

# Drain Back Tank

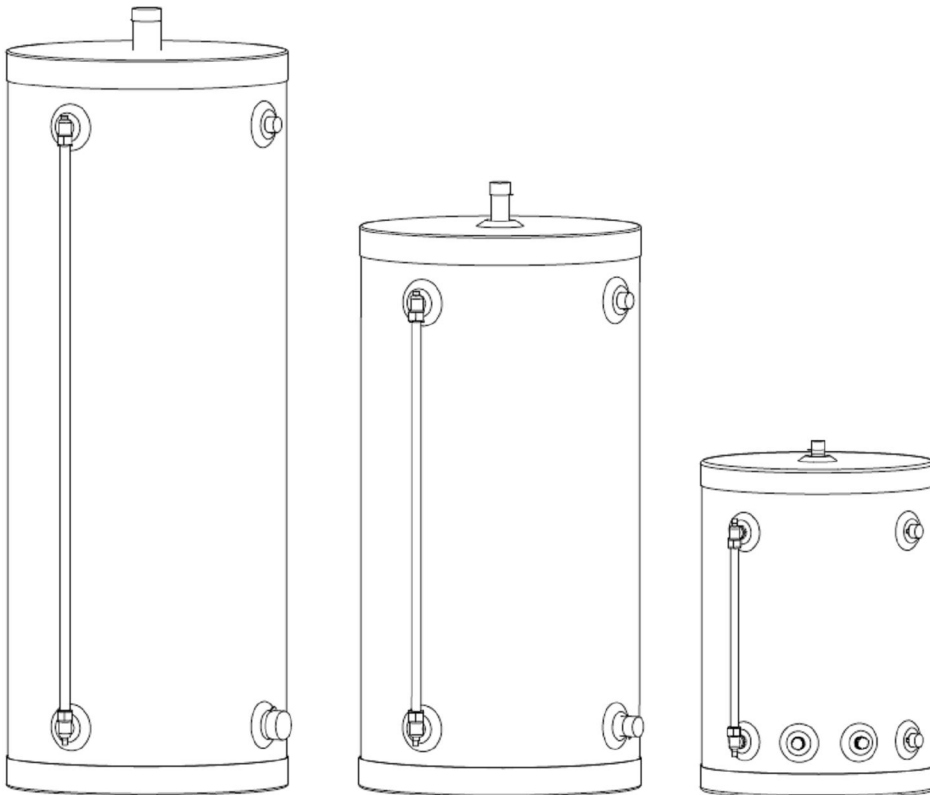
**Installation**

**Maintenance**

**Drain Back Tank Models:**

- 915-001 10 Gallon Solar Skies Drain Back Tank with sight glass, no heat exchanger
- 915-002 15 Gallon Solar Skies Drain Back Tank with sight glass, no heat exchanger
- 915-003 20 Gallon Solar Skies Drain Back Tank with sight glass, no heat exchanger
- 915-004 30 Gallon Solar Skies Drain Back Tank with sight glass, no heat exchanger
- 915-022 45 Gallon Solar Skies Drain Back Tank with sight glass, no heat exchanger
- 915-023 60 Gallon Solar Skies Drain Back Tank with sight glass, no heat exchanger

- 915-007 10 Gallon Solar Skies Drain Back Tank with additional heat exchanger & sight glass
- 915-008 15 Gallon Solar Skies Drain Back Tank with additional heat exchanger & sight glass
- 915-009 20 Gallon Solar Skies Drain Back Tank with additional heat exchanger & sight glass



**NOTICE:** Solar Skies Mfg. reserves the right to make product changes or updates without notice and will not be held liable for typographical errors in literature.

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## **SPECIAL ATTENTION BOXES**

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the product.

### **⚠ DANGER**

**DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

### **⚠ WARNING**

**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

### **⚠ CAUTION**

**CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

### **CAUTION**

**CAUTION** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

## **FOREWORD**

This manual is intended to be used in conjunction with other literature provided with the solar water heating system. This includes all related control information. It is important that this manual, all other documents included with this system, and additional publications including Solar Water Heating System Design and Installation Guidelines, be reviewed in their entirety before beginning any work.

Installation should be made in accordance with the regulations of the local code authorities and utility companies which pertain to this type of water heating equipment.

**NOTE TO CONSUMER: PLEASE KEEP ALL INSTRUCTIONS FOR FUTURE REFERENCE.**

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## FOR THE INSTALLER

INSTALLATION OR SERVICE OF THIS SOLAR PRODUCT IS REQUIRED TO BE PERFORMED BY LICENSED PROFESSIONALS WHERE SOLAR, PLUMBING, AND ELECTRICAL WORK IS REQUIRED.

The installer should be guided by the instructions furnished with the tank, local codes and utility company requirements. Preference should be given to codes and requirements where they differ from the furnished instructions.

Additional publications which should guide the installer include:

*Solar Water Heating System Design and Installation Guidelines, SRCC OG-300*, from Solar Rating and Certification Corporation, 1679 Clearlake Road, Cocoa, FL 32922-5703.

*Code for the installation of Heat Producing Appliances* (latest version), is available from American Insurance Association, 85 John Street, New York, NY 11038.

The latest version of the *National Electrical Code, NFPA No. 70*.

In Canada, refer to *Canadian Electrical Code C 22.1*, from Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.

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## INTRODUCTION

Drain back tanks are designed to allow solar collectors and related piping to drain heat transfer fluid into the drain back reservoir when not in use.

Drain back systems are versatile: ideally suited for both cold and warm regions. The drain back process protects solar system components from both freezing and overheating, and saves power by shutting down the solar system when there is no longer a demand for hot water. Drain back systems have fewer components than pressurized systems, making drain back systems easier to use, service, and maintain.

Your drain back tank may come with an internal heat exchanger (for use with a storage tank), or without a heat exchanger (for use with either a solar water heater with an internal heat exchanger or a storage tank with an external plate and frame heat exchanger).

Job site conditions will require your installation contractor to supply some or all of the following:

- Plumbing Connections
- Piping and Insulation
- Valves Between the Existing Domestic Water System and the Drain Back Solar System

## PART 1: GENERAL SAFETY INFORMATION

### A. PRECAUTIONS

**NOTE:** OBTAIN ALL APPLICABLE PERMITS AND OBEY ALL LOCAL CODES.

**NOTE:** Install all system components and piping in such a manner that does not reduce the performance of any fire rated assembly.

### **⚠ WARNING**

If any system component(s) is/are exposed to the following, do not operate until the affected component(s) has/have been inspected by a qualified serviceman.

1. FIRE
2. DAMAGE
3. SUBMERSION IN WATER

### **CAUTION**

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

### **CAUTION**

Ensure there are no low points or dips in sloped non-vertical supply and return pipe runs from the solar collectors to the drain back tank. Low points and improperly designed solar piping can trap water and possibly rupture in freezing weather. Pitch non-vertical piping  $\frac{1}{4}$ " per foot towards the drain back tank to facilitate proper drainage, and take care to properly layout piping to ensure there are no low points.

In addition, the drain back tank and solar storage tank must be protected from freezing temperatures. Care must be taken when filling the system to avoid overfilling and exposing pipes to a freezing condition.

**NOTE: SOLAR SKIES MFG. DOES NOT WARRANT THE DRAIN BACK TANK AGAINST FREEZE RELATED DAMAGE.**

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ALL PIPING AND PLUMBING CONNECTIONS SHOULD BE MADE WITH COPPER OR STAINLESS STEEL PIPE **ONLY**. No less than ¾" I.D. copper tube of the type meeting local codes must be used for piping. Pipe runs must be solidly attached with proper clamping methods. Soldered connections should be secured with 95/5 lead-free solder. Use only pipe rated for 230°F minimum on both the collector return and supply piping.

**B. CHEMICAL VAPOR CORROSION**

**NOTE: DAMAGE TO THE SOLAR WATER TANK, COLLECTOR, OR RELATED COMPONENTS CAUSED BY EXPOSURE TO CORROSIVE VAPORS IS NOT COVERED BY WARRANTY.** The limited warranty is voided when failure of water tank is due to a corrosive atmosphere. (Refer to the limited warranty for complete terms and conditions).

PRODUCTS TO AVOID	AREAS LIKELY TO HAVE CONTAMINANTS
Spray cans containing fluorocarbons	Dry cleaning/laundry areas and establishments
Permanent wave solutions	Swimming pools
Chlorinated waxes/cleaners	Metal fabrication plants
Chlorine-based swimming pool chemicals	Beauty shops
Calcium chloride used for thawing	Refrigeration repair shops
Sodium chloride used for water softening	Photo processing plants
Refrigerant leaks	Auto body shops
Paint or varnish removers	Plastic manufacturing plants
Hydrochloric or Muriatic acid	Furniture refinishing areas and establishments
Cements and glues	New building construction
Antistatic fabric softeners used in clothes dryers	Remodeling areas
Chlorine-type bleaches, laundry detergents, and cleaning solvents	Garages and workshops
Adhesives used to fasten building products	

**Table 1 – Chemical Contaminants**

**C. INSULATION BLANKETS**


For installation of insulation blankets, refer to *Solar Water Heating System Design and Installation Guidelines, SRCC OG-300*.

**D. SCALD PREVENTION**

**⚠ WARNING**

Households with small children, disabled, or elderly persons may require a 120°F or lower temperature setting to prevent scalding.

**⚠ DANGER**



**Water temperature over 125 degrees F. can cause severe burns instantly, or death from scalds. Children, disabled, and elderly are at highest risk of being scalded. See instruction manual before setting temperature at water heater. Feel water before bathing or showering! Temperature limiting valves are available.**

APPROXIMATE TIME / TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 ½ to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 ½ seconds
155°F	About 1 second



## **PART 2: GENERAL INFORMATION**

### **A. PIPING**

Collector piping requires the use of copper and brass fittings in the collector loop. To avoid leaks and fluid loss, copper and brass ground joint unions should be used to join the collectors. Use only lead-free solder. Engelhard Silvacore 100 or equivalent is the required soldering material. Use of 50/50 lead solder is expressly prohibited. Use of galvanized steel, CPVC, PVC or any other non-rated plastic pipe is prohibited.

All vertical piping between the drain back tank and collector(s) shall be supported at each story or at maximum intervals of ten feet (10'). In addition, all non-vertical solar collector piping should pitch  $\frac{1}{4}$ " per foot down to the drain back tank to facilitate proper drainage. Ensure that there are no dips or low points in solar piping that could trap fluid and possibly rupture in freezing conditions. Copper plumbers tape or tube strap is the required strapping material. The pipe insulation may not be compressed or crimped by the strapping material.

The installation of all piping may not reduce the performance or rating of structural members or fire rated assemblies and must adhere to all applicable local codes and ordinances.

### **B. SIZING THE DRAIN BACK TANK**

To ensure proper operation of the drain back solar system, the drain back tank volume should be sized with double the volume capacity of the total volume of the solar collectors and all solar piping above the top of the drain back tank.

Example:

- (2) SS-32 collectors have a capacity of 2.10 gallons
- 100' of  $\frac{3}{4}$ " copper pipe has a capacity of 2.7 gallons
- Total capacity is 4.8 gallons
- Use a 10 gallon drain back tank

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## PART 3: SPECIFICATIONS

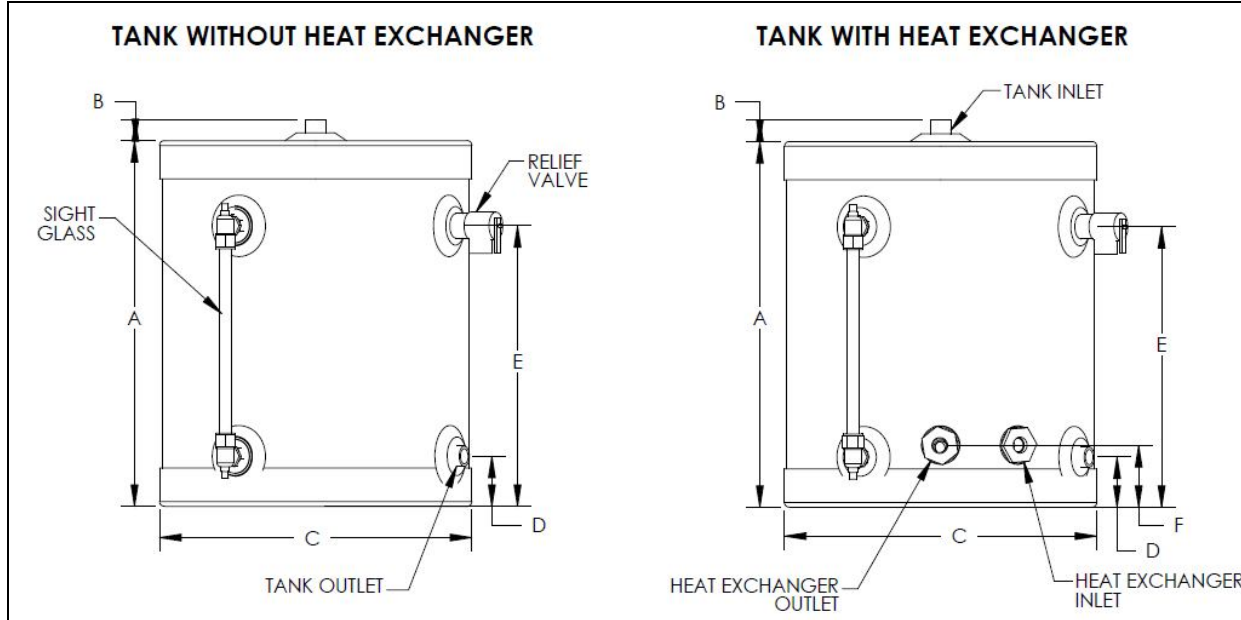


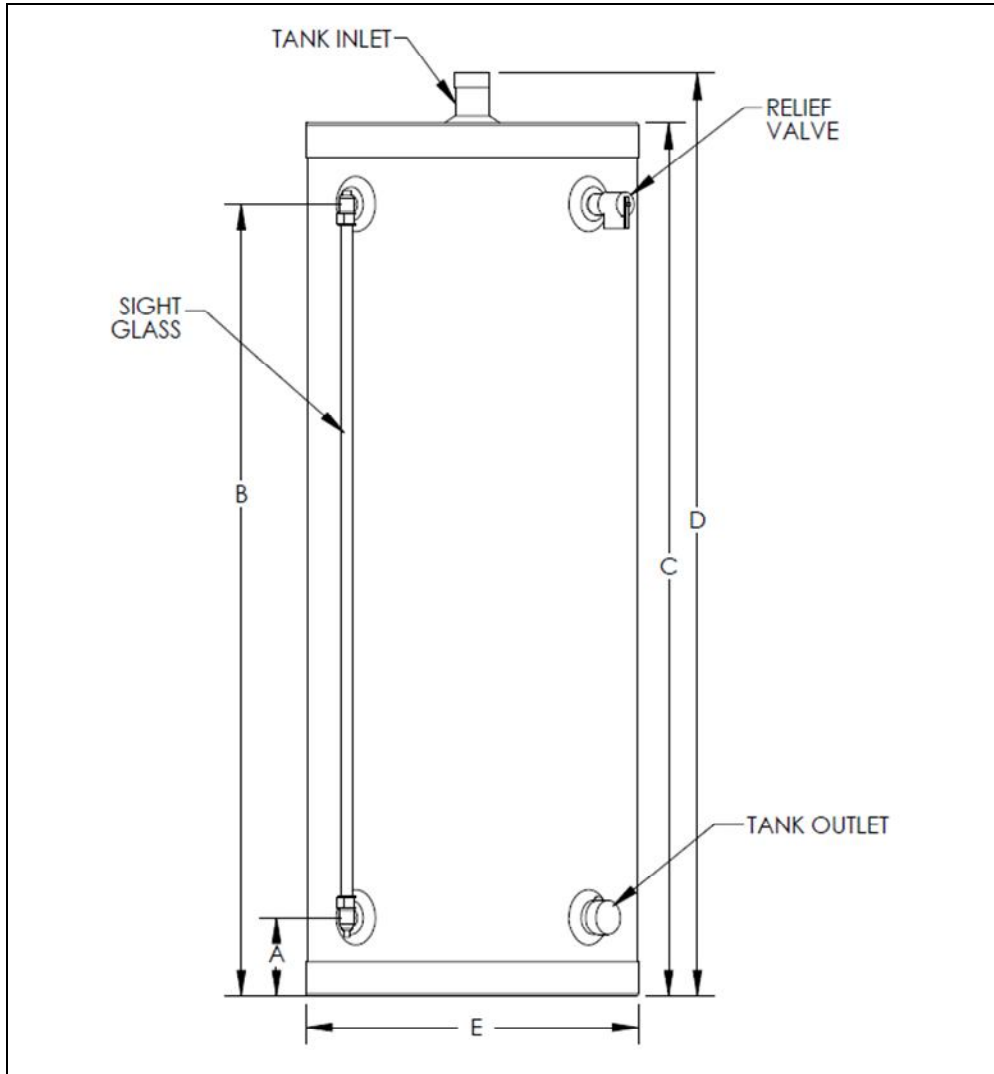
Figure 1 – Drain Back Tank Specifications and Dimensions

MODEL #	GAL.	A	B	C	D	E	F
915-001	10	19"	1 1/4"	19 1/4"	5"	15"	N/A
915-002	15	23"	1"	19 1/4"	4 1/2"	17"	N/A
915-003	20	28"	1 1/2"	19 1/4"	4 1/2"	21 3/4"	N/A
915-007 w/HX	10	19"	1"	19 1/4"	2 1/2"	14 1/2"	3 1/2"
915-008 w/HX	15	23"	1"	19 1/4"	4 1/2"	17"	4 1/4"
915-009 w/HX	20	28"	1 1/2"	19 1/4"	4 1/2"	21 3/4"	4 1/2"

MODEL #	TANK INLET	TANK OUTLET	HX PORT SIZE	SHIPPING WEIGHT
915-001	3/4"	3/4"	N/A	31 lbs.
915-002	3/4"	3/4"	N/A	33 lbs.
915-003	1"	1"	N/A	37 lbs.
915-007	3/4"	3/4"	1/2"	39.7 lbs.
915-008	3/4"	3/4"	1/2"	47.5 lbs.
915-009	1"	1"	1/2"	54.1 lbs.

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MODEL #	GAL.	A	B	C	D	E
915-004	30	4 1/2"	33 3/4"	39 1/2"	42 1/2"	19 1/4"
915-022	45	4 1/2"	45 5/8"	51 7/8"	53 3/4"	19 1/4"
915-023	60	4 3/4"	46 1/4"	52 1/8"	53 1/2"	23 1/4"

MODEL #	TANK INLET	TANK OUTLET	SHIPPING WEIGHT
915-004	1"	1"	49 lbs.
915-022	1 1/2"	1 1/2"	61 lbs.
915-023	1 1/2"	1 1/2"	89 1/2 lbs.

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## PART 4: INSTALLATION

### A. DRAIN BACK TANK LOCATION

To minimize expense and heat loss, locate the drain back tank as centrally to the solar tank and near the solar collectors as possible. The tank must also be located in as warm a location as possible, away from areas which would subject the drain back reservoir to freezing temperatures. If the solar tank has a gas-fired backup, this location must provide adequate ventilation, with a minimum 6 – 8" clearance for access to controls and serviceable parts. The drain back tank has no controls, but the sight glass must have clearance for inspection and service.

Install a 2" high catch pan with a minimum of ¾" drain line to prevent water damage if leakage should occur (See Figure 2).

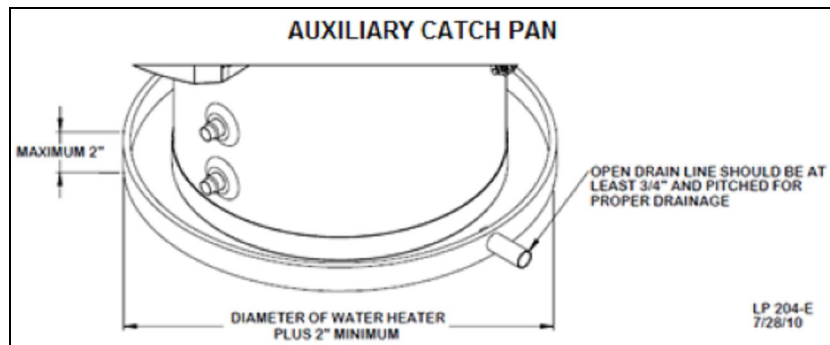


Figure 2 – Catch Pan Illustration

### B. SYSTEM PIPING AND PLUMBING

**NOTE:** To ensure proper drainage, consider system piping **BEFORE** making a final decision on collector mounting

#### **CAUTION**

It is very important that you do the potable piping before you pipe into your solar system. Failure to do so may damage your water heater.

It is mandatory that plumbing be done in accordance with all local and state plumbing codes. **FAILURE TO DO SO WILL VOID THE WARRANTY.**

The solar collector array can be installed level but all horizontal pipe must be pitched at a minimum of ¼" per foot for drainage and must drain without any fluid traps to prevent freezing. Ensure there are no dips, low points, or piping configurations that may trap fluid and rupture in freezing conditions.

ALL PIPING AND PLUMBING CONNECTIONS SHOULD BE MADE WITH COPPER OR STAINLESS STEEL PIPE **ONLY**. No less than ¾" I.D. copper tube of the type meeting local codes must be used for piping. Pipe runs must be solidly attached with proper clamping methods. Soldered connections should be secured with 95/5 lead-free solder. No check valves are allowed within the solar piping loop. Remove integral check from pump if so equipped.

Insulate pipe with ¾" pipe insulation rated for 250°F minimum. Insulate all hot water piping and all exposed cold water piping at the entrance to the solar tank. Paint pipe insulation exposed to ultraviolet radiation with insulation manufacturer approved UV resistant latex based paint, or wrap with PVC pipe wrap. Support piping with plumbers straps or pipe hangers and install in such a manner as to not crush the insulation.

### **C. INSTALLATION OF THE TANK**

#### **CAUTION**

On stainless steel tanks ONLY: Never use dielectric unions or galvanized steel fittings on any domestic water connections or auxiliary connections. ONLY use copper or brass fittings. Teflon thread sealant must be used on all connections.

#### **1. DRAIN BACK TANKS WITHOUT HEAT EXCHANGERS**

- a. Pipe solar collector return to the inlet fitting located on the top of the drain back tank.
  - b. Pipe drain back tank outlet (located near the bottom of the tank) to the solar heat exchanger inlet.
  - c. Pipe solar heat exchanger outlet to the solar collector supply fitting.
- (See installation diagrams in Part 5 for piping details.)

#### **2. DRAIN BACK TANKS WITH HEAT EXCHANGERS**

- a. Pipe solar collector return to the inlet fitting located on the top of the drain back tank.
  - b. Pipe drain back tank outlet to the solar collector supply fitting.
  - c. Pipe cold supply water from the solar storage tank to the heat exchanger inlet fitting located on the drain back tank.
  - d. Pipe heat exchanger outlet to hot return fitting on solar storage tank.
- (See installation diagrams in Part 5 for piping details.)

Insulate all hot water lines, as well as the final 5' of cold water supply pipe leading to the system, with at least ¾" thick heat resistant rubber tubing insulation.

Before commissioning the system, install the sight glass and an ASME/ANSI rated 30 PSI pressure relief valve into the appropriate fittings on the drain back tank using pipe dope. Follow further pressure relief valve installation information listed below.

#### **⚠ WARNING**

To avoid water damage or scalding due to relief valve operation:

- Discharge line must be connected to relief valve outlet and run to a safe place of disposal. Terminate the discharge line in a manner that will prevent possibility of severe burns or property damage should the relief valve discharge.
- Discharge line must be as short as possible and the same size as the valve discharge connection throughout its entire length.
- Discharge line must pitch downward from the valve and terminate at least 6" above the floor drain, making discharge clearly visible.
- The discharge line shall terminate plain, not threaded, with a material serviceable for temperatures of 375°F or greater.
- Do not pipe discharge to any location where freezing could occur.
- No valve may be installed between the relief valve and heater or in the discharge line. Do not plug or place any obstruction in the discharge line.
- Test the operation of the relief valve after filling and pressurizing the system by lifting the lever. Make sure the valve discharges freely. If the valve fails to operate correctly, immediately replace with a new, properly rated relief valve.
- Test relief valve at least once annually to ensure the waterway is clear. If valve does not operate, turn the heater "off" **and call a plumber immediately.**
- Take care whenever operating relief valve to avoid scalding injury or property damage.

**FAILURE TO COMPLY WITH THE ABOVE GUIDELINES COULD RESULT IN FAILURE OF RELIEF VALVE OPERATION, RESULTING IN POSSIBILITY OF SUBSTANTIAL PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.**

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**⚠ WARNING**

Households with small children, disabled, or elderly persons may require a 120°F or lower temperature setting to prevent scalding.

**⚠ CAUTION**

The circulating pump becomes very hot when running. Allow sufficient time to cool before touching.

**D. SOLAR SYSTEM PUMP**

Solar pumps must be installed below drain back tank. Remove integral check if so equipped. The solar system pump must be sized to lift water to the top of the collector array.

**E. ELECTRICAL INSTALLATION**

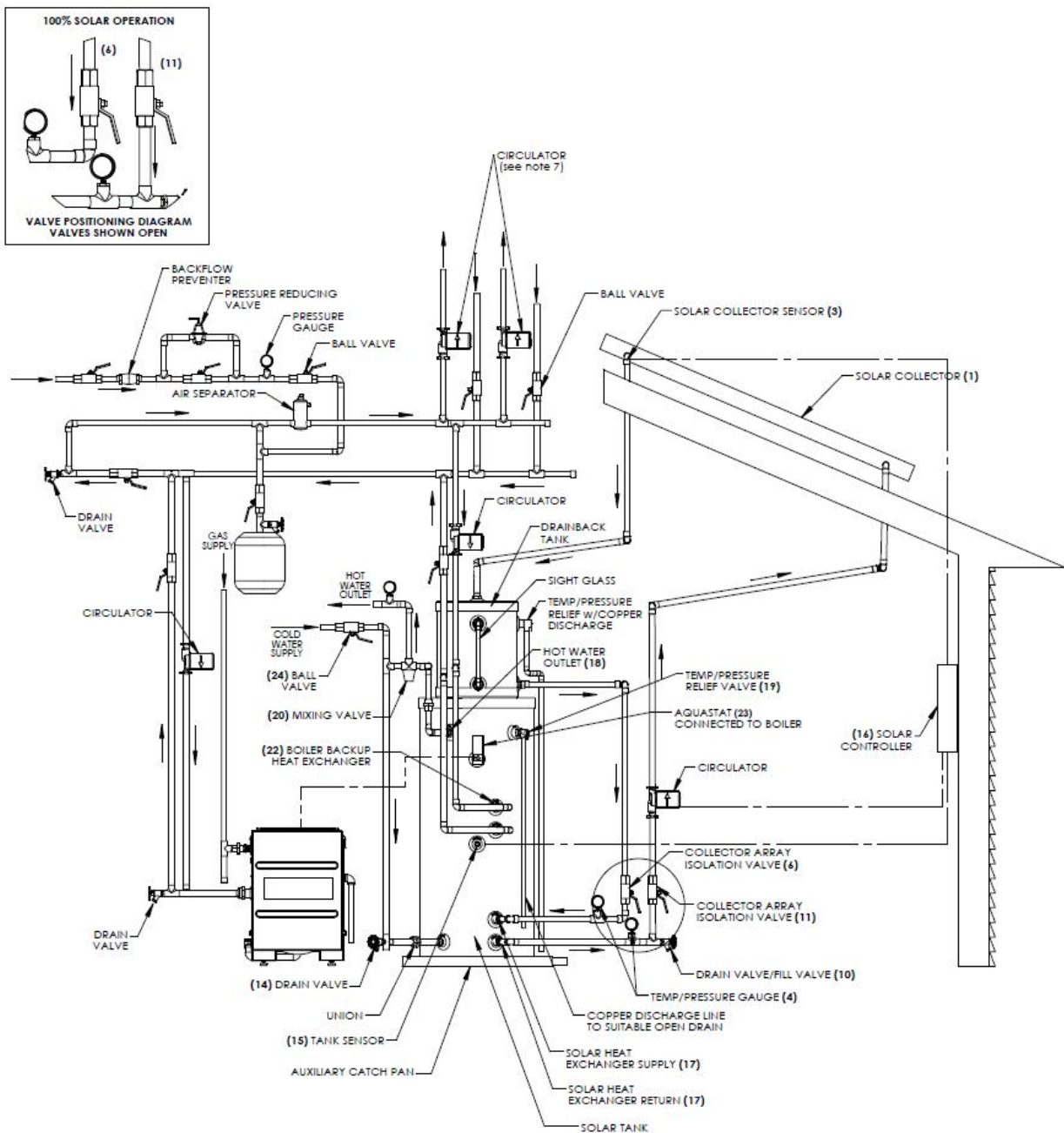
ALL CONNECTIONS MUST BE MADE IN ACCORDANCE WITH LOCAL ELECTRICAL CODES. A qualified electrician or contractor is required to install a 115-120VAC duplex receptacle adjacent to the solar storage tank. This receptacle is used to supply power to the pump/control combo.

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***B. DRAIN BACK TANK WITH BOILER AND INDIRECT WATER HEATER***



**NOTES:**

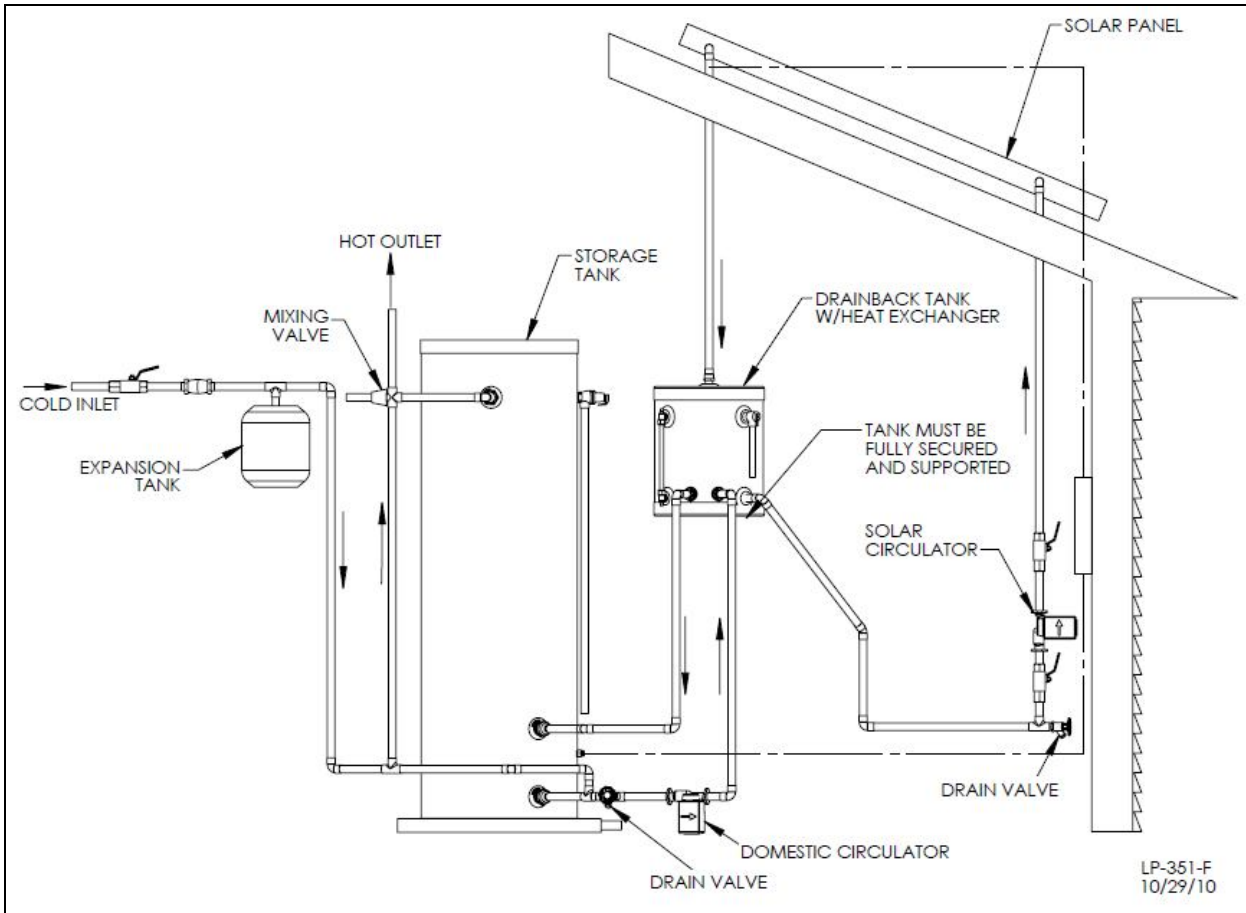
1. This drawing is meant to demonstrate system piping concept. The installer is responsible for all equipment and detailing per local codes.
2. Anti-freeze, non-potable heat transfer fluid shall only be used for the solar heat exchanger circuit. Never introduce anti-freeze to any connection other than the solar heat exchanger.
3. If there is a check valve on the cold water feed line, a thermal expansion tank suitable for potable water must be sized and installed within this piping system between the check valve and the cold water inlet of the solar water heater.
4. A thermostatic mixing valve is recommended if the domestic hot water setting is above 120 degrees F.
5. A minimum of 12 diameters of straight pipe must be installed upstream of all circulators.
6. Make sure tank is fully purged of air before power is turned on to the backup heat source.
7. Circulators in hydronic piping should have an integral flow check or alternately use a stock pump with an external spring type check valve. **(Due to extreme temperatures, circulators with integral flow checks are not to be used in solar systems. If solar circulator comes equipped with an integral flow check, remove it.)**
8. Drain back solar system piping should pitch 1/4" per foot to facilitate draining.
9. No check valves are allowed in the solar loop.
10. Solar pumps must be installed 3' below the drain back tank.

**Figure 4 – Drain Back System with Boiler Back Up**

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**C. DRAIN BACK TANK WITH HEAT EXCHANGER**



**Figure 5 – Drain Back System with Heat Exchanger**



## PART 6: HEAT TRANSFER FLUID QUALITY

Two heat transfer fluids may be used in drain back systems: Distilled water or glycol/water mix. Water in direct flow through the drain back tank must first meet potable water requirements and, in addition, the following:

<b>TOTAL DISSOLVED SOLIDS</b>	<600 ppm
<b>TOTAL HARDNESS</b>	<200 ppm
<b>CHLORIDE</b>	<40 ppm
<b>FREE CHLORINE</b>	<5 ppm
<b>MAGNESIUM</b>	<10 ppm

**Table 2**

Lime scale may form inside the header pipe in areas with “hard” water (> 200 ppm) where a direct flow format is used. In such regions, it is advisable to install a water softening device to ensure the long term efficient operation of the collector, or use a closed loop for the solar circulation loop.

In order to meet health and safety regulations, drain back system antifreeze fluid should be food grade polypropylene glycol, FDA rated as “generally recognized as safe” (GRAS). Using proper concentrations of glycol, solar systems can be operated at ambient temperatures as low as -60°F. Freeze tolerance limits are based upon an assumed set of environmental conditions. Refer to the glycol manufacturer’s specification sheet for recommended concentrations. If using a glycol/water mix, the water must meet the above requirements, and the glycol content of the liquid must not exceed 50%, unless the manufacture specifies that a different ratio is recommended for use with solar water heaters. HTP recommends using a pre-blended glycol/water mix. Glycol may need to be changed periodically (every 3-5 years) to prevent it from becoming acidic; please refer to the guidelines provided by the glycol manufacturer regarding replacement.

**NOTE: SOLAR SKIES MFG. DOES NOT WARRANT THE DRAIN BACK TANK AGAINST FREEZE RELATED DAMAGE.**

## PART 7: STARTING YOUR DRAIN BACK SYSTEM

**NOTE: DO NOT MOVE ON TO THESE STEPS UNTIL THE ENTIRE SOLAR SYSTEM, INCLUDING ALL PIPING, SOLAR COLLECTORS, SENSORS, PUMP, CONTROLS, AND ELECTRICAL CONNECTIONS, ARE PROPERLY SECURED, INSULATED, LABELED AND INSTALLED.**

### **A. FILL THE DRAIN BACK RESERVOIR**

1. Attach hose to solar loop fill valve. The location of the fill valve varies depending on numerous factors, including whether the drain back tank has a heat exchanger.
2. Open fill valve and the pressure relief valve on the drain back tank).
3. Slowly fill the drain back reservoir to the top of the sight glass.
4. When full, shut off fill valve and close the relief valve.
5. Remove fill hose.

### **B. START-UP PROCEDURE**

Once the system is filled as prescribed above:

1. Plug the controller cord into a standard 115 VAC wall outlet.
2. Turn on pump and let run for 5 minutes.
3. Check for leaks at collectors and in attic, if applicable.
4. If no leaks are found, switch controller to automatic mode.

If the sun is shining and the tank is cool, the pump should turn on and begin circulating water. Check control settings to maximize your system performance.

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## **PART 8: SERVICE/MAINTENANCE PROCEDURES**

### **A. SHUT DOWN PROCEDURE**

To shut down the drain back system, simply unplug the differential controller. The pump will stop and water will drain out of the collectors into the reservoir.

#### **⚠ CAUTION**

Never open the pressure relief valve while the system is in operation or hot water is present. Allow to cool prior to opening.

### **B. DRAINING THE DRAIN BACK RESERVOIR**

1. Unplug the controller and wait until all water returns to the reservoir.
2. Attach hose to fill valve.
3. Open the pressure relief valve (see the caution statement above).
4. Open fill valve.
5. Allow the system to completely drain.
6. Close fill valve and the pressure relief valve.
7. Remove drain hose.

### **C. ROUTINE MAINTENANCE**

The heat transfer fluid level in the drain back reservoir should be checked twice a year. With the system turned off, make sure that the water level in the reservoir reaches the top of the sight glass. If not, follow the instructions in Part 7, Section A: "FILL THE DRAIN BACK RESERVOIR".

Periodically check the temperature difference between the collector supply (from the tank to the collector) and collector return lines (from the collector to the tank). As a rule, an 8 – 12° temperature gain should be expected across a collector, in bright sun, at the proper flow rate.

The storage tank should be flushed to prevent scale build up on an annual or bi-annual basis following the manufacturer's recommendations.

### **D. VACATION PROCEDURES**

If hot water isn't to be used for some time, unplug the controller and allow the solar collectors and piping to drain into the drain back reservoir. To re-energize, simply plug in the controller.

## **PART 9: TROUBLESHOOTING**

Owners are advised to contact the installer whenever in-depth interaction with the solar system is required.

### **A. LEAKS**

For leaks in the solar system piping, shut down the system by pulling the plug on the solar controller and call a plumber.

### **B. OTHER PROBLEMS**

A noisy pump could be an indication of worn bearings, obstruction, or a leak in your system. Call your installer for diagnosis of the problem, repair of the system, and/or replacement of components.

#### **⚠ CAUTION**

For your safety, DO NOT attempt repair of electrical wiring, thermostat, heating element or other operating controls. Refer repairs to qualified service personnel.

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## SOLAR SKIES MFG. CUSTOMER INSTALLATION RECORD FORM

The following form should be completed by the installer for you to keep as a record of the installation in case of a warranty claim. After reading the important notes at the bottom of the page, please also sign this document.

Customer's Name:	
Installation Address:	
Date of Installation:	
Installer's Code/Name:	
Product Serial Number(s):	
Comments:	
Installer's Phone Number:	
Signed by Installer:	
Signed by Customer:	

**IMPORTANT NOTES:**

***Customer: Please only sign after the installer has reviewed the installation, safety, proper operation and maintenance of the system. In the case that the system has any problems, please call the installer. If you are unable to make contact, please contact your Solar Skies Mfg. Sales Representative.***

*Distributor/Dealer: Please insert contact details.*

**Solar Skies Mfg, LLC**

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