROOF sensor will be indicated by the display flashing SE-U, SE-L or SE-r. The system will automatically shut off, and the display will flash until the sensor has been repaired, replaced or re-connected.

System Self Monitoring

The system continuously monitors for water temperature increase while the pumps are operating. If the controller senses the water is not heating after 4 hours of system operation, the system will shut off and display “FLO” indicating the water or heat transfer fluid is not flowing properly through the system. Contact your installer for system evaluation and repair.

Operating Indicators

To determine if the system is operating properly and providing solar heated water, verify the top tank water temperature is warm. For single tank systems, verify the top tank water temperature is higher than lower tank water temperature when the system is activated.

10: Troubleshooting

The Solar Water Heating System is designed to operate trouble-free for many years. Use the table below to troubleshoot unexpected problems.

PROBLEM	WHAT TO DO
System Doesn't Turn On	<ol style="list-style-type: none"> 1) Confirm that the system is not activating: <ul style="list-style-type: none"> • Place your hand on the ICM. You should feel a slight vibration and hear a slight hum. Caution! Some surfaces may be hot! 2) If the system is not activating: <ul style="list-style-type: none"> • Confirm that the power cord is plugged into a working 120 VAC outlet. • Confirm that the power cord is firmly plugged into the controller power jack. Display should show water temperature in water heater/water storage tank. • Verify all sensor wires are firmly attached and functioning properly, if not the controller display flashes SE-U, SE-L, SE-r for upper tank, lower tank or roof sensor respectively. • Verify pumps are turning on by placing your hand on each of the pumps. You should feel heat, feel a slight vibration and/or hear a slight hum. • Verify heat transfer fluid is flowing. The controller continuously monitors for water temperature increase in the water heater while the pumps are operating. If after 4 hours of operation, the controller senses the water in the water heater is not heating, the controller display flashes FLO. After system repair, system operation is restored by moving solar switch to OFF, then back to AUTO. • Verify that the roof temperature is at least 10 hotter than the lower tank temperature. • Verify that the upper tank temperature is less than the selected Max Water Temp.
Leaks	<ul style="list-style-type: none"> • If the leak is coming from a fitting, tighten the fitting or push the tube fully into the fitting. Refer to the section in this manual on the proper procedure for installing tube fittings. • If the leak is coming from inside the ICM, contact FAFCO for further instruction. • If the leak is coming from the solar collector panel body, a tube repair kit may be used to plug one or more tubes. • If the leak is coming from the solar collector header, contact FAFCO for further instruction. • If the leak is coming from the reservoir, other than the reservoir's relief valve, contact FAFCO for further instruction..
Low on Hot Water	<ol style="list-style-type: none"> 1) If the system has two tanks or an on-demand heater, refer to the water heater manufacturer's operation manual to troubleshoot. 2) If the system has one electric water heater tank: <ul style="list-style-type: none"> • Suggest to the homeowner reducing or spacing out their hot water usage. • Consider installing low flow shower heads and other low flow hot water fixtures. • Consider upgrading to a larger water heater tank. • Raise water heater thermostat setting, although this may decrease energy savings.

If the problem persists, visit www.FAFCO.com for further information.

Maintenance

Ensure that the homeowner is provided with an Owner's Manual. Refer to the Owner's Manual for system maintenance. System components are designed to be low maintenance with estimated replacement life beyond 20 years. FAFCO HTF is designed to last for the life of the system. However, the chemical composition of the HTF may change over time. To check fluid, with tubing cool to the touch, take a very small fluid sample from the fill or drain valve. Fluid that is dark, dirty or has an acidic smell should be replaced.

DRAIN AND REPLACE FLUID

1. Insert tubes into fill and drain ports and place free ends into a bucket
2. Open fill and drain ports to drain glycol. The glycol will drain freely at first and then it will start to drain more slowly.
3. Make sure both tubes are above glycol level in bucket and wait a few minutes.
4. If glycol does not flow freely after five minutes. Go onto roof and remove tubing from upper header connection to break vacuum in the collector loop.
5. Refer to System Fill Procedure on page 21.

Specifications

SOLAR COLLECTORS

Two 2' x 12' Solar Collectors



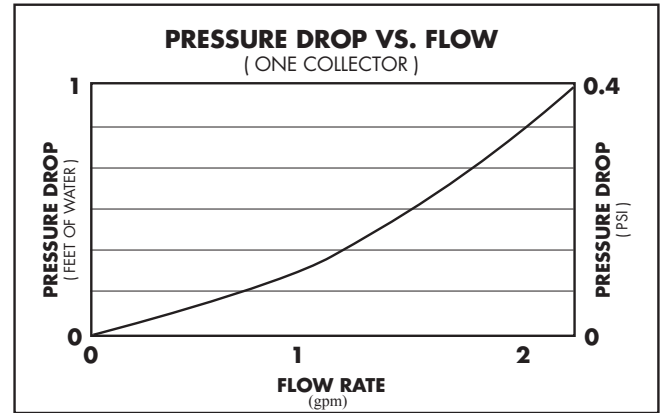
ROOF MOUNTING SPACE: 6' x 13' (two collectors)

1. Material: Black UV resistant copolymer
2. Collector Dimensions: 24"x144" or 48"x144" or 24"x 96"
3. Weight: Dry 0.5 Lbs./Ft²
Full of fluid 1 lbs./Ft²
4. Chemical Resistance: Compatible with common collector fluids, chemical, and corrosion resistant
5. Weatherability: Weatherometer, accelerated outdoor exposure, and other extensive laboratory testing demonstrates long-term weatherability of solar collectors (refer to warranty)
6. Maximum Operating Pressure: 30 psi
7. Maximum Operating Temperature: 200° F
8. Maximum Stagnation Temperature: 235° F
9. Absorptivity: 0.96
10. Emissivity: 0.90
11. Collector flowrate is within +/- 10% up to 144 square feet.

Three 2' x 8' Solar Collectors



ROOF MOUNTING SPACE: 7.5' x 9' (three collectors)



Note: This graph applies to both solar collector lengths, 96" and 144".

INTEGRATED CIRCULATION MODULE (ICM):

1. Input: 12VDC - 2.5A 30W Max. or optional PV
2. Operation: Fully automatic, factory pre-programmed
3. Sensors: 10k Ohm Thermister, UV & weather resistant wire
4. Dimensions: 10" x 6" x 6.5"
5. Maximum Operating Pressure: 150 psi
6. Maximum Operating Temperature: 180° F
7. Compatible with FAFCO HTF

EXPANSION RESERVOIR:

1. Material: Black UV resistant copolymer
2. Dimensions: 20in. X 8.5in. X 2.5in (1.2 Sq*ft).
3. Capacity: 1.4 Gallons.
4. Weight: Dry 2.1 Lb, Wet 14 lb.
5. Air Vent / Pressure Relief Valve opens at 1 psi.
6. Maximum Operating Vacuum: -1 psi.
7. Maximum Operating Temperature: 200° F.
8. Maximum Stagnation Temperature: 235° F.
9. Compatible with FAFCO HTF and corrosion resistant

HEAT EXCHANGER:

1. Type: Brazed plate, 10 plates.
2. Material: AISI 316 stainless steel with copper brazed plates.
3. Maximum Testing Pressure: 290 psi.
4. Maximum Operating Temperature: 437° F
5. Single-Wall Construction
6. Overall Dimensions: 7.51" X 2.87" X 1.94"
7. Weight: 1.48 Lbs

FLEXIBLE HOSE:

1. Type: Corrugated with 1/2" FIP Connections
2. Material: Lead-Free 304 Series Stainless Steel, Brass Nuts, EPDM Gaskets
3. Maximum Operating Pressure: 200 psi
4. Maximum Operating Temperature: 250°F

WIRING:

1. All sensor and PV wires are UV and weather resistant.
2. All wires are rated above maximum environmental and system operating conditions and temperatures
3. All wires are protected from degradation and false signals.

ICM POWER SUPPLY:

1. UL Recognized Class II with integrated ground wire.
2. Input: 100-120VAC ~50-60Hz 0.8A.
3. Output: 12VDC - 2.5A 30W Max.
4. AC Inlet: 3 pin plug-in type
5. Cord: 18 AWG, 6 ft long with
6. ICM Plug: Barrel 2.1 x 5.5 x 9.5 mm (straight).

FAFCO HEAT TRANSFER FLUID:

1. Type: Clear Propylene Glycol
2. Tested L.D.: 20.3 g/kg (>15 g/kg)
3. Toxicology Rating: Gosselin 1
4. AWWA Rating: Class II
7. Additives: FDA Generally Recognized as Safe (GRAS)
5. Maximum Operating Temperature: 250° F / 1200° C.
6. Minimum Operating Temperature: -50° F / -450° C.
7. FDA Listing: Generally Recognized as Safe (GRAS).
8. Compatible with FAFCO Copolymer at all operating conditions.
9. MSDS available at www.fafco.com for information on disposal and First Aid.
10. FAFCO system is overheat protected and has little metal in contact with fluid. It therefore does not promote deposits, corrosion, or degradation of fluid mixture.

TUBING AND FITTINGS:

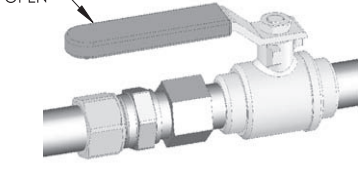
1. FAFCO UV Resistant Solar Tubing and Fittings
2. Material: Black UV resistant copolymer
3. Maximum Operating Temperature: 200° F.
4. Maximum Stagnation Temperature: 235° F.
5. Maximum Operating Pressure: 30 psi
6. Dimensions: Conforms to ASTM F876, standard specifications for Cross Linked Polyethylene (PEX) tubing, 1/2" nominal tube size. (SDR 9)
7. Compatible with FAFCO HTF and corrosion resistant
8. Not for potable use

Required Labels

PART #08917

FAFCO, INC 435 OTTERSON DRIVE, CHICO, CA 95928

COLD WATER SHUT-OFF VALVE



NORMAL OPERATING POSITION

PART #08904

FAFCO, INC 435 OTTERSON DRIVE, CHICO, CA 95928

FREEZE PROTECTION & FLUID SAFETY

CLOSED LOOP PROPYLENE GLYCOL & POTABLE WATER SYSTEM: NO HOMEOWNER ACTION IS NECESSARY FOR FREEZE PROTECTION. INTEGRATED CIRCULATION MODULE (ICM) MUST BE KEPT IN A CONDITIONED ROOM THAT DOES NOT DROP BELOW 32°F.
FREEZE TOLERANCE LIMIT: -20°F

HEAT EXCHANGER: STAINLESS STEEL, BRAZED PLATE, SINGLE WALL
HEAT TRANSFER FLUID TYPE: 35% PROPYLENE GLYCOL & POTABLE WATER MIXTURE
AWWA CLASS II

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

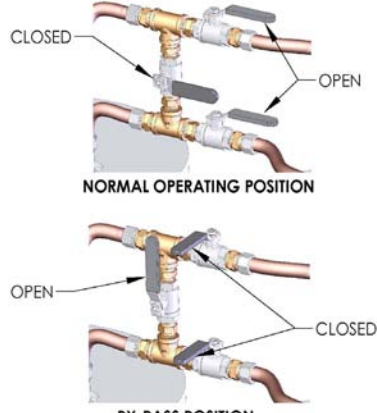
USE ONLY FAFCO HEAT TRANSFER FLUID (HTF) DILUTED WITH POTABLE WATER. FAFCO HTF HANDLING INSTRUCTIONS ARE LOCATED IN THE MSDS SHEET AT THE END OF THE INSTALLATION MANUAL.

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

PART #08917

FAFCO, INC 435 OTTERSON DRIVE, CHICO, CA 95928

STORAGE TANK BY-PASS



NORMAL OPERATING POSITION

BY-PASS POSITION

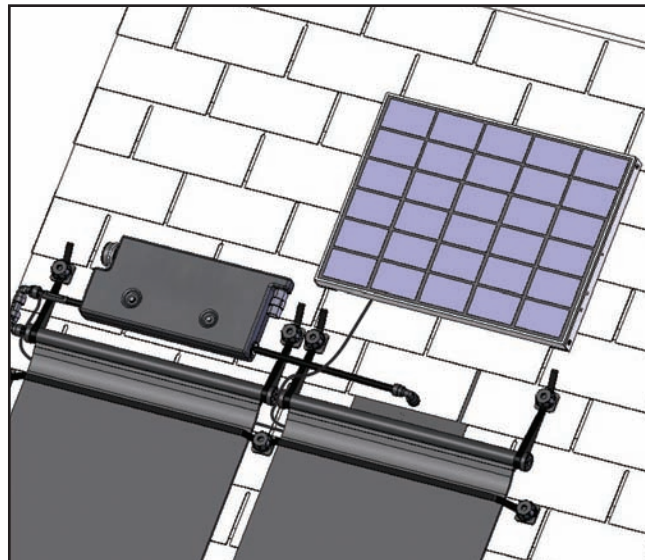
Optional Kits Instructions

PV Panel Kit	29
Collector Add-On Kit	33
Coaxial Adapter Kit.....	34
Tile Roof Installation Kit (TRIK)	36

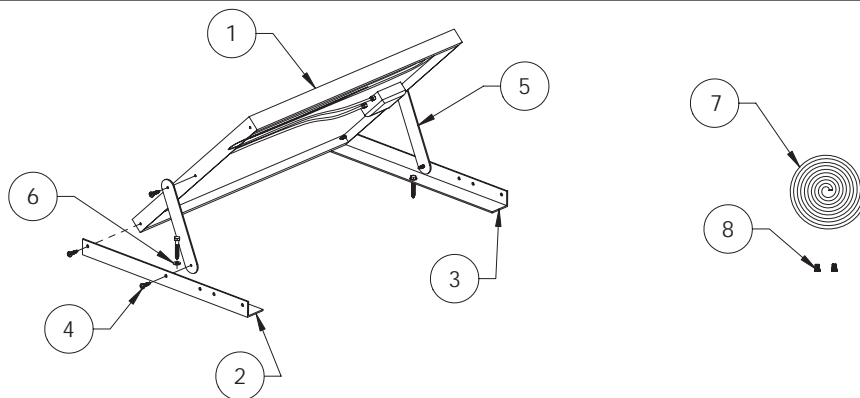
PV Panel Kit

Overview

Once the PV Panel Kit has been installed and connected to the Solar Hot Water System Controller, the solar system will and operate on PV power, whenever sufficient PV power is available. The PV Panel Kit includes the required hardware for the panel to be installed in either a flush mount or tilt mount configuration. Tilt mount angles can be 20, 30, or 45 degrees. Optimum tilt is equal to the site latitude in degrees. For example: Phoenix AZ latitude is 33 degrees.



Parts List

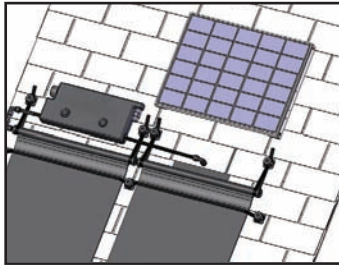


Item No.	FAFCO PN#	QTY	Description
1	08845	1	PV panel, 40W, FAFCO P/N 08845
2	08846	1	Angle, right flush, PV panel
3	08847	1	Angle, left flush, PV panel
4	08752	6	#14 x 1" phil hd self tapping screw
5	08848	2	Tilt leg, PV panel
6	08701	2	Washer, flat, 1/4, stainless
7	08852	1	Cable, gray 50 ft, PV panel
8	08399	2	Wire nut, 16-18 ga, blue

Asphalt Composition Roof Installation

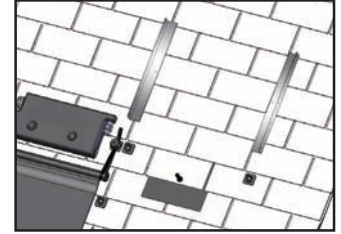
Step 1: Choose Location

The PV panel should ideally be placed above the solar collectors. Alternatively, choose an unshaded area, close enough to allow the PV panel wires to reach under the roof jack into the attic. If the panel is to be tilted, don't shade the solar collectors.



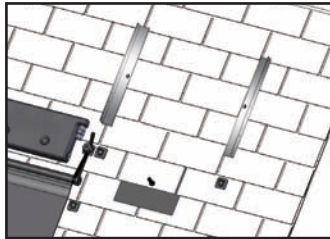
Step 2: Layout Angle Mounts

The two angle mounts are designed for the lag screws to be affixed into two roof trusses on 24-inch centers. Locate two trusses, place angles parallel to each other 27" apart outside-to-outside measurement, with the mounting holes centered over the trusses.



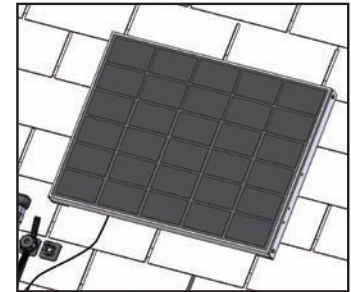
Step 3: Affix Angle Mounts

Mark the location of each mounting hole and move the angle mounts aside. Place a nickel sized daub of Sikaflex sealant at each hole location. Replace the angles parallel to each other, 27" apart outside-to-outside measurement. Securely affix with two 1/4" x 2" lag screws into the trusses. Structural members penetrated by solar system components meet code.



Step 4: Mount PV Panel

Lay the PV panel inside the angles with the wires protruding below. Attach with (4) #14x1" self-tapping screws. If tilt mounting is required, use two tilt legs to set at proper angle depending on your latitude.

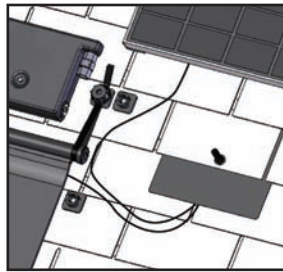


PV Panel Kit

Asphalt Composition Roof Installation (Continued)

Step 5: Run PV Panel Wire Into Attic

Run PV panel wires alongside roof sensor wire under roof jack into attic.

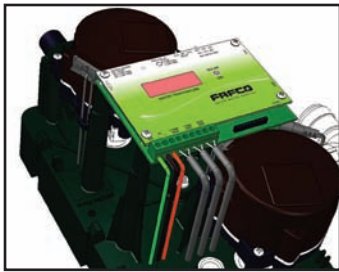


Step 6: Run 50' PV Wire

Run 50' PV wire from ICM, alongside sensor wire, and connect to PV panel wire in attic with wire nuts. **Connect positive to positive and negative to negative.**

Step 7: Connect PV Wiring To ICM

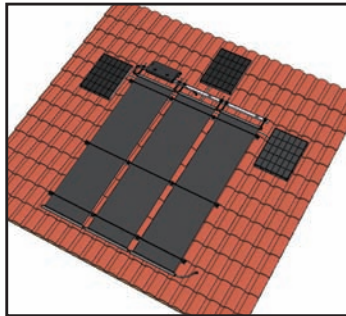
Connect the 50' PV wire to the controller terminal block. **Connect positive to positive and negative to negative.**



Tile Roof Installation

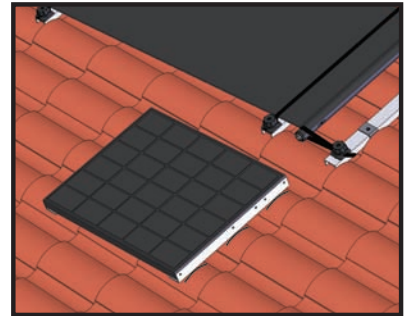
Step 1: Choose Roof Location

Choose any unshaded area close enough to allow the PV panel wires to reach under the roof jack into the attic. The PV panel mounts vertically on a tile roof. Shown are three possible locations.



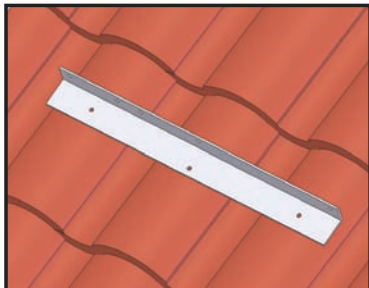
Step 2: Mark Upper Angle Mount Location

Hold one angle mount in place against the upper end of the panel and place panel vertically in chosen position as shown. Mark the location of the angle mount with a pencil.



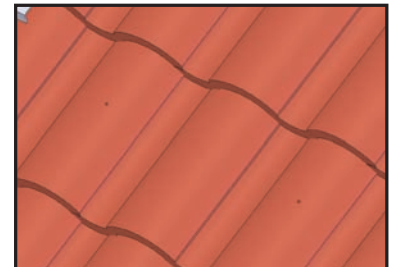
Step 3: Drill Mounting Holes In Angle

Holding the angle in place, move the panel out of the way. Mark on the angle for a mounting hole at the two outside tile peaks. Drill a 1/4" hole in the angle at each mark.



Step 4: Drill Mounting Holes In Tiles

Mark each hole location on the tiles. Move angle aside and drill a hole through the tiles at each mark with a 3/16" masonry bit. Clean away the drilling dust.

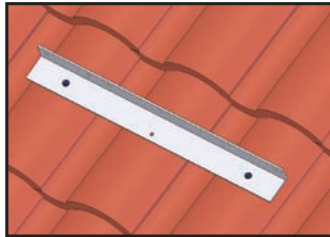


PV Panel Kit

Tile Roof Installation (Continued)

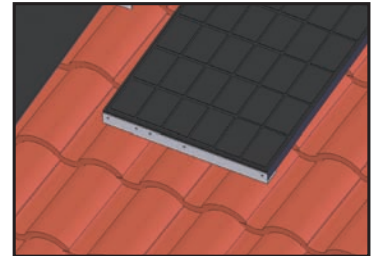
Step 5: Seal And Secure Angle

Place a nickel size daub of roof sealant at each hole. Replace angle and secure to tiles with two 1/4" x 1-1/4" concrete screws.



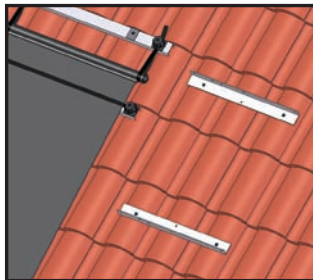
Step 6: Place Lower Angle Mount

Hold lower angle mount in place against lower end of panel and lay panel in place against upper angle mount.



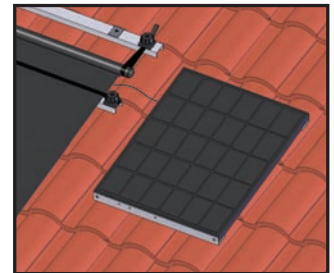
Step 7: Secure Lower Angle Mount

Repeat procedure for lower angle mount.



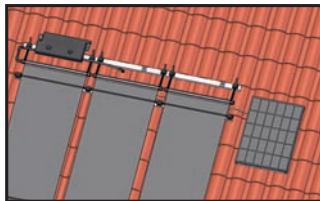
Step 8: Secure PV Panel To Angles

Lay panel inside angles with wire protruding toward upper roof jack. Attach with (4) #14 x 1" self-tapping screws.



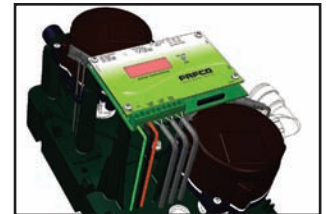
Step 9: Connect PV Wire To Panel

Run PV panel wires alongside roof sensor wire under roof jack into attic. Run 50' PV wire from ICM, alongside sensor wire, and connect to PV panel wire in attic with wire nuts. **Connect positive to positive and negative to negative.**



Step 10: Connect PV Wire To ICM

Connect the 50' PV wire to the controller terminal block. **Connect positive to positive and negative to negative.**



Collector Add-on Kit

Overview

Collector Add-On Kits are available for three 8-foot collectors or two 12-foot collectors. Each add-on kit contains parts and hardware to add an additional 48 square feet of solar collector area. Note: The system is designed for a maximum of two add-on kits, which will provide a maximum solar collectors area of 144 square feet.

Kit Components

Two 12-foot Collectors - PN 758

Item	Description	Part number	Qty
1	Two Collectors, 2' x 12'	08842	1
2	Base, Tie Down	06918	10
3	Cap, Tie Down	06919	10
4	Collet Lock	08819	8
5	Connector, PP Tube	08883	4
6	Strap, 5/8" X 40' Long	08907	1
7	FAFCO Heat Transfer Fluid, 1 Gallon	08897	1

Three 8-foot Collectors - PN 759

Item	Description	Part number	Qty
1	Three Collectors, 2' x 8'	08891	1
2	Base, Tie Down	06918	15
3	Cap, Tie Down	06919	15
4	Collet Lock	08819	8
5	Connector, PP Tube	08883	6
6	Strap, 5/8" X 40' Long	08907	1
7	FAFCO Heat Transfer Fluid, 1 Gallon	08897	1

Coaxial Adapter Conversion Kit

Overview

The Coaxial Adapter Conversion Kit allows the solar tank drainport to feed and return filtered solar storage tank water to the ICM. The adapter kit also retains the drain bibb for tank flushing or draining. The Coaxial Adapter Conversion Kit eliminates the brass tee fitting and filter screen atop the solar storage tank which draws water to the ICM through the cold water dip tube. The adapter kit includes all required hardware to feed and return at the drainport.

Kit Components

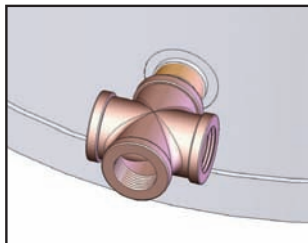
Coaxial Adapter Conversion Kit - PN 776

Item	Description	Part number	Qty
1	Cross, Brass, 3/4" X 3/4", FPT, Lead-Free	08865	1
2	Reducer, Brass, 3/4" MPT X 1/2" MPT, Lead-Free	08862	2
3	Nipple, Brass, 3/4" MPT X 3" Long, Lead-Free	08863	1
4	Nipple, Hex, Brass, 1/2" MPT X 1-1/2" Long, Lead-Free	08854	1
5	Hose, Corrugated, ST/ST, 1/2" X 1/2" X 36" Long	08834	1
6	Filter, Coaxial Tube	08855	1
7	Diptube	08777	1

Step-by-Step Installation

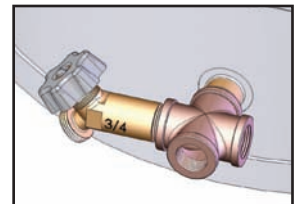
STEP 1: INSTALL BRASS CROSS

Apply thread sealant to the 3" nipple and install finger tight into one port of 3/4" brass cross. Install nipple and cross assembly into drain port at the bottom of the solar storage tank, stopping with cross oriented horizontally. Note: Do not over tighten and crack the brass cross.



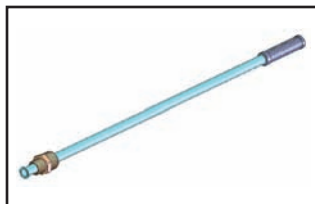
STEP 2: INSTALL DRAIN BIBB

Apply fresh thread sealant to the water heater drain bibb and install into cross on a side port most convenient for future water heater flushing. Do not install drain bibb on the front port of the cross.



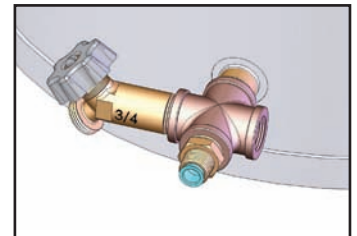
STEP 3: DIP TUBE ASSEMBLY

Apply thread sealant to the 3/4" side of the reducer.



STEP 4: INSERT DIP TUBE

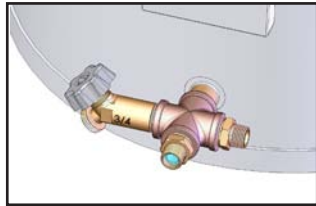
Insert dip tube assembly, filter first, into the solar storage tank and tighten reducer.



Coaxial Adapter Conversion Kit

STEP 5: INSTALL REDUCER

Apply thread sealant to the remaining reducer and install in cross. Install check valve, right side up, with arrow toward tee. Apply thread sealant and insert 1/2" nipple into check valve and tighten.



STEP 6: CONNECT THE 6' HOSE TO ICM

Using the 1/2" nipple, couple the 3' long flex hose provided in the adapter kit to the 3' long flex hose provided in the solar water heating system kit, to make a 6' finished hose. Attach the 6' flexible hose to the nipple. Attach the other end of the flexible hose to the threaded fitting on top of the ICM by carefully forming hose so as to not apply a side load to the fitting. Note: Flexible hose does not require thread sealant.



STEP 7: CONNECT 5' FLEXIBLE HOSE

Push the flared end of the blue dip tube up against the reducer and connect the 5' flexible hose (provided in the solar water heating system kit). Form the hose as needed and attach to the ICM at the threaded metal fitting inside the ICM next to the lower pump. All inter-connecting hot water piping shall be insulated with R-2.6 or greater insulation.



Proceed with the Tubing & Sensor Installation on page 19.

Tile Roof Installation Kit (TRIK)

Overview

The TRIK mounting systems can be installed on curved and flat tile roofs and can only be used for vertical installations. The advantages are:

- Concealed roof penetrations
- Maintains the integrity of the solar collector and roof covering
- Fits flush against the roof tiles for a visually appealing installation

Note: Use an additional TRIK for each Collector Add-On Kit. All necessary materials are provided in the kit, except for weather resistant 1/4" lag screws for each tile clip, as these will vary in length depending on the tile shape. Also, two #14 x 2-1/2", self tapping, stainless steel screws are required when mounting the expansion reservoir.

Kit Components

Three 8-foot Collectors - PN 769

Item	Description	Part number	Qty
1	Channel, TRIK, 3 Collectors	08899	1
2	Clip, tile, channel rack	08734	10
3	#14 X 3/4" self tapping screw	08752	10
4	Screw, phillips, self tapping, #6 x 1/2"L	08458	8
5	Substrate, 2ft x 6'l (22 x 75)	08723	4

Two 12-foot Collectors - PN 767

Item	Description	Part number	Qty
1	Channel, TRIK, 2 Collectors	08901	4
2	Clip, tile, channel rack	08734	8
3	#14 X 3/4" self tapping screw	08752	21
4	Screw, phillips, self tapping, #6 x 1/2"L	08458	24
5	Substrate, 2ft x 6'l (22 x 75)	08723	4

Tools Required

3/16" Drill bit	Tape measure 12' min.	Leather gloves (tile protection)
Rechargeable drill	Black marker	Nail bar to loosen tile nails
3/8" Drive ratchet & sockets	Chalk line	#3 Phillips bit (for #14 screws)
1/4" Masonry drill bit	#2 Phillips bits for drill	Eye protection (for drilling of tiles)

Step-by-Step Installation

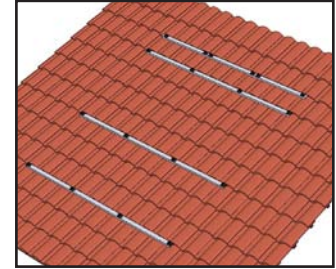
Step 1: Attach bases to channels

The configurations depicted in the installation sequence show 8-Foot Collectors. Attach bases to channels using the large #14 screws. The upper header channel gets bases with slots aligned vertically for the header straps. All body channels get bases with slots aligned horizontally for the body straps.



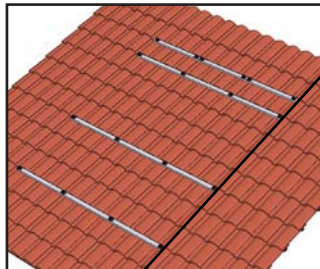
Step 2: Determine layout

- Place upper header channel against the lip of the second tile row down from the ridge. Note; If installing a PV Panel Kit above solar collectors, place upper channel against fourth tile.
- Place the first body channel against the lip of the next tile row down.
- Measure down the roof from the first body channel and place the bottom body channel against the lip of a tile row at approximately 7' for 8-foot long or 11' for 12-foot long collectors. (Measurement will vary with tile spacing)
- Place remaining channel(s) in between, spaced as evenly as possible.



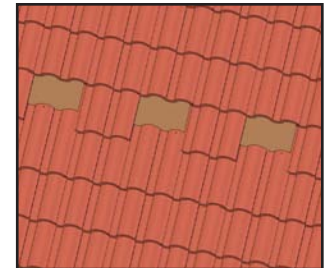
Step 3: Snap chalk line

Snap a vertical chalk line down the roof for aligning the channel ends. Each channel gets 3 tile clips for the 8-foot collectors; 2 clips for the 12-footers. If working with curved tiles, the clips go on the tile high points. Temporarily move the channels aside.



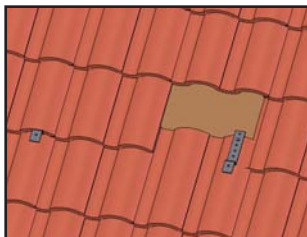
Step 4: Remove tiles and drill holes

- Start with the clips at the bottom channel, remove the tile directly above each clip. If the tile has a short nail into batten strip, a nail bar may be helpful.
- Using a 1/4" masonry bit, drill out the existing high point nail holes. (not the holes in the tile valleys)



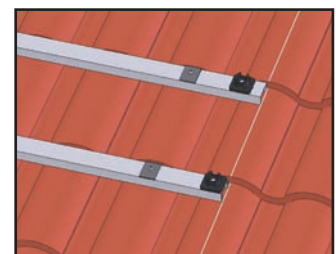
Step 5: Attach tile clips

- Choose the tile clip hole that will allow the channel to be mounted closest to the tile lip.
- Secure the clips using the appropriate length 1/4" lag screws.
- Lag through the drilled tile hole, batten strip, underlayment, and sheathing. Note: Snug only or tile will crack.
- Replace the removed tiles.



Step 6: Attach channels

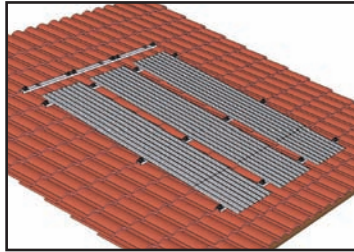
- Align the channel end with the chalk line and slide into place under the tile clips.
- Secure channel to clips with provided #14 self-tapping screws.
- Repeat procedure for next channel up, working up the roof. Note: Install the upper roof jack before the top channel.



Step-by-Step Installation

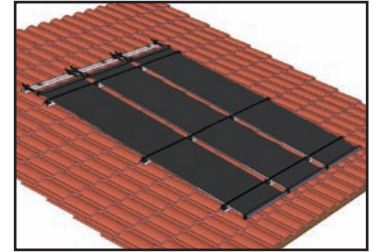
Step 7: Lay corrugated sheet

- A. Lay two pieces of the corrugated sheet on the channels with overlapped ends. Adjust to a total length of 94" for 8' collectors or 142" for 12' collectors and secure together with a #6 screw. Slide sheet until the ends hang over equally above and below the channels.
- B. Center sheet equally side-to-side between the bases. Drive a #6 screw into the channels at every other valley. Clean away all metal shavings.



Step 8: Mount Collectors

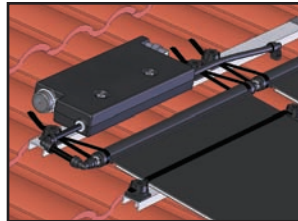
Lay collectors on substrate with top headers hanging over substrate. Install and adjust header straps so that top headers remain hanging over and touching the end of the sheet. Install the body straps. When installing additional collectors, the additional channel ends should be aligned flush against the others.



Step 9: Mount Expansion Reservoir

Place reservoir on channel above chosen outlet collector header, centered between header straps as shown. Mark and drill pilot holes with 3/16" drill bit. Mount reservoir to channel with two #14 x 2-1/2", self tapping, stainless steel screws with fender washers. These are not provided.

Note: Snug down only, do not over tighten.



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