



ARCHITECTURAL
SERIES
BY INTEGRATED SOLAR, LLC
SOLAR WATER HEATING SYSTEMS

**DRAINBACK SYSTEM WITH
DRAINBACK MODULE
HEAT EXCHANGER
Installation, Operation
and Maintenance
Manual**



INTEGRATED SOLAR, LLC
(623) 869-0561 Phone
(623) 869-0891 Fax
2001 W Lone Cactus Dr Ste A
Phoenix, Arizona 85027 • USA
www.integratedsolar.com

TABLE OF CONTENTS

DRAINBACK HEAT EXCHANGE SOLAR SYSTEM	2
INTRODUCTION.....	2
SYSTEM CONCEPT AND OPERATION DESCRIPTION.....	3
SRCC DISCLAIMER STATEMENT	3
OPERATION OF A DRAINBACK SYSTEM	4
GENERAL CONSIDERATIONS	5
SOLAR COLLECTOR INSTALLATION	6
COLLECTOR SIZING AND LOCATION	6
MOUNTING THE COLLECTORS	7
INSTALLER SUPPLIED COLLECTOR MOUNTING MATERIALS	9
COLLECTOR LOOP PLUMBING	10
PIPING RECOMMENDATIONS.....	10
SOLAR STORAGE TANK	11
SUGGESTED MATERIALS FOR INSTALLING TANK	11
INSTALLER SUPPLIED MATERIALS FOR INSTALLING TANK.....	11
INSTALLATION DETAILS FOR TANK.....	11
SOLAR STORAGE TANK LOCATION	12
PLUMBING FOR TANK INSTALLATION (SINGLE TANK SYSTEMS).....	12
TANK ELECTRICAL WIRING (SINGLE TANK SYSTEMS)	13
PLUMBING FOR TANK INSTALLATION (DUAL TANK SYSTEMS)	15
PLUMBING FOR TANK INSTALLATION (SYSTEMS USING TANKLESS GAS WATER HEATER AS BACKUP)	16
DRAINBACK TANK INSTALLATION	17
SUPPLIED MATERIALS FOR DRAINBACK/HEAT EXCHANGER.....	17
DBHX SIZE SELECTION CRITERIA	17
INSTALLER SUPPLIED MATERIALS FOR DRAINBACK/HEAT EXCHANGER	18
INSTALLATION OF DRAINBACK TANK.....	18
SETTING THE CONTROLLER.....	18
PLUMBING THE DRAINBACK TANK	19
COMPLETING THE INSTALLATION	20

BASICS ABOUT THE DRAINBACK SYSTEM'S OPERATION.....	22
COLLECTING THE SUN'S ENERGY.....	22
THE SYSTEM AT REST.....	22
IN AN EMERGENCY.....	23
FREEZE PROTECTION	23
BEFORE CALLING FOR SERVICE.....	24
MAINTENANCE.....	24
WHEN TO CALL FOR SERVICE	25
MODEL AND SERIAL NUMBER RECORDS:	25
DRAINBACK/HEAT EXCHANGER SYSTEM WARRANTY	26
EFFECTIVE DATE	27
TROUBLE SHOOTING GUIDE	28
CONTROLLER OPERATION TEST.....	28
PREPARATION FOR TESTING	28
ON/OFF TEST.....	28
BASIC FUNCTION TEST	28
TEMPERATURE VS. RESISTANCE CHART	29
SENSOR CHECK	29
TROUBLESHOOTING ACTION TABLE.....	30

DRAINBACK HEAT EXCHANGE SOLAR SYSTEM

Introduction

Integrated Solar's "DBHX" Drainback/Heat Exchange method of freeze protection is the most reliable and safest type of system to use. The drainback system is a positive approach to prevent freezing and scaling of the solar collectors, and to prevent overheating/stagnation of the collector fluid in high temperatures and low usage situations. The drainback tank contains a closed loop of water which circulates through the collector(s) and transfers the energy to the storage tank located in the non-freezing environment of the house. The drainback tank contains all of the water necessary to fill the collector loop while the differential control operates the circulating pump. Gravity drains the water out of the collector(s) and piping when the pump is off. The collector fluid is stored in the insulated and protected drainback tank.

There are numerous advantages of a drainback system:

1. Beneficial in all climates
2. Power is not required for the drainback freeze protection to work.
3. Deep and prolonged freezes can be tolerated repeatedly.
4. The collector fluid will not stagnate in high temperature/low usage situations.
5. The closed loop protects collector fluid passages in hard water areas.

The key to a successful drainback system is proper installation. Proper installation requires the collector supply and return lines be installed with sufficient slope to drain back to the tank. Failure to observe this simple rule will circumvent the freeze protection offered by this system concept. The ideal installation is to mount the collectors in a vertical orientation with the transfer module lower than the collectors.

This manual refers to the following system model numbers:

Single Tank Systems Using Solar Tank With backup element

ASDX-65-40P
ASDX-65-40C
ASDX-65-48C
ASDX-80-40P
ASDX-80-40C
ASDX-80-32PX2
ASDX-80-48P
ASDX-80-48C
ASDX-120-40PX2

Systems w/existing Electric Water Heater for storage and backup

ASDX-50-24C
ASDX-50-32P

Dual Tank Systems w/Electric Water Heater for backup

ASDX-65-E-40P
ASDX-80-E-40C
ASDX-80-E-32PX2
ASDX-120-E-40PX2

Dual Tank Systems w/Gas Water Heater for backup

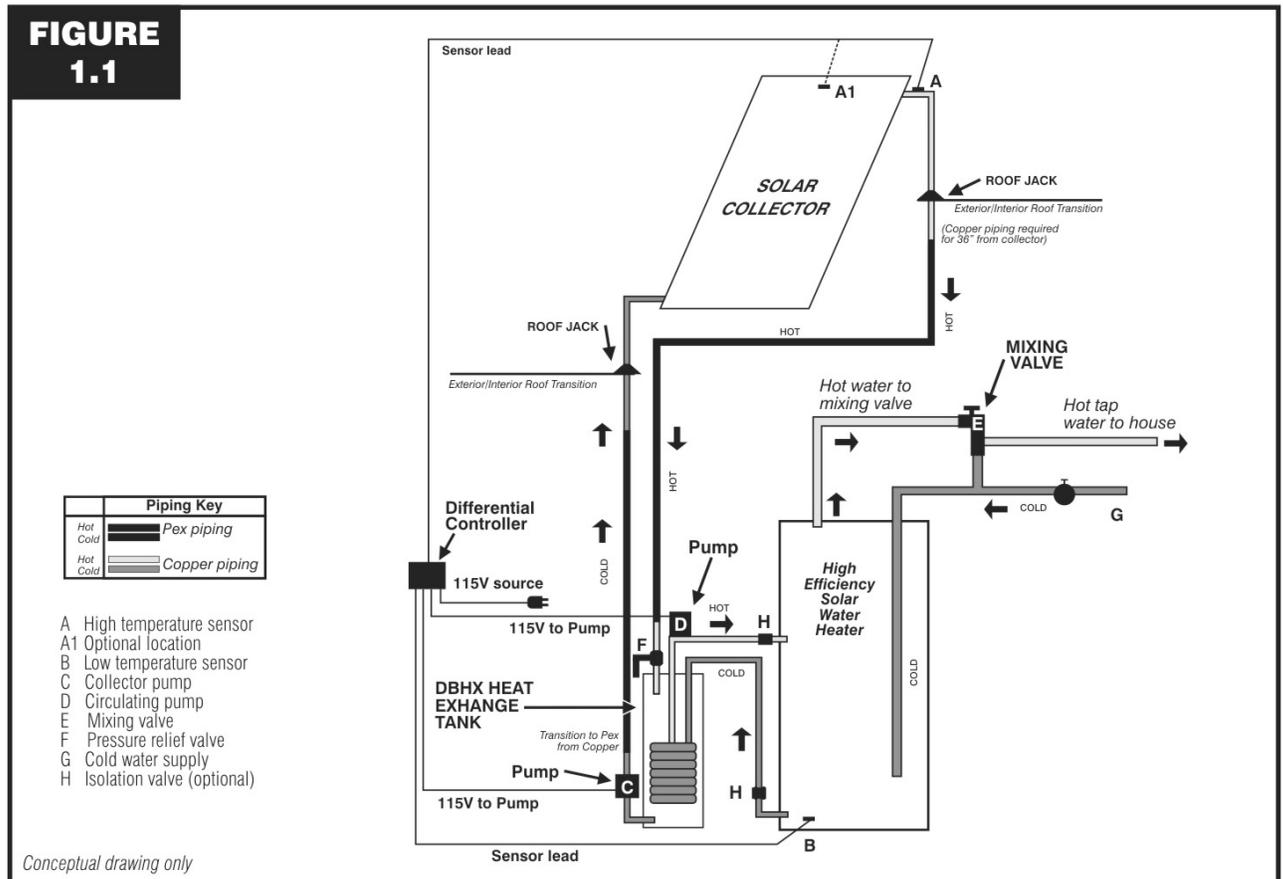
ASDX-50-G-24C
ASDX-50-G-32P
ASDX-65-G-40P
ASDX-80-G-40C
ASDX-80-G-32PX2
ASDX-120-G-40PX2

Systems w/Tankless Gas Water Heater for backup

ASDX-80-TLG-40C

SYSTEM CONCEPT AND OPERATION DESCRIPTION

A diagram of a typical Drainback system is shown in Figure 1.1. A detailed list of Integrated Solar's supplied components and typical installer supplied components is provided in the related sections of this document.



Collector circuit can be all 3/4" copper tubing; if using PEX use only where shown in diagram.

Drainback System Conceptual Drawing Only

Figure 1.1

SRCC Disclaimer Statement

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

OPERATION OF A DRAINBACK SYSTEM

The operation of a Drainback System is simple. Whenever the collector sensor reaches a temperature 16° to 24° F higher than the water at the bottom of the storage tank, the control turns on the pumps. The first pump circulates the water stored in the drainback (DBHX) storage tank through the solar collector. The water increases in temperature and is returned to the drainback storage tank, bathing the copper coil heat exchanger in solar heated water. The second pump circulates water from the storage tank through the copper coil heat exchanger which transfers the heat from the collector to the storage tank. This process continues until the collector temperature sensor is within 4° F of the storage tank temperature sensor, or the storage tank reaches the pre-set high temperature limit, at which time, the control unit turns the pumps off. The water in the collector loop then drains back into the insulated DBHX tank where it remains until the collector temperature again reaches 16° to 24° F higher than the storage tank.

Freeze protection is automatic. When the control has turned the pumps off, the water in the collector loop drains back into the DBHX storage tank. If freezing conditions occur, there is no water in the collectors or piping to freeze and, therefore, no damage occurs.

Overheating and stagnation of the collector fluid is also automatically avoided, because the water in the collector loop also drains back into the DBHX storage tank when the hot water storage tank is fully heated

The primary advantage of the drainback system is that it is fail safe and can be used anywhere. Loss of power does not disable the freeze protection, nor does any other probable malfunction.

The key to the installation of a drainback system is to provide the proper pitch in both the supply and return lines that connect the collector array and the DBHX reservoir tank. The water will drain back through the pump, but to do so, air must go up the return line. Proper sloping in all lines and the collector array, with the avoidance of water traps in the supply line, are required to provide the drainback feature.

GENERAL CONSIDERATIONS

All installations must conform to local building code requirements especially for penetrating structural members and fire-rated assemblies.

The design and installation of the system must not impair emergency movement of the building occupants.

Do not install the collectors on a roof which already needs repairs. Keep a safe distance from roof vents, chimneys, skylights, etc.. Take special precautions to prevent damage to tile, shake and slate roofs.

Be sure the collector(s) are not shaded by external obstructions more than the specified period allowed in the site design

The location, orientation, and position of the collector(s) relative to nearby objects and surfaces shall be such that water run-off from the collector surface is not impeded. In climates where snow may collect on the roof, excessive build-up of snow on lower portions of the collector glazing shall not be permitted to occur. Collectors should be mounted as close to the peak as practical on smooth roof surfaces like metal roofs and as close to the lower edge as practical on rougher roof surfaces like asphalt shingles.

Penetrations of the building through which piping or wiring is passed shall not reduce or impair the function of the enclosure. Structural components penetrated by solar system components must meet applicable codes. Penetrations through fire-rated assemblies shall not reduce the building's fire resistance required by local codes, ordinances, and applicable standards. Penetrations through wall 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. Be sure any caulking and/or sealant is recommended for use on the surface(s) to which it is applied.

Building materials adjacent to solar components should not be exposed to elevated temperatures. Insulation in the sides and back of the collectors protect adjacent materials from heat produced by the collector, pipe insulation must be installed to protect materials from the heat of the collector loop piping. Insulation around the drainback tank and pipe insulation serve to protect adjacent materials from the heat of the solar heated water. Be sure to position the drainback module so that the pumps are not too close to walls or other building materials, and so that the pumps are isolated from public traffic areas.

Filled Weights of Integrated Solar components

AS406C Collector	89 lbs
AS406C Collector	92 lbs
AS408P Collector	120 lbs.
AS408C Collector	121 lbs.
AS410P Collector	146 lbs.
AS410C Collector	151 lbs.
AS412P Collector	174 lbs.
AS412C Collector	179 lbs.
DBHX08 Drainback Module	117 lbs.
DBHX12 Drainback Module	164 lbs.

Temperature and Pressure Ratings of Integrated Solar components

All Collectors	Maximum Operating Temperature 230° F. Maximum Operating Pressure 30 PSI (in drainback loop) Test Pressure 150 PSI
Drainback Modules	Maximum Operating Temperature 230° F. Maximum Operating Pressure 30 PSI (in drainback loop) Maximum Operating Pressure 125 PSI (in Heat Exchanger loop)

SOLAR COLLECTOR INSTALLATION

Locate all collectors for accessibility and check the proposed roof area for compatibility. Collectors must be located for a southerly orientation. The best location for the solar collectors is one that provides a day-long shadow-free view of the southern sky.

Determine which manifold ends of the collector or array are to be used for the inlet and outlet connections; the inlet at the bottom and the outlet at the top. The inlet and outlet must be at diagonally opposite corners of the collector or array, to insure balanced flow. The collector outlet side should be the side closest to the tank to minimize the return pipe length. Consider the best access to the roof and internal access for attic work. Plan routes to be used and prepare the clearances. Plan the piping runs for the least number of bends and fittings while maintaining a minimum 1/4" per foot slope in horizontal runs.

Collector Sizing and Location

The Architectural Series collector array is typically made up of one or two collector panels plumbed together. It is possible to plumb up to a maximum of five collectors together for a residential Domestic Hot Water (DHW) application. It is recommended that the array be mounted with the waterways in the vertical position (up the slope of the roof) in all cases. Collectors mounted horizontally may not drain properly.

Select the collector array location and determine the inlet roof penetration. Locate the rafters to which the array will be mounted and mark with a chalk line.

From the inlet pipe location, strike a horizontal line a minimum of 10 feet. Make certain there are no dips or sags in the roof which may prevent the collector from draining. To insure complete drainage for the solar energy system, the vertical collector array must be installed with a minimum vertical drop towards the inlet of 1/4" per foot of collector header. Lay out the collectors at the proposed location and place a 2 foot (min.) level on the collector near one edge of the glazing and parallel with the ends. Orient the collector array so that the bubble indicates the proper slope. Make certain there is no trap in the collector supply pipe from the roof jack to the collector.

Mounting the collectors

Collectors can be mounted either parallel to a pitched roof surface, or, using a Panel Tilt Kit, on a flat roof or on a pitched roof at a steeper angle than the roof slope. Any alternate mounting method must be capable of maintaining tilt and azimuth to design conditions.

To mount collectors parallel to a pitched roof, use kit #ASZ1 or #AS1 for a single collector, Kit #ASZ2 or #AS2 for 2 collectors side by side, or Kit #ASZ3 or #AS3 for 3 collectors side by side. Figure 2.1 shows several acceptable methods for attaching the Solar Strut to the roof structure; local codes may dictate which method to use. CAUTION: NEVER LAG INTO THE ROOF SHEATHING ONLY.

For barrel or "S" shaped concrete tiles, remove one tile at each penetration point and attach a hanger bolt, threaded rod or "J" hook as shown in Figure 2.1. Use a long enough fastener so that it extends above the top ("peak") of the tile. Drill a hole in the tile so the fastener can extend up through the tile when it is replaced. The strut should be above, not touching, the top of the tile. See Figure 2.2. Although the tile is not the waterproof portion of the roof, it's still a good idea to seal where the fastener extends through the tile with an appropriate sealer.

For metal roofs, use fasteners recommended by the roof manufacturer to attach the Solar Strut.

To mount collectors using the Architectural Series Tilt Kit, first determine the length of the riser needed to achieve the desired angle for the installation. Use one Panel Tilt Kit per collector. Use Kit #ASTKXX5 (where "XX" is the riser length) if you wish to attach the 5" base shoes directly to the roof as shown on the left hand side of Figure 2.3. Use Kit #ASTKXX3 if you wish to attach the 3" shoes to Solar Strut as shown on the right side of Figure 2.2 (for multiple collectors, the Solar Strut method is usually easier). Attach the 5" shoes or the Solar Strut to the roof in one of the ways shown in Figure 2.1. CAUTION: NEVER LAG INTO THE ROOF SHEATHING ONLY.

All collector installations must allow for a 2" minimum clearance between the back of the collector and the roofing material.

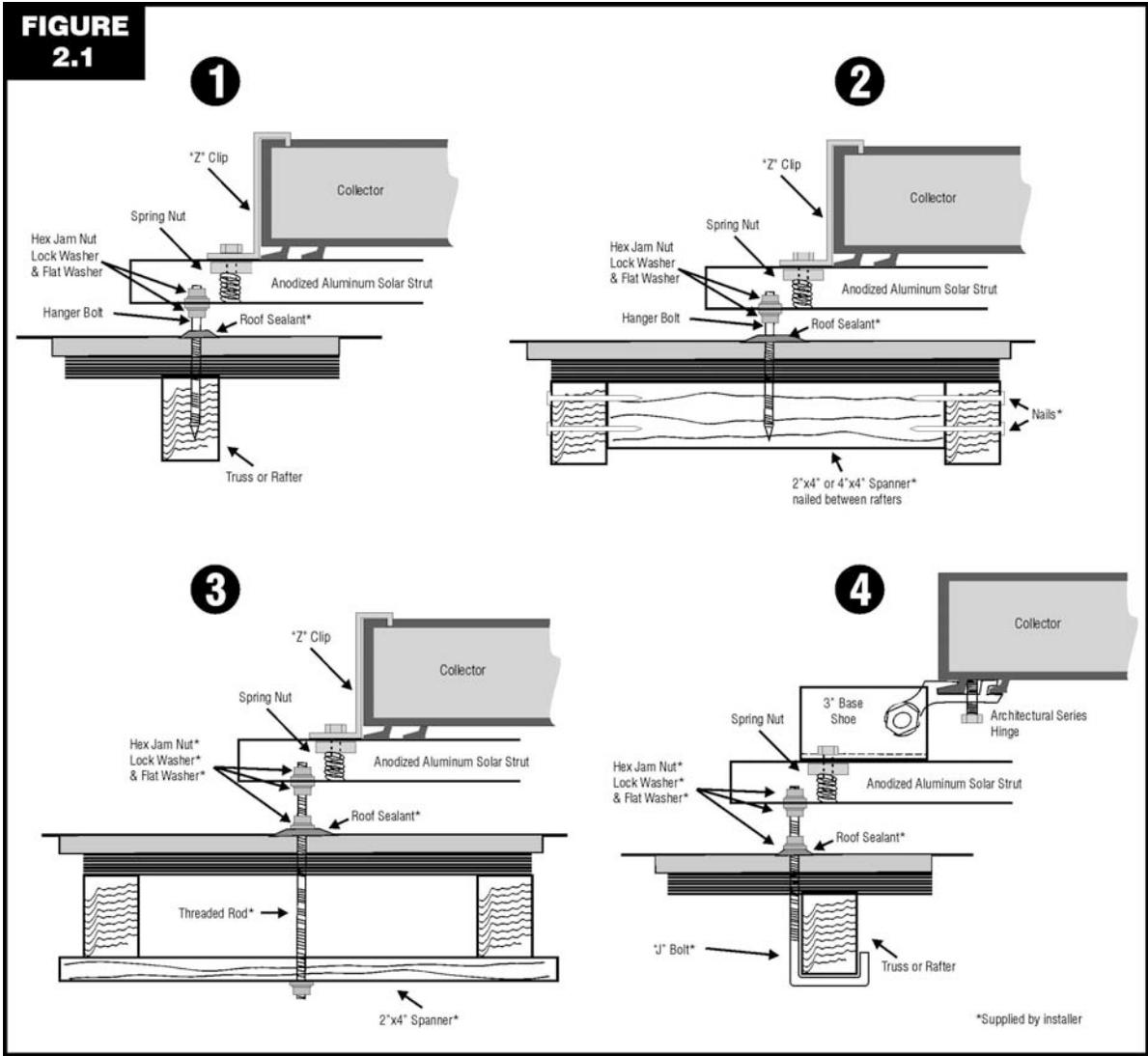


Figure 2.1

Methods of attaching to the roof structure

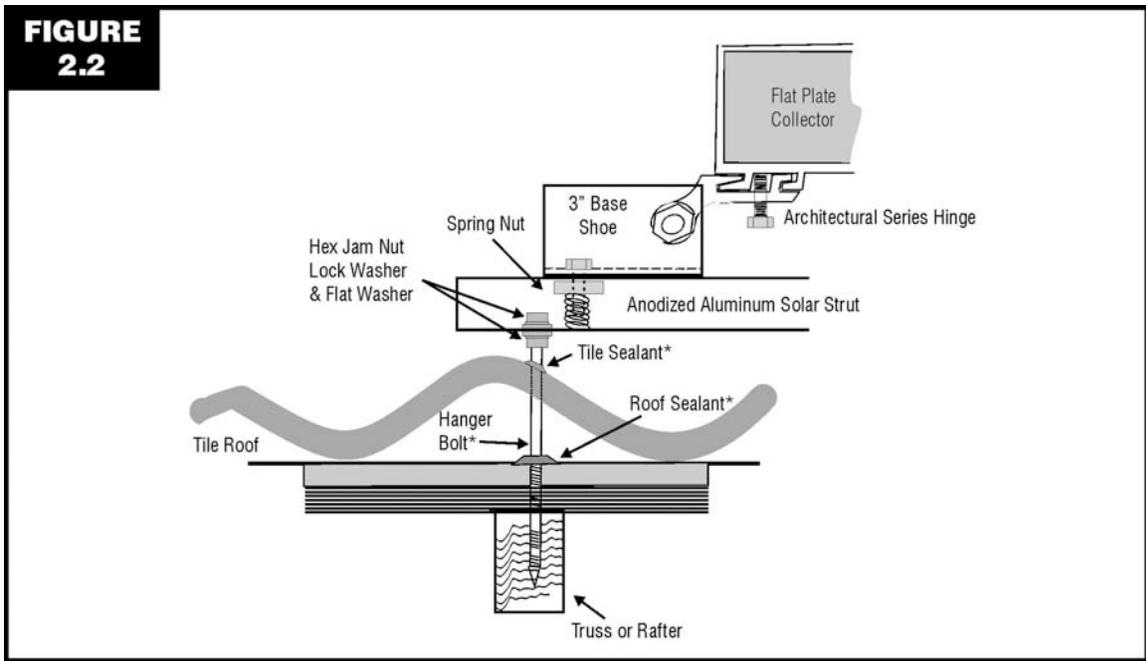


Figure 2.2

Mounting above concrete tile

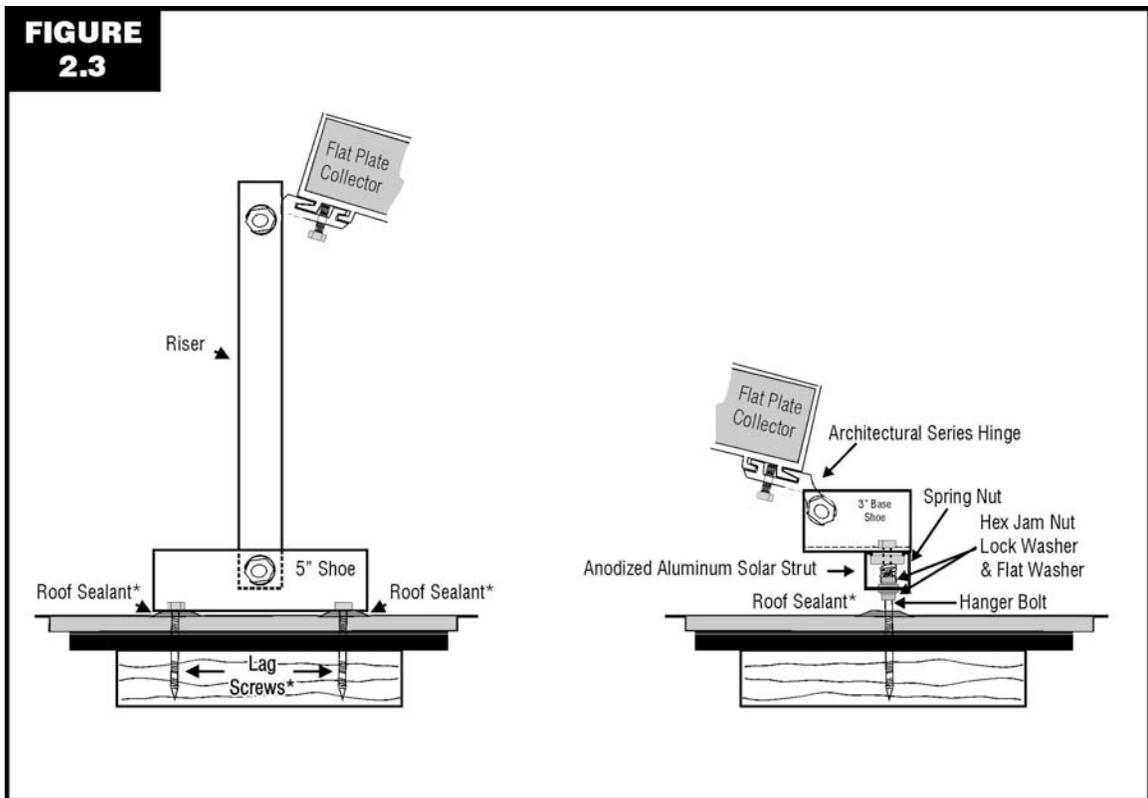


Figure 2.3

Panel Tilt Kit showing both 5" shoes directly on the roof and 3" shoes on strut

Suggested collector materials for installation

Integrated Solar's drainback solar water heating systems will require the following parts to attach to the Drainback Module and complete the system:

- A. Collector panel with sensor
- B. Collector panel(s) if more than one required
- C. Appropriate mounting kit for the roof type and slope.
- D. 2 - 3/4" unions or couplers for connecting supply and return pipes to collectors
- E. 2 - 1" x 3/4" reducing adapter for header connections
- F. 2 - 1" Copper Caps to cap header ends not being used
- G. 2 - 1" C x C unions or couplers per additional collector if more than one required
- H. 2 - flashings for roof plumbing penetrations

Installer supplied collector mounting materials

The installer must bring the following components to the roof to properly install the Architectural Series solar collector array.

- A. Lag screws or bolts (and nuts) and washers (length and size to be compatible with the local conditions and roof type)
- B. Flux
- C. Lead free solder
- D. Sealing and caulking materials
- E. Pipe insulation having an R2.6 or higher rating, such as Insul-Tube® with at least a 1/2" wall thickness, and weather proof coating for exposed insulation.
- F. Pipe supports
- G. 1" stainless steel hose clamp
- H. Wire nuts
- I. #18/2 shielded wire (rated for outdoor use).

Collector Loop Plumbing

The collector loop must be Type M or Type L 3/4" copper tubing (PEX may be used only where shown in Figure 3.1 or Figure 4.1) and must be continuously sloping downward (at least 1/4" per foot) toward the drainback tank.

Piping recommendations

- A. Collector circuit can be all 3/4" copper tubing. If using PEX, use only where shown in Figure 3.1 or Figure 4.1; the PEX must not be exposed to sunlight, and you must use 36" of uninsulated copper from both the collector inlet and outlet before converting to PEX.
- B. Clean and flux all sweat joints before soldering. Use only 95/5 or approved lead free solder in the collector loop.
- C. Plumb all solar loop lines on 3" minimum centers to accommodate pipe insulation.
- D. Use pipe insulation having an R2.6 or higher rating, such as Insul-Tube® with at least a 1/2" wall thickness. All collector loop piping must be insulated, except the 36" of uninsulated copper from both the collector inlet and outlet if you are using PEX.
- E. Slip insulation over straight runs before soldering, keeping 6" clear of all joints for soldering and leak detection. Insulation exposed to sunlight should be painted with a UV resistant latex paint or wrapped in aluminum foil duct tape.
- F. Secure all piping with adequate pipe hangers and straps in order to insure proper support and drainage slope of at least 1/4" per foot. Supports must not compress the insulation.
- G. Be careful not to pinch or cut the sensor wire insulation, especially where it enters the roof flashing, goes through the ceiling, or where it is supported. Sensor wire used outside must be rated for outdoor use and protected from ultraviolet radiation.
- H. Hard water conditions can result in sediment in the storage tank and within the drainback tank loop. A water softener or filter should be used to protect the solar energy system.

CAUTION

Air Vents should not be installed on DBHX system collector loop

SOLAR STORAGE TANK

Integrated Solar does not manufacture Solar Storage Tanks. For a single tank system, always use a solar storage tank with a backup element that is listed and labeled by an accredited listing organization, such as Underwriter's Laboratories Inc.®. For either a dual tank system or a system with a tankless gas water heater backup, always use both a solar storage tank and a backup water heater that is listed and labeled by an accredited listing organization, such as Underwriters Laboratories, Inc.®. For a system using an existing (or new) 50 gallon electric tank as both storage and backup, always use an electric water heater with a backup element that is listed and labeled by an accredited listing organization, such as Underwriter's Laboratories Inc.®.

Water heaters with an insulation rating of less than R-12 should have an exterior insulation blanket installed to provide a minimum insulation rating of R-12.

Suggested Materials for Installing Tank

- A. Solar storage tank with electric element backup (Dual Tank Systems do not require the electric element backup in the tank, the backup heating is provided by the existing gas or electric water heater.)
- B. Plumbing components
 - 2 - 1/2" ball valves (optional)
 - 1 - tank earthquake strap set (if required)
 - 2 - 3/4" x 1/2" dielectric unions
 - 2 - 3/4" x 18" (or other length as required) water flex connectors
 - 1 - 3/4" mixing valve (120 to 160 degrees F.)
 - 1 - 150 psi, 210 degrees F. (T & P) relief valve
 - 2 – In Line Thermometers (Only 1 for Dual Tank Systems)
 - 3 – 3/4" 2 way ball valves (Dual Tank Systems only)
 - 1 - Brass 3/4" FIP Tee (only for systems using 50 gallon Electric Water Heater for both storage and backup (ASDX-50-24C and ASDX-50-32P))
 - 1 – Brass 3/4" X CLOSE Nipple (only for systems using 50 gallon Electric Water heater for both storage and backup (ASDX-50-24C and ASDX-50-32P))
- C. Tank installation Instructions

Installer Supplied Materials for Installing Tank

- A. #18/2 bell or shielded wire (rated for outdoor use)
- B. Wire nuts (4)
- C. Silicone Sealant
- D. 95-5 or approved lead-free solder
- E. Flux
- F. 1/2" and 3/4" copper pipe
- G. Misc. copper fittings
- H. Pipe insulation having an R2.6 or higher rating, such as Insul-Tube® with at least a 1/2" wall thickness, and weather proof coating (as required)
- I. #14 gauge wire and conduit (tank power and ground)

Installation Details for Tank

Single tank systems are recommended for applications where electric water heaters are existing. Dual tank systems with electric backup may be used to increase capacity for large usage. Dual tank systems with gas backup are used when gas will be providing the backup. All piping and component installation must conform to local and state codes.

Solar Storage Tank Location

The storage tank should be located, whenever possible, in the same location as the old water heater, since the electrical and plumbing connections will already exist. Position the tank in a place where it can be accessed for service and maintenance. Water heater tanks located in or above the living space shall be installed on a drip pan with a drain line to a waste line or outside or have other means to safely remove any excess liquid.

Plumbing for Tank Installation (Single Tank Systems)

Follow these instructions and refer to Figure 3.1 (See Figure 3.3 for 50 Gallon Electric Water heater being used as storage and backup):

- A. Turn off the cold water feed to the existing water heater. Ensure that the existing shut off valve is working correctly, and repair or replace it if necessary.
- B. Remove old water heater
- C. Set the new storage tank on a solid floor foundation and use shims as needed to level it.
- D. Position the tank so that the two inspection covers and drain valve are accessible. Building materials adjacent to solar components should not be exposed to elevated temperatures.
- E. Install the supplied pressure and temperature relief valve with a 3/4" drain line to discharge no higher than 6" from the floor, or as required by local codes.

WARNING

T & P relief valve discharge line
must not be blocked or reduced in size.

- F. Install a tempering (mixing) valve to reduce the possibility of scalding injury to the system users. The tempering valve must allow a range of selectability of at least 10°C (18°F) and must include a set point of 50°C (122°F).

WARNING

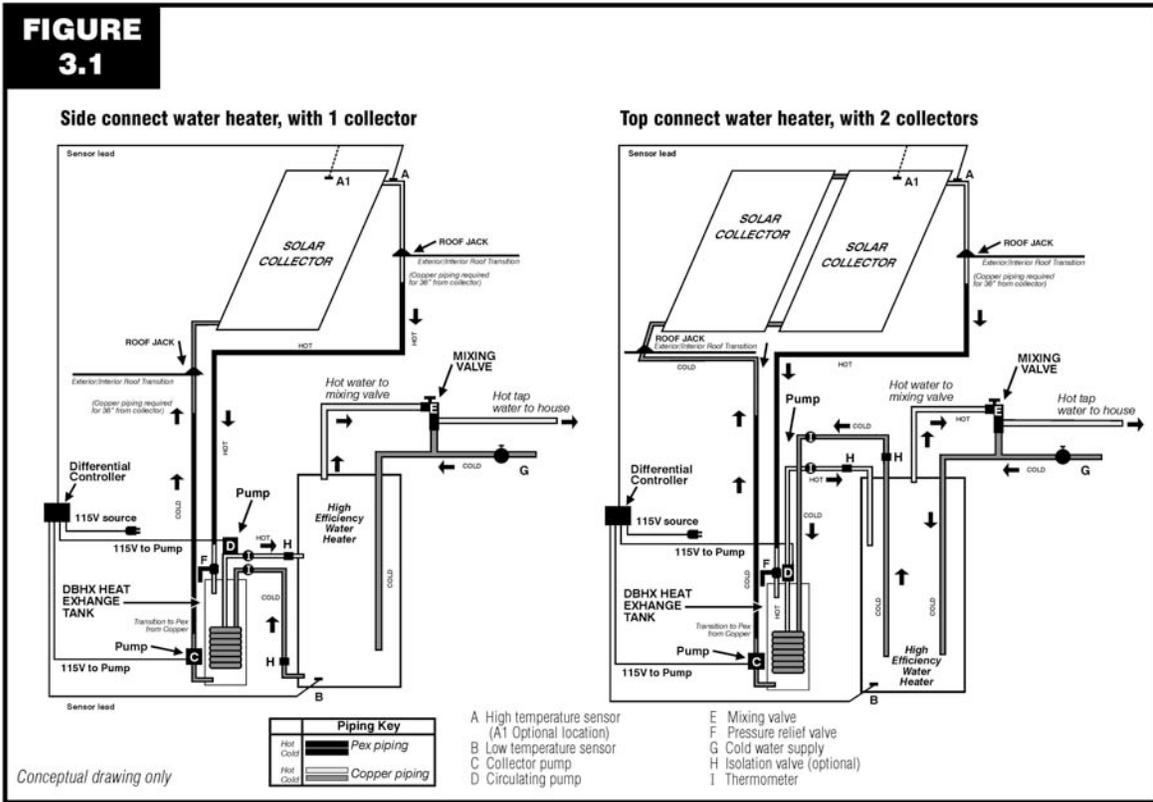
An approved tempering valve must be used in
the hot water line to the house.

- G. It is recommended that the cold water feed line to the mixing valve be connected to the bottom of the valve in order to avoid unwanted thermosyphon or possible damage to certain types of mixing valves. A heat trap is required for the hot side of the Watts 70A mixing valve. See manufacturer's instructions.

CAUTION

Avoid heat damage to the tempering valve.
Remove the thermostatic assembly before soldering.
Once the tempering valve has cooled, reinstall the valve assembly.

- H. Install the cold and hot water lines to the tank. Dielectric unions are not required in all code jurisdictions, however, they are a good idea since the nipples supplied with most tanks are not a dielectric connection.
- I. Insulate all hot water lines, and the final 5 feet of the cold water feed line (or all the exposed cold water feed line if less than 5 feet is exposed from the wall to the tank) with pipe insulation having a minimum R2.6 value, such as Insul-Tube® with at least a 1/2" wall thickness.



Collector circuit can be all 3/4" copper tubing; if using PEX use only where shown in diagram.

Figure 3.1

SINGLE TANK SYSTEM

Tank Electrical Wiring (Single Tank systems)

WARNING

To avoid fatal shock hazard shut off main power supply before beginning.
 Lock and red tag the box to prevent accidental connection of power.
 For 110 volt A.C. connections,
 turn off power to circuit to which connection is to be made.

The wiring diagram for the electrical element is located on the inside of the upper access cover or in the water heater installation instructions. Also see Figure 3.2.

On a 50 gallon electric tank being used for both storage and backup (Systems ASDX-50-24C and ASDX-50-32P), set the thermostat at 80° F on the lower heating element. Leave the upper thermostat at about 125° so it will operate as the backup.

WARNING

Do not turn on power to electric element until tank is full of water.
 Failure to follow this instruction will burn out the element and void the tank manufacturer's warranty.

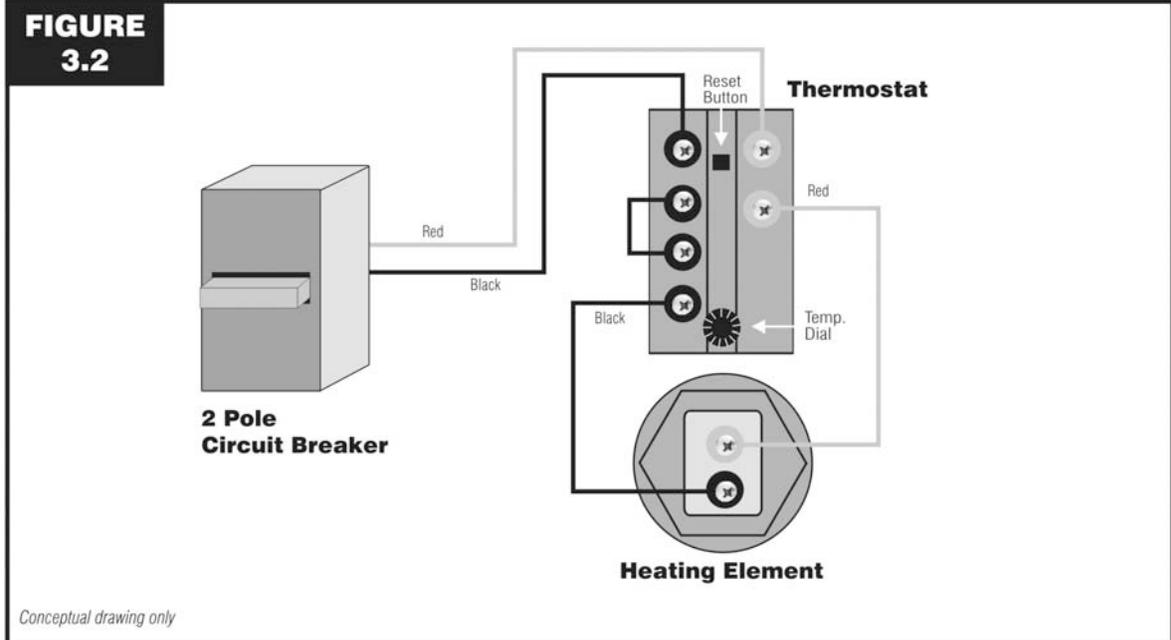


Figure 3.2

Water Heater Electrical Schematic

WARNING

WATER HEATER MUST BE GROUNDED.
CONNECT A #14 (MIN.) GAUGE WIRE FROM A SUITABLE GROUND SOURCE
TO THE GROUND TERMINAL OF THE WATER HEATER.

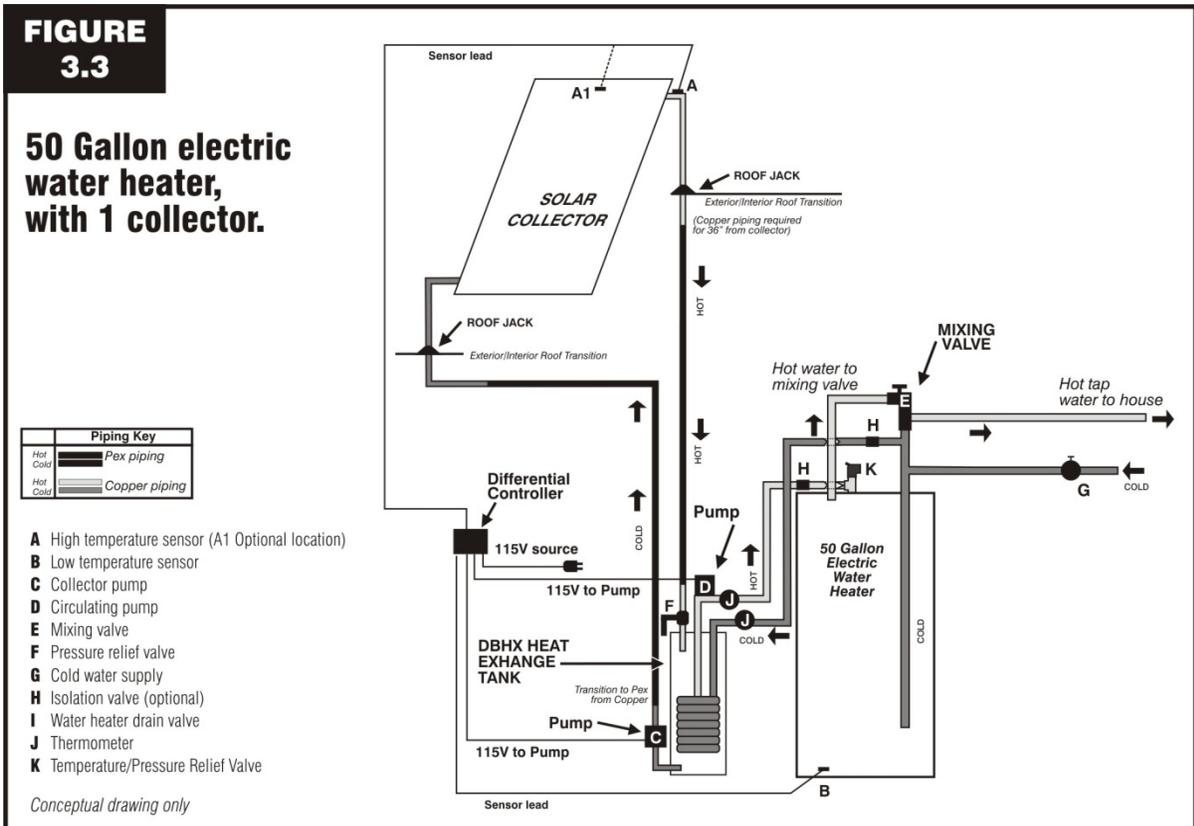


Figure 3.3

FIFTY GALLON ELECTRIC WATER HEATER AS STORAGE AND BACKUP

Plumbing for Tank Installation (Dual Tank Systems)

Follow these instructions and refer to Figure 4.1:

- A. Turn off the cold water feed to the existing water heater. Ensure that the existing shut off valve is working correctly, and repair or replace it if necessary.
- B. Locate the solar storage tank as close as possible to the existing water heater.
- C. Set the new storage tank on a solid floor foundation and use shims as needed to level it. Water heater tanks located in or above the living space shall be installed on a drip pan with a drain line to a waste line or outside or have other means to safely remove any excess liquid.
- D. Position the new storage tank so that the two inspection covers and drain valve are accessible. Building materials adjacent to solar components should not be exposed to elevated temperatures. In a dual tank system, do not connect any element(s) in the solar storage tank to electrical power. Backup heat is provided by the second (existing) electric or gas water heater.
- E. Install the supplied pressure and temperature valve with a 3/4" drain line to discharge no higher than 6" from the floor, or as required by local codes.

WARNING

T & P relief valve discharge line
must not be blocked or reduced in size.

- F. Install a tempering (mixing) valve to reduce the possibility of scalding injury to the system users. The tempering valve must allow a range of selectability of at least 10°C (18°F) and must include a set point of 50°C (122°F).

WARNING

An approved tempering valve must be used
in the hot water line to the house.

- G. It is recommend that the cold water feed line to the mixing valve be connected to the bottom of the valve in order to avoid unwanted thermosyphon or possible damage to certain types of mixing valves. A heat trap is required for the hot side of the Watts 70A mixing valve. See manufacturer's instructions

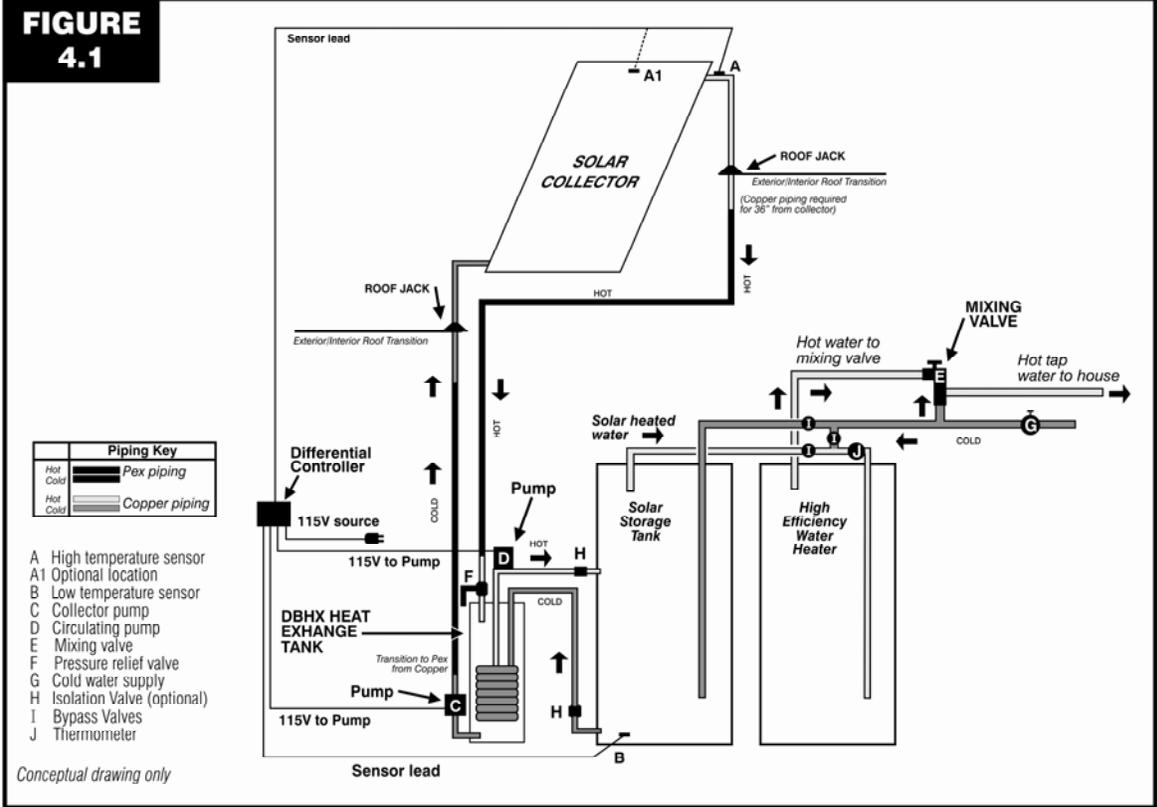
CAUTION

Avoid heat damage to the tempering valve.
Remove the thermostatic assembly before soldering.
Once the tempering valve has cooled, reinstall the valve assembly.

- H. Install the cold and hot water lines to the tank. Install 3 3/4" 2 way ball valves as shown in Figure 4.1 to allow the solar storage tank to be bypassed if ever necessary. Install an in line thermometer in the line between the "Hot" outlet of the solar storage tank and the "Cold" inlet of the backup tank. Dielectric unions at the tank connections are not required in all code jurisdictions, however, they are a good idea since the nipples supplied with most tanks are not a dielectric connection.
- I. Insulate all hot water lines, and the final 5 feet of the cold water feed line (or all the exposed cold water feed line if less than 5 feet is exposed from the wall to the tank) with pipe insulation having a minimum R2.6 value, such as Insul-Tube® with at least a 1/2" wall thickness.

If you are replacing the existing electric or gas water heater, follow the water heater manufacturer's instructions, and conform to all applicable local codes for the water heater installation as well as the solar system installation.

FIGURE 4.1



Collector circuit can be all 3/4" copper tubing; if using PEX use only where shown in diagram.

Figure 4.1

DUAL TANK SYSTEM

Plumbing for Tank Installation (Systems using Tankless gas water heater as backup)

Follow all the instructions under Dual Tank Systems, and refer to Figure 4.2. Be sure that the tankless water heater senses the temperature of the incoming water, so that it will not turn on if the solar system is supplying hot enough water. Refer to the tankless water heater manufacturer's instructions and specifications.

FIGURE 4.2

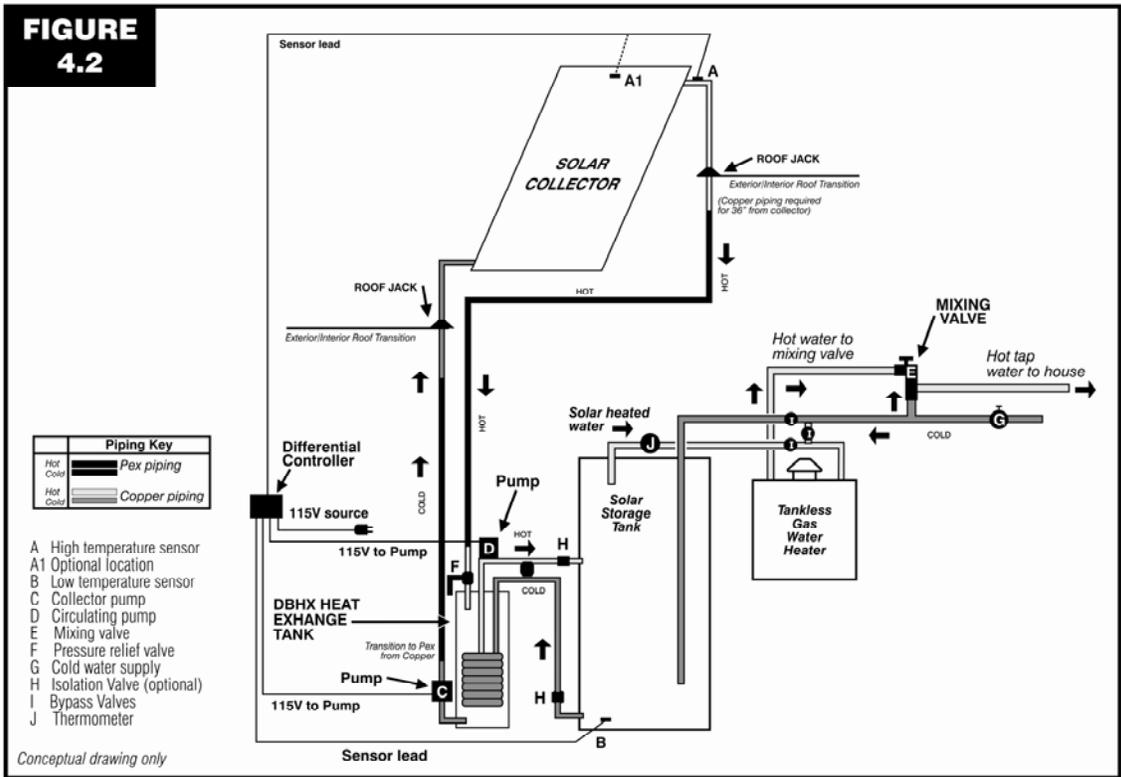


Figure 4.2

TANKLESS GAS WATER HEATER AS BACKUP

DRAINBACK TANK INSTALLATION

Supplied Materials for Drainback/Heat Exchanger

Separate all parts from packing material and check each one with the illustration and the listing below to make certain all items are accounted for before discarding any packing material.

Transfer module (drainback heat exchanger tank with integral pumps (2), and controller with power cord)

10K sensor for collector (if the sensor is not already installed on the collector).

10K sensor for Storage Tank

Installation Manual (Includes Troubleshooting Guide)

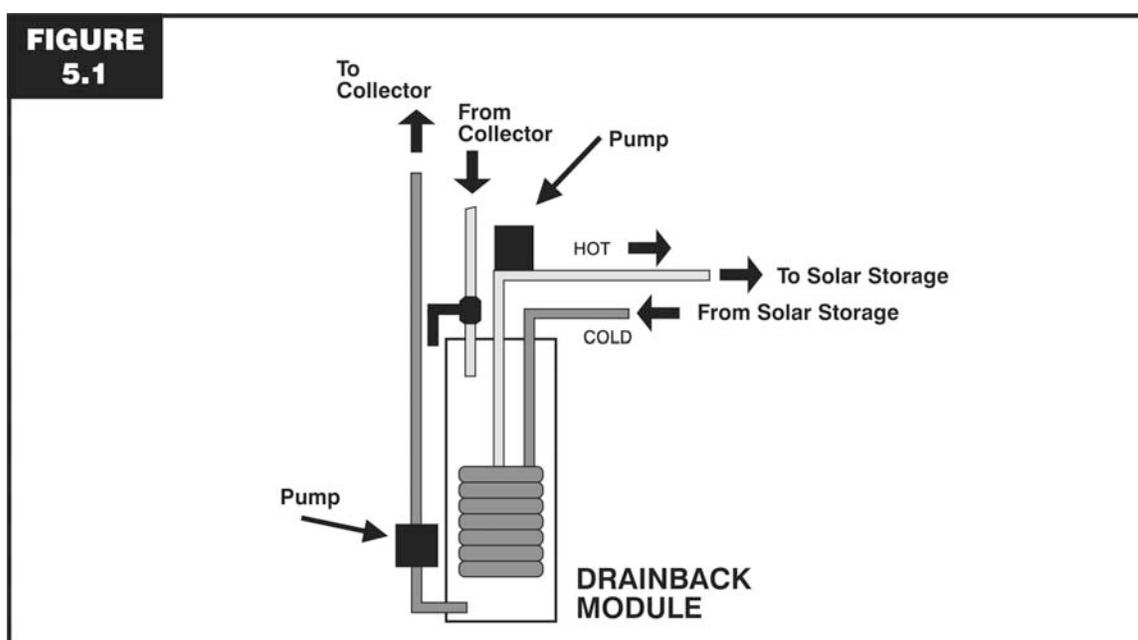


Figure 5.1

DRAINBACK MODULE

DBHX Size Selection Criteria

The Integrated Solar drainback heat exchange module comes in two sizes: an eight gallon unit and a twelve gallon unit. The eight gallon model should be used in applications utilizing 64 square feet or less of collector area and a maximum total pipe length of 155 feet with 3/4" piping, or for 80 or 96 square feet of collector area and a maximum total pipe length of 95 feet. The twelve gallon model should be used in applications with a collector array of 80 or 96 square feet with system piping up to 155 total length, or for 64 square feet or less of collector area with system piping up to 215 feet total length. In the event the collectors are to be installed higher than 25 feet above the DBHX tank, a booster pump is required and the factory should be consulted. Consult the factory if there are any questions concerning proper drainback tank sizing or selection.

Installer Supplied Materials for Drainback/Heat Exchanger

The installer must bring the following components to the area where the drainback tank is to be installed in the drainback system:

- A. 95/5 solder or approved lead free solder
- B. Flux
- C. Grounded 115 VAC outlet
- D. Misc. 1/2" and 3/4" copper fittings and hard copper to connect the transfer module with the collector array and the storage tank
- E. 18/2 shielded wire for connecting sensors to the control
- F. Pipe insulation having an R2.6 or higher rating, such as Insul-Tube® with at least a 1/2" wall thickness, and weather proof coating (as required)
- G. Funnel with 1/2" opening and bucket to measure water fill (3/8" tubing may be used to siphon fluid to drainback tank)
- H. 3/4" MIP Hose Bib or 3/4" brass plug for drain port tee.
- I. 30 psi pressure relief valve, or adjustable pressure relief valve set to 30 psi

Installation of Drainback Tank

The module should be located as close as possible below the collectors to provide best drainage results. Maintain access to pumps, control and drain port. Building materials adjacent to solar components should not be exposed to elevated temperatures. Insulation around the drainback tank and pipe insulation serve to protect adjacent materials from the heat of the solar heated water. Be sure to position the drainback module so that the pumps are not too close to walls or other building materials, and so that the pumps are isolated from public traffic areas.

CAUTION

DO NOT INSTALL ANY TYPE OF AIR VENT ON THE COLLECTOR/DRAINBACK TANK LOOP. CONSTANT INFLUX OF NEW OXYGEN WILL CAUSE THE DRAINBACK TANK INTERIOR TO RUST

The module must not be installed in an area where it is subject to freezing.

We do not recommend installing the module higher than the top of the storage tank unless space considerations require it. Do not install the module less than two feet below the bottom header of the collectors to insure adequate drainback..

Setting the Controller

Refer to Figure 5.3 for controller settings behind the removable panel on the controller

- A. Install the supplied storage sensor in the bottom of the solar storage tank.
- B. Connect the storage sensor wire to the control at terminals 1 and 2, labeled "Tank". See Figure 5.2
- C. Connect the collector sensor to the control at terminals 3 and 4, labeled "Solar". See Figure 5.2.
- D. Set the "Turn On" differential (Top Dial) to 24° F (All the way clockwise).
- E. Set the "Hi Limit" (Bottom Dial) to the desired setting, typically 140° to 160° F. The High Limit is the temperature at the bottom of the solar tank which will turn off the solar water heating system. For Gas Backup Systems, set the High Limit no higher than 140° F. You may set the High Limit lower if the household hot water usage is expected to be low (few people in the home), or, for Electric Backup systems, higher if usage is expected to be high (large family size, large bathtub(s), frequent guests, etc).

CAUTION

ALWAYS SET THE CONTROL HIGH LIMIT SETTING
LOWER THAN THE TANK MANUFACTURER'S HIGH TEMPERATURE LIMIT

- F. Set the "On-Auto-Off" slide switch to "Auto". In "Auto," the controller will turn on the pumps only when there is heat available from the sun and the tank needs heat. In "On," the controller will operate the pumps continuously, and in "Off," the controller will keep the pumps off all the time.

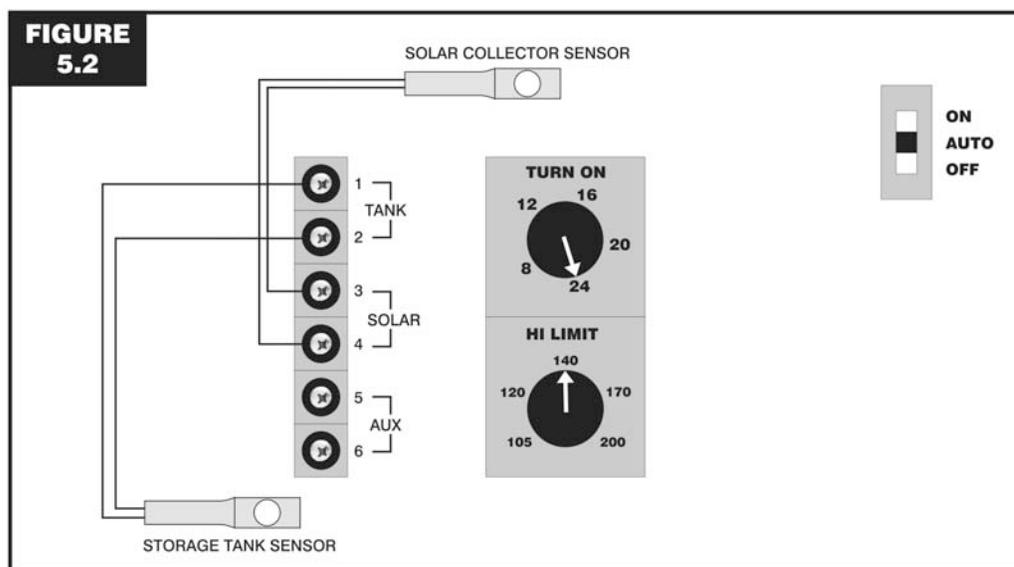


Figure 5.2

Setting the Controller

Plumbing the Drainback Tank

(Refer to Figure 5.3 for drainback module connections and filling procedures.)

- A. Install the 3/4" MIP hose bib or 3/4" brass plug in the drain port tee.
- B. Connect the collector supply to the outlet of the lower pump at the dielectric union.
- C. Fill drainback tank to the fill union using the funnel or siphoning hose. Fill until the fluid level is at the fill union using potable water.
- D. Connect the collector return to the drainback module at the fill union.
- E. Connect the storage supply line to the module at 1/2" union and to the 1/2" ball valve and dielectric union at the tank port. On a side connect tank, the storage supply port is the lower port. On a top connect tank, the supply port may be labeled "To Solar", "To Collector", "Pump Suction", etc. On a 50 gallon electric tank being used for both storage and backup (Systems ASDX-50-24C and ASDX-50-32P), use a 3/4" Tee to connect to the cold water feed directly above the tank (See Figure 3.3) On a dual tank system using a 50 gallon tank as storage (Systems ASDX-50-G-24C and ASDX-50-G-32P), use a 3/4" Tee and nipple to connect between the tank drain port and tank drain valve.
- F. Connect the storage return to the pump at 1/2" union and to the 1/2" ball valve and dielectric union at the tank port. On a side connect tank, the storage return is about the middle of the tank. On a top connect tank, the storage return may be labeled "From Solar" "From Collector", "Pump Discharge", etc.. On a 50 gallon electric tank being used for both storage and backup (Systems ASDX-50-24C and ASDX-50-32P), connect both the return line and the T & P Relief Valve to a 3/4" FIP Brass Tee fitted to the T & P Relief Valve port on the water heater (See Figure 3.3). On a dual tank system using a 50 gallon tank as storage (Systems ASDX-50-G-24C and ASDX-50-G-32P), use a 3/4" Tee to connect to the cold water feed line into the tank.
- G. On a single tank system, install an in line thermometer in both the storage supply and the storage return lines as shown in Figure 3.1 or Figure 3.3.
- H. Fill the solar storage tank and check entire system for leaks.
- I. Plug in the control and test system.
- J. Unplug control. Open drain below collector pump and drain tank. This process has flushed the collector loop of flux and debris.

- K. Refill drainback tank and plug in control. Use only potable, distilled, or de-ionized water in the DBHX.

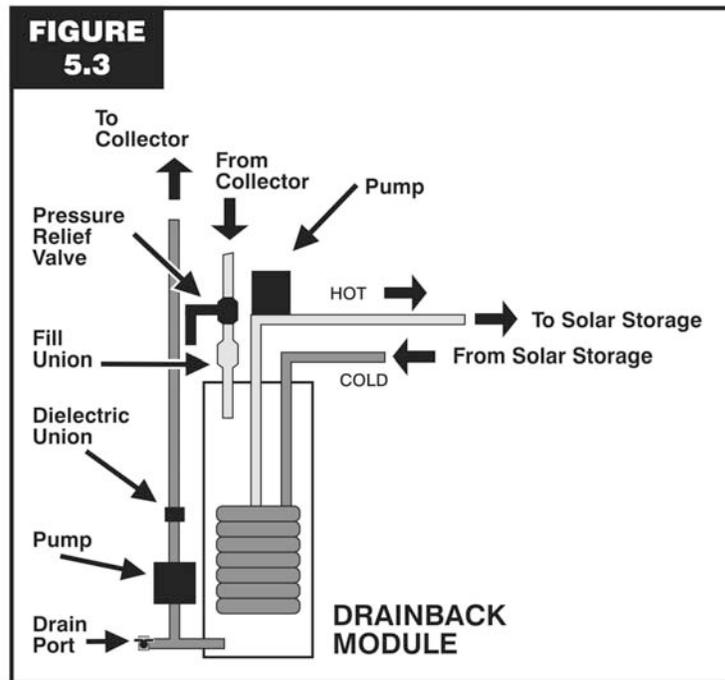


Figure 5.3

Plumbing the Drainback Tank

COMPLETING THE INSTALLATION

If the sun is shining when you finish the installation, the pumps should be operating and the system should be collecting heat. Check all your plumbing connections to insure that there are no leaks. If the sun is not shining, turn the control to "On" long enough to check for leaks, then return the switch to "Auto".

Label the drain and fill valves and major components using the labels in the System Label Kit #LABELDBSYS (and #LABELDBDUAL for dual tank systems) or make your own permanent labels using the information in Figure 6.1. Locations for the labels are shown in Figure 6.2.

Double check all areas where you penetrated the roof and walls to be sure each area is sealed. Be sure all the pipes are insulated and that pipe insulation has been painted or taped where it is exposed to sunlight. Be sure all pipes are completely supported to avoid sagging, and that all horizontal pipe runs slope downward at least 1/4" per foot. Be sure to collect all your tools and clean up the work area thoroughly.

Fill in the Installing Company's name, address and phone number in this manual and leave it with the homeowner. Review the operation of the system with the homeowner, paying particular attention to the location and operation of the mixing valve, the location and operation of the cold water supply shut-off valve, the location and operation of the bypass valves on a Dual Tank system and the "In An Emergency" instructions in this manual.

FIGURE 6.1

<p>CIRCULATING PUMP D CAUTION Surface temperature may exceed 140° F during normal operation</p>	<p>HEAT EXCHANGER ISOLATION VALVE (2 OF 2) H2 During normal operation, valve handle should be all the way counter-clockwise. To isolate heat exchanger, turn both valves all the way clockwise.</p>	<p>DBHX MODULE FILL UNION P NOT TO BE OPENED DURING NORMAL OPERATION CAUTION Unplug Transfer Module and allow water to drain into DBHX Reservoir Tank before opening. Water may be discharged at high temperature. The heat transfer medium must be water or other nontoxic fluid having a toxic rating or Class of 1 as listed in the Clinical Toxicology of Commercial Products, 5th edition. 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.</p>	<p>DBHX MODULE RESERVOIR DRAIN PORT K NOT TO BE OPENED DURING NORMAL OPERATION CAUTION Water may be discharged at high temperature. If opened, unplug Transfer Module until system is serviced. The heat transfer medium must be water or other nontoxic fluid having a toxic rating or Class of 1 as listed in the Clinical Toxicology of Commercial Products, 5th edition. 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.</p>
<p>COLLECTOR PUMP C CAUTION Surface temperature may exceed 140° F during normal operation</p>	<p>WATER SUPPLY VALVE G During normal operation, valve handle should be all the way counter-clockwise. To turn off water supply to the water heater, turn valve handle all the way clockwise.</p>	<p>DBHX MODULE PRESSURE RELIEF VALVE F CAUTION Water may be discharged at high temperature.</p>	
<p>MIXING VALVE E To reduce water temperature at all fixtures, turn knob clockwise as desired. To increase temperature at all fixtures (up to maximum temperature of water in the water heater tank), turn knob counterclockwise as desired. CAUTION Valve body temperature may exceed 140° F during normal operation.</p>	<p>HEAT EXCHANGER ISOLATION VALVE (1 OF 2) H1 During normal operation, valve handle should be all the way counter-clockwise. To isolate Heat Exchanger, turn both valves all the way clockwise and unplug Transfer Module.</p>	<p>WATER HEATER TEMPERATURE /PRESSURE RELIEF VALVE L CAUTION Water may be discharged at high temperature and/or pressure.</p>	
<p>WATER HEATER DRAIN VALVE M CAUTION Water may be discharged at high temperature and/or pressure. Follow Water Heater Manufacturer's Instructions to drain water heater.</p>	<p>SOLAR BYPASS VALVE (1 OF 3) I1 During NORMAL OPERATION, Bypass Valve 1 handle should be turned all the way counter-clockwise. To BYPASS SOLAR, turn Bypass Valves 1 and 2 all the way clockwise, turn Bypass Valve 3 all the way counter clockwise and unplug Transfer Module.</p>	<p>SOLAR BYPASS VALVE (2 OF 3) I2 During NORMAL OPERATION, Bypass Valve 2 handle should be turned all the way counter-clockwise. To BYPASS SOLAR, turn Bypass Valves 1 and 2 all the way clockwise, turn Bypass Valve 3 all the way counter clockwise and unplug Transfer Module.</p>	<p>WATER HEATER DRAIN VALVE O CAUTION Water may be discharged at high temperature and/or pressure. Follow Water Heater Manufacturer's Instructions to drain water heater</p>
<p>SOLAR BYPASS VALVE (3 OF 3) I3 During NORMAL OPERATION, Bypass Valve 3 handle should be turned all the way clockwise. To BYPASS SOLAR, turn Bypass Valves 1 and 2 all the way clockwise, turn Bypass Valve 3 all the way counter clockwise and unplug Transfer Module.</p>		<p>WATER HEATER TEMPERATURE /PRESSURE RELIEF VALVE N CAUTION Water may be discharged at high temperature and/or pressure</p>	<p>WATER HEATER TEMPERATURE /PRESSURE RELIEF VALVE N CAUTION Water may be discharged at high temperature and/or pressure</p>

Figure 6.1: Drainback System Hang Tags

FIGURE 6.2

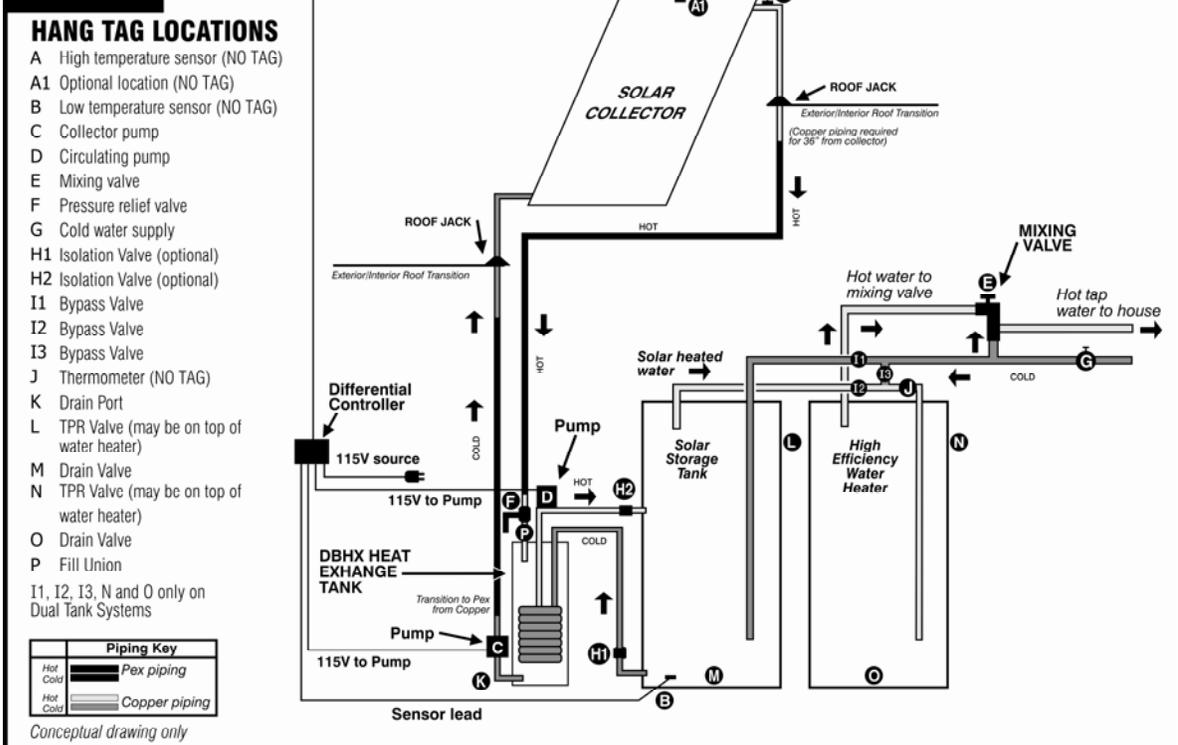


Figure 6.2: Drainback System Hang Tag Locations

BASICS ABOUT THE DRAINBACK SYSTEM'S OPERATION

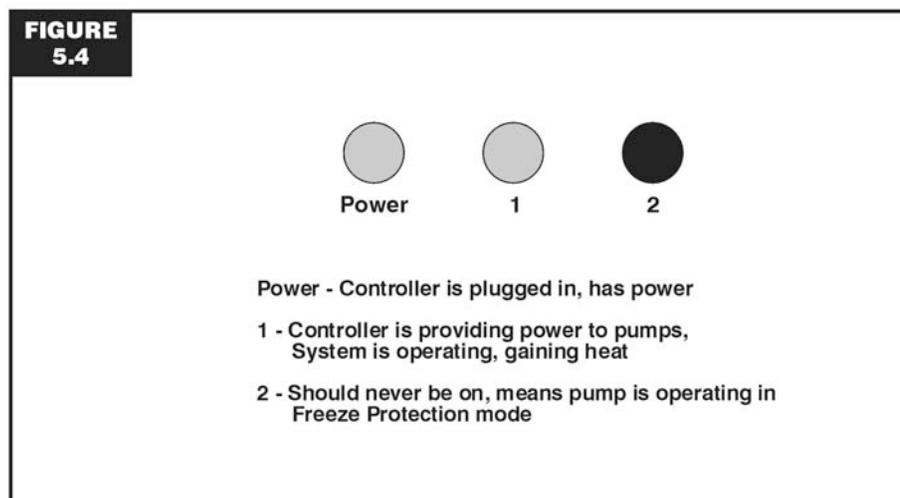
Collecting the Sun's Energy

When the temperature of the collector sensor in the array reaches a temperature 16° to 24° F higher than the temperature of the water near the storage sensor, the control turns on both pumps. The water in the DBHX module is circulated through the solar collector array on the roof, where it is heated by the sun, and returned to the DBHX module. At the same time, water near the bottom of the storage tank (the coldest part) is pumped through the heat exchanger and returned near the middle of the storage tank, closer to the hot water outlet on the tank. This continues as long as the solar collector array remains at least 4° F above the temperature of the water at the bottom of the tank and the storage tank temperature at the bottom does not exceed the high temperature limit protection setting.

There are three small lights on the bottom right hand side of the control, labeled "POWER", "1" and "2". See Figure 5.4. The "POWER" light indicates that the control is plugged in and has power. Only the "POWER" light will be on if there is no heat available from the sun, or if the solar system has already heated the storage tank. Both the "POWER" and "1" lights will be on when the system is operating and collecting heat. The "2" light should never be on for a drainback system.

For single tank systems compare the temperatures of the two thermometers on the drainback supply and solar storage return pipes when the pumps are running on a clear sunny day. The return line temperature (the return line is the line between the pump on the top of the Drainback Module and the storage tank) should be about 3° to 5° warmer than the supply line temperature when the pumps are running.

For dual tank systems check the temperature on the thermometer in the pipe leaving the solar storage tank at the end of a clear, sunny day. A hot water tap must be opened to get a correct reading. The temperature should be above 100° F. if little hot water was used during the day.



**Figure 5.4
Control Lights**

The System At Rest

As night approaches, or inclement weather moves in, the solar collector temperature will drop to less than 4° F above the storage tank temperature. This causes the control to turn off both pumps. The control will also turn off the pumps when the bottom of the tank reaches the Hi Limit temperature setting. When the pumps turn off, bubbles of air from the DBHX module travel up the solar collector return pipe, breaking the vacuum. This forces all of the water in the solar collector array and its piping to drain safely back into the reservoir. The back-up heater element in the storage tank then provides any additional heating to maintain a minimum water temperature of 120° F.

The system operation is similar for a dual tank system, the only major difference being the back-up heating is done by the second (existing) tank.

In an Emergency

If there is a leak in the collector, the drainback tank, or the pipes to the collector, unplug the controller and call your service dealer.

If there is a leak in the solar storage tank, backup tank, or plumbing, close the cold water supply valve, unplug the controller, turn off the circuit breaker that controls the hot water heater, or turn off the gas supply valve if it is a gas water heater and call your service dealer. In a dual tank system, if the emergency affects only the solar storage tank; unplug the controller and turn the bypass valves to bypass the solar storage tank.

Extended Period Shut-down and Start-up Procedures

If you plan to be gone for an extended period of time, it is not recommended that you shut down your system. As long as the power remains on, the system will operate only as needed to maintain the hot water temperature, and you'll have hot water available as soon as you return.

If, for some reason, the system must be shut down for an extended period you must follow these procedures and cautions.

- A. To shut down the drainback system, simply unplug the control.
- B. To shut down the backup hot water system, turn off the circuit breaker that controls the hot water heater, or turn off the gas supply valve if it is a gas water heater.
- C. In addition, if the area where the drainback module and storage tank are located may be subjected to freezing temperature, completely drain the drainback tank, storage tank and piping.
- D. To start up the backup hot water system, turn the water supply on; be sure the tank is filled by turning on a hot water faucet until the water flow is steady. Then turn the circuit breaker back on. For a gas water heater, follow the water heater manufacturer's instructions for start-up, or call a qualified service technician.
- E. To start up the drainback system, simply plug in the differential control (if the drainback tank was drained, it should be refilled first following the installation instructions in this manual). After a few minutes, if the sun is shining, you will hear water being pumped to the collector(s) from the drainback tank. If not, refer to the servicing section.

Freeze Protection

Freeze protection of the collector(s) is automatic in a properly installed drainback system. Whenever the collectors are not warmer than the bottom of the storage tank, there is no circulation and water drains from the collector(s) into the drainback module. If the area where the drainback module and storage tank are located may be subjected to freezing temperature, unplug the controller, turn off the circuit breaker to the backup electric element(s), turn off the gas supply valve to a gas water heater, and completely drain the drainback tank, storage tank and piping.

The Architectural Series Drainback Solar Water Heating System has a freeze tolerance limit of -60° F (60° F below zero° F) ambient air temperature. Freeze tolerance limits are based on an assumed set of environmental conditions. Extended periods of cold weather, including ambient air temperatures above the specified limit, may cause freezing in exposed parts of the system. It is the owner's responsibility to protect the system in accordance with the Supplier's instructions if the air temperature is anticipated to approach the specified freeze tolerance limit.

Before Calling for Service

For single tank systems compare the temperatures of the two thermometers on the drainback supply and solar storage return pipes when the pumps are running on a clear sunny day. The return line temperature (the return line is the line between the pump on the top of the Drainback Module and the storage tank) should be about 3° to 5° warmer than the supply line temperature when the pumps are running.

For dual tank systems check the temperature on the thermometer in the pipe leaving the solar storage tank at the end of a clear, sunny day. A hot water tap must be opened to get a correct reading. The temperature should be above 100° F. if little hot water was used during the day.

Often, a service call proves to be unnecessary and the expense incurred is time and money wasted. Check the following items before calling for service if your system fails to operate or seems to operate improperly.

1. Make sure the slide switch on the control is in the "Auto" position.
2. Make sure the control is plugged into a 120 VAC wall outlet.
3. Check for "open" circuit breakers or blown fuses.
4. Check the cold water shut-off valve if hot water does not flow at all. It should be turned all the way counterclockwise.

WARNING

Turn off storage tank electric heating element circuit breaker
before proceeding to Step 5.

5. On single tank systems, the manual reset temperature limiting device on the storage tank heater element will cut all power to the element if the water temperature has exceeded 180° F. You may try resetting this once by turning off power to the heating elements and carefully removing the top storage tank access cover and pressing the reset button. If it trips again, call your dealer/installer.

Maintenance

Your Architectural Series Drainback Solar Water Heating System has been designed to require little regular maintenance. Flushing or draining the water heater, and checking/replacing the anode rod according to the water heater manufacturer's instructions will help to extend the life of the water heater. The coating on the pipe insulation should be repainted every 2 to 4 years, or as needed.

Parts replacement projections

Your solar energy system has been designed for a useful life of 20 to 30 years. The tanks, pumps and controller may require replacement after 5 to 10 years. The following parts may be ordered from your installing dealer, or from Integrated Solar:

PART #	DESCRIPTION
AS406C	Collector(s) for system model numbers ending in "-24C"
AS408C	Collector(s) for system model numbers ending in "-32C" or "-32CX2"
AS408P	Collector(s) for system model numbers ending in "-32P" or "-32PX2"
AS410C	Collector(s) for system model numbers ending in "-40C" or "-40CX2"
AS410P	Collector(s) for system model numbers ending in "-40P" or "-40PX2"
AS412C	Collector(s) for system model numbers ending in "-48C" or "-48CX2"
AS412P	Collector(s) for system model numbers ending in "-48P"
R006BC4HW	Taco 006 circulation pump (on top of drainback module)
R005-020-RP	Taco 006 replacement cartridge with impeller
TACO009	Taco 009 collector loop pump (on side of drainback module)
R009-02RP	Taco 009 replacement cartridge with impeller
RDX088	gallon Replacement Drainback Tank with Heat Exchanger
RDX1212	gallon Replacement Drainback Tank with Heat Exchanger
GL30	Goldline Control (on top of drainback module)
GLB10	Replacement 10K sensor for collector or storage tank
004-0011	30 PSI Pressure Relief Valve for collector loop
004-0005	Watts 70A Thermostatic Mixing (tempering) Valve

Remember:

1. A sudden jump in your utility bill may be due to an unnoticed electric or gas rate hike.
2. Solar energy collection can be substantially reduced during inclement weather.
3. Winter time storage temperatures will, in most areas, be lower than summer time storage temperatures. This is normal for a solar domestic water heating system.

WHEN TO CALL FOR SERVICE

We at Integrated Solar want you to be completely satisfied with your new solar hot water components. Should your solar energy system require professional service, call your dealer/installer. Our warranty covers defects in workmanship and materials for components labeled Integrated Solar only. Components not supplied by Integrated Solar and installation related problems are solved by your dealer/installer.

The following conditions should be referred to the dealer/installer for service.

1. Reduced hot water when your past experience says you should have more.
2. The pump does not shut off at night or in extended periods of inclement weather.
3. Any unusual noises except during start up or shut down.
4. Any water leaks from the plumbing or components.
5. Any physical solar collector damage.

Model and Serial Number Records:

The installer should fill in the information below for your records.

System Model Number _____

Collector Model Number(s) _____

Collector Serial Number(s) _____

Drainback Module Model Number _____

Drainback Module Serial Number _____

Installed by: _____ Date: _____

Install Company Address _____

City, State, Zip: _____ Phone: _____

If your installer is unable to resolve warranty issues, contact:

INTEGRATED SOLAR, LLC
2001 W Lone Cactus Dr Ste A
Phoenix, AZ 85027 Phone 623-869-0561

DRAINBACK/HEAT EXCHANGER SYSTEM WARRANTY

This warranty applies to the solar domestic hot water components (Equipment) furnished by Integrated Solar, LLC and installed, maintained and operated in accordance with Integrated Solar's installation manual, installation sheets and Owner's Manual.

LIMITED WARRANTY ON THE ARCHITECTURAL SERIES COLLECTOR MANUFACTURED BY INTEGRATED SOLAR, LLC

SCOPE OF COVERAGE: This warranty applies to a new solar collector manufactured by Integrated Solar, LLC, (hereinafter called IS) and installed in the United States of America. It extends to the first retail buyer of the collector. **TEN YEAR WARRANTY** IS warrants the collector to be free from defects in material and workmanship when installed in accordance with IS standards for ten years from the date of original installation. If a defect does occur during the warranty period, IS will reimburse for repairs to any part of the collector as shown below, or at IS's option, provide a replacement part. A replacement part may consist of a new or factory rebuilt component or part of at least the same quality. Repairs and/or replacement parts are warranted only for the unexpired term of the original warranty. This warranty applies to collectors installed for use in medium temperature (110°F to 210°F) domestic hot water applications only.

ONE YEAR WARRANTY WHEN USED AS A PART OF A SWIMMING POOL OR SPA HEATING SYSTEM: IS warrants the collector to be free from defects in material and workmanship when installed in accordance with industry standards for one year from the date of original installation. If a defect does occur during the warranty period, IS will provide a replacement part, or at IS's option, reimburse for repairs to any part of the collector. A replacement part may consist of a new or factory rebuilt component or part of at least the same quality. Repairs and/or replacement parts are warranted only for the unexpired term of the original warranty. This warranty applies to collectors installed for use in low temperature (60°F to 104°F) swimming pool or spa applications only.

SERVICE LABOR REIMBURSEMENT: IS will reimburse up to \$150.00 per collector for IS authorized repairs, or for removal and reinstallation of an IS authorized replacement part or collector.

FREIGHT AND SHIPPING EXPENSES: During the first year of warranty coverage, IS will pay the shipping costs for an authorized replacement part or collector from IS to the nearest local distributor, dealer, or authorized service center in the continental United States. After the first year freight and packing costs are the responsibility of the owner and are not covered under this warranty.

WARRANTY EXCLUSIONS: This warranty does not cover defects of any kind resulting from faulty installation. This warranty does not cover damage caused by fire, flood, lightning, hurricane, tornado, hail, winds, earthquake, or other acts of God. This warranty does not cover damage caused by vandalism, war, riots, explosions, misuse, abuse, negligence, accident, alteration, falling objects, harmful chemicals, acetic or caustic fluids, fumes or vapors, including improperly applied or maintained heat transfer fluids, propylene glycol pH levels above 10 or below 8, or other circumstances beyond IS's control. This warranty does not cover damage caused by operation of the collector under excessive pressure, or by erosion corrosion of the copper tubing resulting from excessive flow rates. This warranty does not cover clouding or similar occurrence resulting from the normal intrusion of moisture into the box, or glass breakage for any reason. This warranty does not cover freeze damage to the collector.

TO OBTAIN WARRANTY SERVICE: To obtain service under this warranty, notify the installation contractor. If the installing dealer is not available, contact IS at the phone number or address below. Each claim will require documentation indicating the original purchaser's name, address, phone number, date of installation, date of failure, reason for failure, product model number and serial number, and the installing contractor's name and phone number. Each claim must be accompanied by a photograph of the manufacturing defect. Warranty service will be provided only during normal business hours. **LIMITATIONS** In the event of a defect, IS's liability is strictly limited to the furnishing of repair or replacement part(s) as provided herein. IS shall not be responsible for repair or replacement of any system components except the collector, for repair or replacement of any component not provided by IS, for any incidental property damage, for any incidental or consequential damages, including inspection costs, lost profits, lost wages, lost savings or any other costs arising out of the use or inability to use the collector, or for any claim by any other party. **SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGE, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.**



Integrated Solar, LLC
2001 West Lone Cactus Drive Suite A
Phoenix, Arizona 85033
Phone 623-869-0561
email info@integratedsolar.com
Effective 7/1/2012



**LIMITED WARRANTY ON
THE INTEGRATED SOLAR DRAINBACK TANK
MANUFACTURED BY INTEGRATED SOLAR, LLC**

SCOPE OF COVERAGE: This warranty applies to a new Drainback Tank reservoir and heat exchanger manufactured by Integrated Solar, LLC, (hereinafter called IS) and installed in the United States of America. It extends to the first retail buyer of the Drainback Tank reservoir and heat exchanger.

FIVE YEAR WARRANTY: IS warrants the Drainback Tank reservoir and heat exchanger to be free from defects in material and workmanship when installed in accordance with IS standards for five years from the date of original installation. If a defect does occur during the warranty period, IS will reimburse for repairs to any part of the Drainback Tank reservoir and heat exchanger, or at IS's option, provide a replacement part. A replacement part may consist of a new or factory rebuilt component or part of at least the same quality. Repairs and/or replacement parts are warranted only for the unexpired term of the original warranty. This warranty applies to Drainback Tanks installed for use in medium temperature (110°F to 180°F) domestic hot water applications only.

SERVICE LABOR REIMBURSEMENT: IS will reimburse up to \$90.00 for IS authorized repairs, or for removal and reinstallation of an IS authorized replacement part or Drainback Tank reservoir and heat exchanger.

FREIGHT AND SHIPPING EXPENSES: During the first year of warranty coverage, IS will pay the shipping costs for an authorized replacement part or Drainback Tank reservoir and heat exchanger from IS to the nearest local distributor, dealer, or authorized service center in the continental United States. After the first year freight and packing costs are the responsibility of the owner and are not covered under this warranty.

WARRANTY EXCLUSIONS: This warranty does not cover defects of any kind resulting from faulty installation. This warranty does not cover damage caused by fire, flood, lightning, hurricane, tornado, hail, winds, earthquake, or other acts of God. This warranty does not cover damage caused by vandalism, war, riots, explosions, misuse, abuse, negligence, accident, alteration, falling objects, harmful chemicals, acetic or caustic fluids, fumes or vapors, including improperly applied or maintained heat transfer fluids, or other circumstances beyond IS's control. This warranty does not cover damage caused by scale build up, or by operation of the Drainback Tank under excessive pressure, or by erosion corrosion of the copper tubing resulting from excessive flow rates. This warranty does not cover damage caused by heat transfer fluids not specifically authorized in the IS Installation Manual. This warranty does not cover color changes or cosmetic damage to the plastic skin. This warranty will not apply if the drainback tank is open to the atmosphere while running or when hot. Pumps and controllers, even if assembled to the Drainback Tank, are covered by their respective manufacturers' warranties, and not by this warranty. This warranty does not cover freeze damage to the Drainback Tank.

TO OBTAIN WARRANTY SERVICE: To obtain service under this warranty, notify the installation contractor. If the installing contractor is not available, contact IS at the phone number or address below. Each claim will require documentation indicating the original purchaser's name, address, phone number, date of installation, date of failure, reason for failure, product model number and serial number, and the installing contractor's name and phone number. Each claim must be accompanied by photographs of the manufacturing defect and of the installation area. Warranty service will be provided only during normal business hours.

LIMITATIONS: In the event of a defect, IS's liability is strictly limited to the furnishing of repair or replacement part(s) as provided herein. IS shall not be responsible for repair or replacement of any system components except the Drainback Tank reservoir and heat exchanger, for repair or replacement of any component not provided by IS, for any incidental property damage, for any incidental or consequential damages, including inspection costs, lost profits, lost wages, lost savings or any other costs arising out of the use or inability to use the Drainback Tank, or for any claim by any other party. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGE, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.



Integrated Solar, LLC
1720 West Parkside Lane
Phoenix, Arizona 85033
Phone 623-869-0561
email info@integratedsolar.com
Effective 1/6/2012

Control Module, Pumps, and Minor Components: Integrated Solar warrants to the purchaser that the pumps, control and all minor components supplied by Integrated Solar will be free from defects in workmanship and material for a period of one year from the date of original installation.

Effective Date

This warranty is effective with respect to all Equipment furnished and installed on or after May 23, 2011. Any and all previous written warranties are of no force or effect with respect to the Equipment furnished and installed on or after May 23, 2011.

TROUBLE SHOOTING GUIDE

This guide contains the most common problems encountered while servicing drainback freeze protection systems. Included for each problem is a list of possible causes and corrective actions required. This guide is intended to assist the installer or serviceman in problem solving. Once the system is identified, the checks should be carried out in the order which they are listed.

The following tools are required for troubleshooting only:

- Architectural Series installation manual
- control test jumper cable

It is recommended that the serviceman have a control tester as well.

The tools required for the repair will be the same as the tools required for the installation of the component.

- small common screwdriver
- medium common screwdriver
- volt-ohm meter (115VAC, 220VAC, and ohms to 20K)
- long tee handle 9/64" Allen wrench
- long 7/16" nut driver

Solar controls are relatively simple, trouble free and very reliable. All controls shipped by Integrated Solar have gone through a rigorous quality control process. Actual experience as shown Integrated Solar controls to have a very low failure rate. Most failures can be identified by performing the following simple tests. If the control and sensors check out good but the system still isn't operating properly, suspect that there is something else wrong with the system.

Controller Operation Test

The following "control operation test" will verify the correct operation of the control. These tests may be performed when the control is mounted and wired into the system but with the sensor wires disconnected or bench tested as described below.

Preparation for Testing

If bench testing a GL30, a test line cord must be connected to the power terminal strip positions L1 and 4 (hot and neutral respectively). Connect protective ground to the ground screw. Plug the line cord into a 120 VAC receptacle. Caution: high voltage is now present on the terminal strip. The power on LED indicator (left) should come on when the line cord is plugged in. The control operation tests can now be conducted.

On/Off Test

This test verifies that the control will turn on and off. With the switch in the "ON" position, power is applied to the normally open relay point, terminal NO. This may be verified with an AC voltmeter across terminals NO and N. If a pump is connected the pump and the pump LED should turn on. With the switch in the "OFF" position power is applied to the normally closed relay point, terminal NC. This may be verified with a voltmeter across terminals NC and N. If the relay will not switch power as noted above the controller should be returned to Integrated Solar for Repair or Replacement

Basic Function Test

Switch the controller to "Auto". Disconnect the four sensor wires at the control block. If the collector input is shorted (connect "Solar" terminals 3 and 4 together at the control block) the control will turn on. If the storage input is shorted (connect "Tank" terminals 1 and 2 together at the control block) the unit will turn off. With both collector input and storage input open or with both inputs shorted, the control may be on or off.

Sensor Operational Test

The SAS-10 thermistor sensors should be checked before connecting them to the control and activating the system. This test requires the use of a volt-ohmmeter. The SAS-10 sensors have a negative temperature coefficient which means they exhibit a very high resistance at low temperatures and a very low resistance at high temperatures. The following Temperature vs. Resistance chart shows this relationship and provides a few resistance readings which correspond to temperatures.

Temperature Vs. Resistance Chart

°F	°C	Ohms Resistance 10K
OPEN		INFINITE
32	0	32.630
41	5	25.380
50	10	19.890
59	15	15.710
68	20	12.490
77	25	10.000
86	30	8.057
95	35	8.531
104	40	5.326
113	45	4.368
122	50	3.601
131	55	2.985
140	60	2.487
149	65	2.082
158	70	1.751
176	80	1.255
194	90	.917
212	100	.680
SHORT		NONE

Sensor Check

To properly perform a sensor check you will need a volt-ohmmeter set to perform the resistance measurements. Be sure the volt-ohmmeter is in good working order and has a fresh battery before using it to test sensors. Connect the volt-ohmmeter leads to the two sensor wires leads coming from the sensor. If the volt-ohmmeter shows an infinite reading this indicates an open circuit.

Check the following:

1. The sensor lead wire to the sensor for a break in the wire. This would usually be found around sharp metal corners or edges such as roof flashings.
2. The sensor lead wire where it connects to the sensors' leads for possible disconnection.

If the volt-ohmmeter indicates a short or zero resistance check the following:

1. A nail or staple through the sensor wire shorting both leads.
2. Insulation that has been scraped off the sensor wires around sharp metal edges such as the roof flashing.
3. At the sensor where it is connected to the sensor lead wire to determine if the sensor itself is shorted.

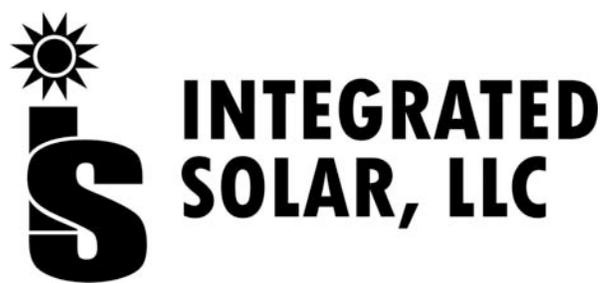
If the volt-ohmmeter indicates a large variation in the resistance reading relative to what you believe is the true temperature referencing the Temperature vs. Resistance chart then a failure of the sensor may have occurred. However, this is not always the case. To further check the suspected faulty sensor you can compare it to another known good sensor placed in exactly the same spot with the same insulation, if any, around the sensors. If this is not possible you can disconnect the suspected faulty sensor from the system and compare it at room temperature with a good sensor. Be sure to leave both sensors in the room together for about 30 minutes so they can reach the same temperature. If the suspect sensor shows a large variation from the good sensor this would confirm a faulty sensor. If not, the sensor is good and the large temperature variation experienced in the system is probably a problem in the plumbing of the system.

TROUBLESHOOTING ACTION TABLE

COMPONENT	SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
CONTROL	Always On	A. Storage sensor or leads open	Replace sensor or repair leads
		B. Collector sensor or leads shorted	Replace sensor or repair leads
		C. Defective control. Use a control tester to diagnose control.	Replace control
	Never On	A. Switch in "off" position	Move switch to "Auto"
		B. No power to control	Provide power
		C. Defective control. Use a control tester to diagnose control.	Replace control
		D. Storage sensor or leads shorted	Replace sensor or repair leads
	No high limit	A. Storage sensor defective or leads open.	Replace sensor or repair leads
		B. Defective control. Use control tester to diagnose control.	Replace control
	No power at output	A. See control "Never On"	Repair
	Intermittent Operation	A. Sensor connections loose	Repair
		B. Radio wave interference	Install shielded cable sensor leads
		C. Low voltage wiring running parallel and close to line voltage.	Install shielded cable sensor leads

COMPONENT	SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
PUMPS	Always On	A. See control "always on"	
		B. Pump miswired	Check pump wiring
	Never On	A. See control "Never On"	
	Power to pumps with no circulation	A. Cartridge seized	Replace cartridge
		B. Pumping against dead head (no flow)	Check for obstructions or closed valves
		C. Pump dry	Fill system. Determine the cause of leak.
		D. Damaged impeller	Replace cartridge
		E. Damaged windings	Replace windings
	Noisy	A. Pump bearings worn	Replace cartridge
	All items checked and corrected but still not operational	A. No sun	
		B. High temperature limit reached	No action required
ABSORBER PUMP	No flow and /or noisy	A. Worn bearings	Replace cartridge
		B. Module incorrectly sized	Re-evaluate requirements. Verify correct fill volume and pump head requirements.

COMPONENT	SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
COLLECTOR	Freeze	A. Sensors miswired	Repair wiring
		B. Improper collector slope	Re-evaluate collector slope
		C. Improper pipe slope	Re-evaluate all pipe runs
		D. DBHX malfunction preventing drainback	Consult factory for details
		E. Storage sensor leads shorted	Replace sensors or repair leads
		F. Defective control	Replace control
WATER HEATER	No hot water lukewarm water	A. No power to back-up element	Provide power
		B. Back-up element burned out	Replace element
		C. Thermostat malfunctioning or set too low	Replace Thermostat or adjust higher
		D. Tempering valve malfunctioning or set too low	Replace valve or adjust higher
		E. System not functioning	See control and pump sections



6/19/2012