INSTALLATION MANUAL
SolarStation XL

The SolarStation XL is SunEarth's solution to medium sized solar thermal systems up to 720 ft2 of collector area. Designed with multi speed pumps to ensure compatibility with a wide range of system configurations.

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1. SYSTEM COMPONENTS AND PRINCIPLES

1.1 SAFETY

DANGER!

Electrical Shock, Fire, Explosion and Burn Hazards

This system must be installed, adjusted, and put into operation only by a trained, qualified professional or service agency in accordance with the National Electric Code ANSI/NFPA 70 (Canada CSA C22.1), state and local codes, and authorities having jurisdiction.

SAFETY PRECAUTIONS

- Secure all ladders on level ground
- Locate all possible hazards, overhead wires, loose shingles, etc.
- Make sure power is turned off before adding water to the system
- NEVER connect power to the water heater or storage tank until it has been filled.
- Use a tempering valve or mixing valve to prevent scalding
- Consult proper authorities and check with your local building inspector for permit requirements and local building codes before project commencement. The system must meet local code requirements for penetrating structural members and fire-rate assemblies.
- Burns from Hot Water and Steam-Use extreme care when opening relief valves, and filling storage tanks.
- Use this appliance only for its intended purpose as described in this installation, operations and Maintenance Manual.

WARNING!

For your safety, the information in this manual must be followed to minimize risk of fire or explosion, electric shock, or to prevent property damage, personal injury, or loss of life.

Be sure to read and understand the entire installation, Operation and Maintenance manual before attempting to install or operate a water heating system. It may save you time and cost. Pay particular attention to the Safety instructions. Failure to follow these warnings could result in serious bodily injury or death. Should you have problems understanding the instructions in this manual, or have any questions, STOP, and contact SunEarth.

1. SYSTEM COMPONENTS AND PRINCIPLES

1.2 COMPONENTS

Item	Description
1	Master Service Switch
2	Differential Temperature Controller
3	Solar Pump Service Switch
4	Digital Flow Meter
5	Potable Circuit Dial Pressure Gauge
6	Solar Circuit Dial Pressure Gauge
7	Solar Circuit Pressure Relief
8	Solar Circuit Pressure Sensor
9	Solar Pump w/ Check Valve
10	Potable Pump w/ Check Valve
11	3/4 FIP Expansion Tank Connection
12	Heat Exchanger Digital Temperature Sensor
13	Mounting Bracket
14	Plate Heat Exchanger
15	6’ ELECTRICAL SOURCE CONDUIT
16	PUMP SERVICE VALVES

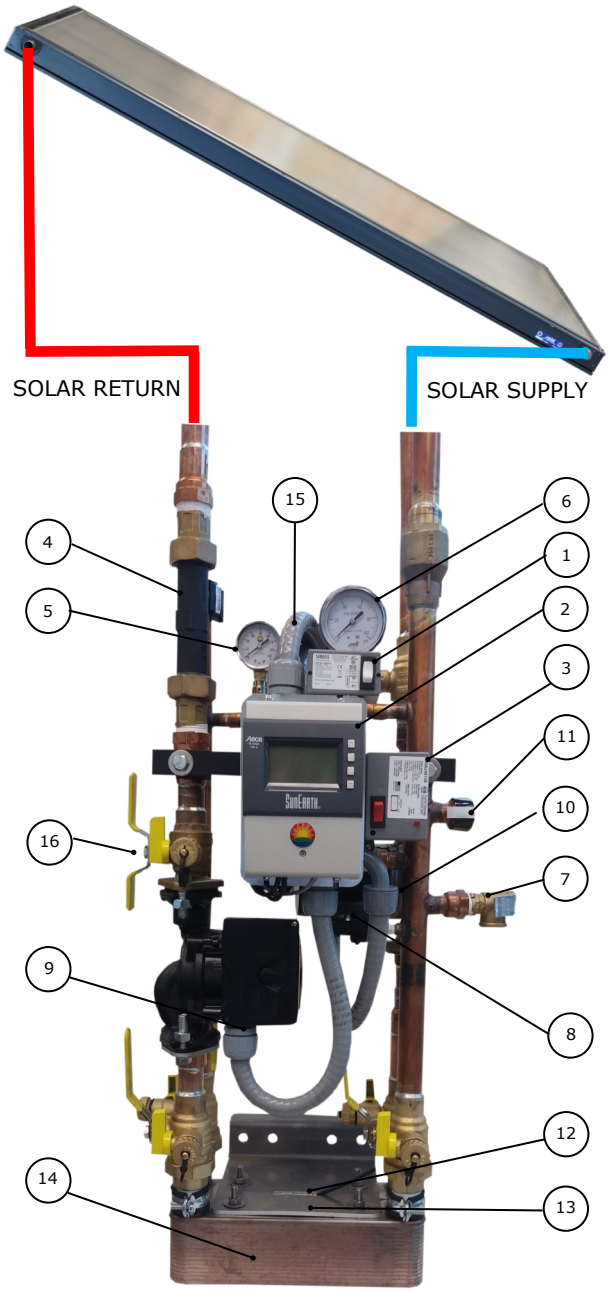


Figure 1.2.1: SolarStation XL Components

1. SYSTEM COMPONENTS AND PRINCIPLES

1.3 SYSTEM PRINCIPLES

When the differential temperature controller detects an adequate temperature difference between the collector temperature sensor "T1" and the bottom tank temperature sensor "T2" the pump begins circulating the propylene glycol heat transfer fluid (HTF) through the system with the solar pump. HTF moves through the collector and absorbs energy from the sun, increasing the HTF temperature. The heated HTF then moves through the heat exchanger. When the heat exchanger temperature sensor "T3" is higher than the storage temperature, the potable pump turns on. This moves the heat from the heat exchanger to the storage tank. Hot water is then available for delivery.

This system's solar loop contains pressurized HTF which can protect your system at temperatures up to –60 degrees Fahrenheit. This system should not be installed in any area that has experienced ambient air temperatures below -60°F. Use **Table 3.3.1** in section 4 to determine the required concentration of propylene glycol and distilled water to provide adequate freeze protection in your specific climate. HTF shall be used in this system as the primary freeze protection agent. Unauthorized fluid substitutions can result in a threat to health, welfare and safety and may cause the system piping to freeze.

When the system is operating, the pump should be on when the sun is shining and there is an adequate temperature differential. The pump should be not be running at night or when the solar tank has reached its default maximum set point temperature T2 of 140 degrees Fahrenheit. The top of tank temperature sensor T5 can be checked to ensure your system has hot water ready for use.

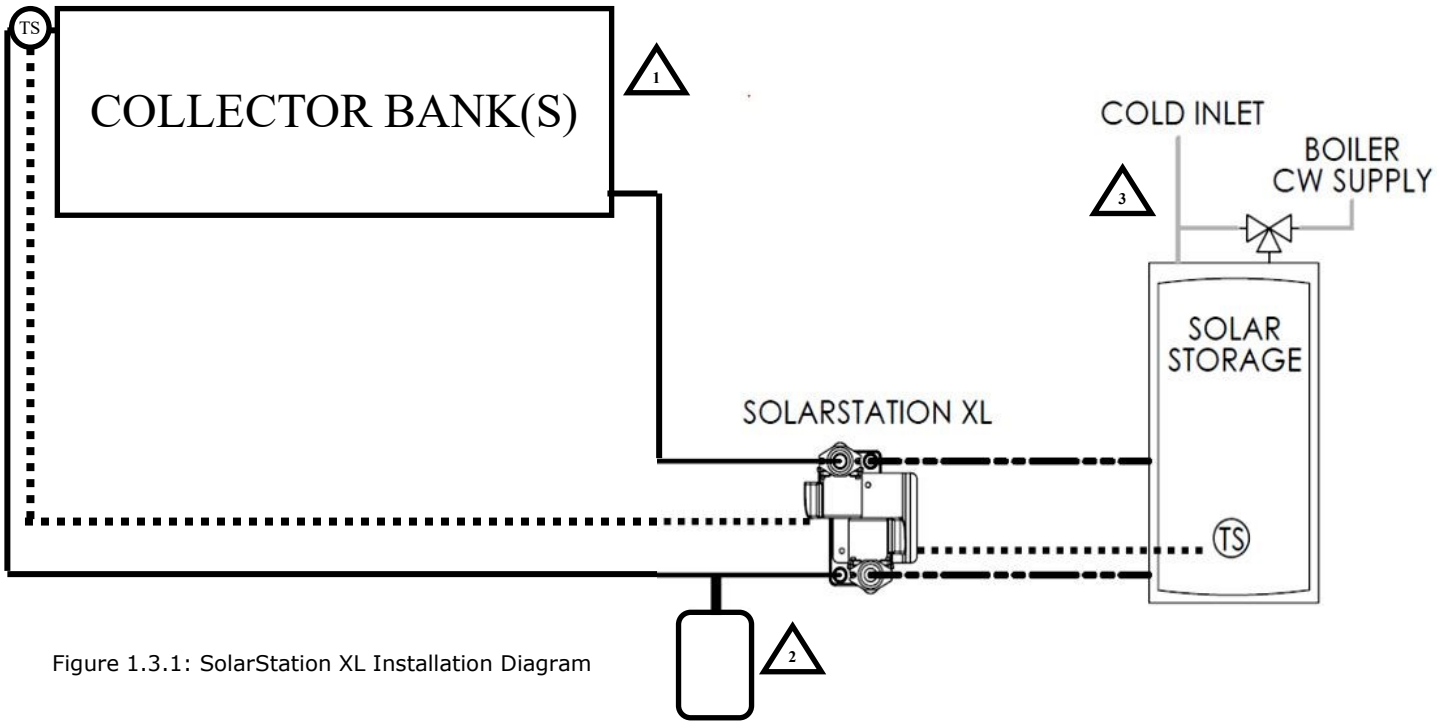


Figure 1.3.1: SolarStation XL Installation Diagram

Notes:

- Array piping sizes to be determined by the array size 1
- The solar expansion tank size to be determined by the array size 2
- A potable water expansion tank should be sized per the solar storage volume and installed on the cold water supply. 3

2. INSTALLATION

2.1. WALL MOUNTING

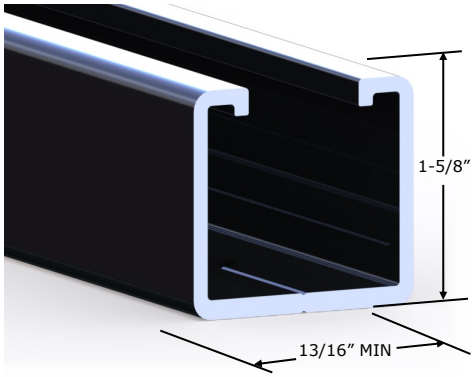
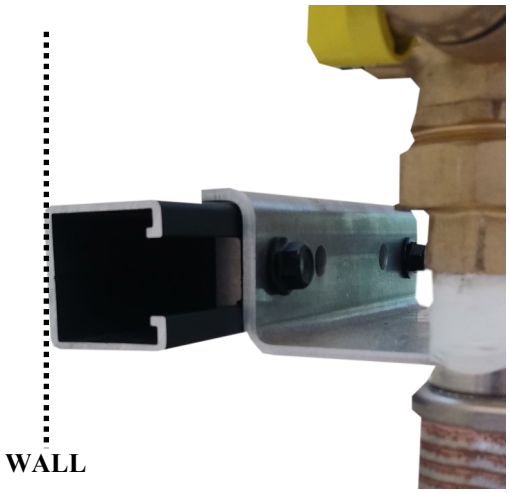


Figure 2.1.1: Strut Dimensions

When wall mounting the SolarStation XL, 1-5/8 by 13/16 (min) inches Solar strut must be used. The strut must have a minimum depth of 13/16 inches for proper clearance from the wall. Using at least 2, 3/8 inch strut nuts and bolts, affix the 5052-H32 aluminum mounting bracket to the strut. Please consult authority having jurisdiction (AHJ) for fasteners sizes and mounting requirements when connecting strut to the wall.



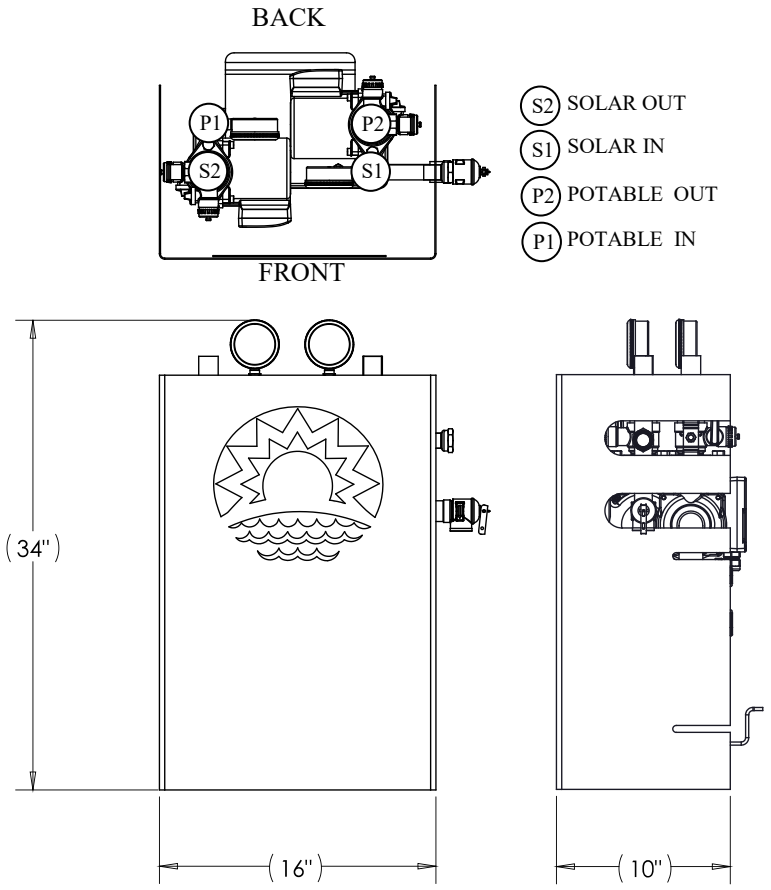


Figure 2.2.1: Connection Details

2.2. PLUMBING CONNECTIONS

The collector loop must be plumbed using copper or stainless steel piping and copper, brass, bronze or stainless steel fittings. Lead-free solder shall be used. Use of galvanized steel, PEX, CPVC or PVC is prohibited. PEX may be used only in systems that meet the following conditions:

• Only Solder Fluxes meeting the criteria of ASTM B 813 should be utilized for joining by soldering any copper and copper alloy tube and fittings in the entire solar system.

It may be necessary to increase the pipe size for longer pipe runs or reduce the pipe size for shorter runs or higher efficiency pumps. The pipe must be large enough that the velocity of the water in the pipe does not exceed 4 ft/s. Hot water flowing at over 4 ft/s in a pipe will erode the pipe and reduce system life.

Allowance should be made for expansion and contraction of piping due to changes in temperature of the fluid and piping. Use flexible pipe supports and avoid long straight piping runs. Include bends and elbows to allow for expansion such as swing joints at the collector inlet & outlet.

The collector loop piping, plus any interconnecting hot water piping shall be well insulated with high quality flexible closed cell insulation to minimize heat loss. The insulation shall have a maximum operating temperature of 220°F or higher. When it comes to pipe

insulation the rule is simple: thicker is better. To the extent possible, slide the insulation material over the pipe without cutting or taping. All butt joints must be sealed with contact adhesive. The use of rigid polyethylene pipe insulation is prohibited. The temperatures generated by your collector in the summer months or under stagnation conditions can melt this type of material. Any above ground exterior pipe insulation is subject to UV degradation and must be jacketed, wrapped with aluminum foil tape, or painted with two coats of high quality water-based acrylic resin coating as supplied by the insulation manufacturer.

The SolarStation XL has four plumbing connections detailed in **Figure 2.2.1**. The two plumbing connections located in the front are associated with the solar circuit. The two plumbing connections at the rear are associated with the potable circuit.

The (1) solar feed should be plumbed to the feed pipe for the solar thermal array. The (2) solar return should be plumbed to the return pipe for the solar thermal array. The (3) potable feed should be plumbed into the solar storage tank on an upper port. The (4) potable return should be plumbed into the solar storage tank on a lower port.

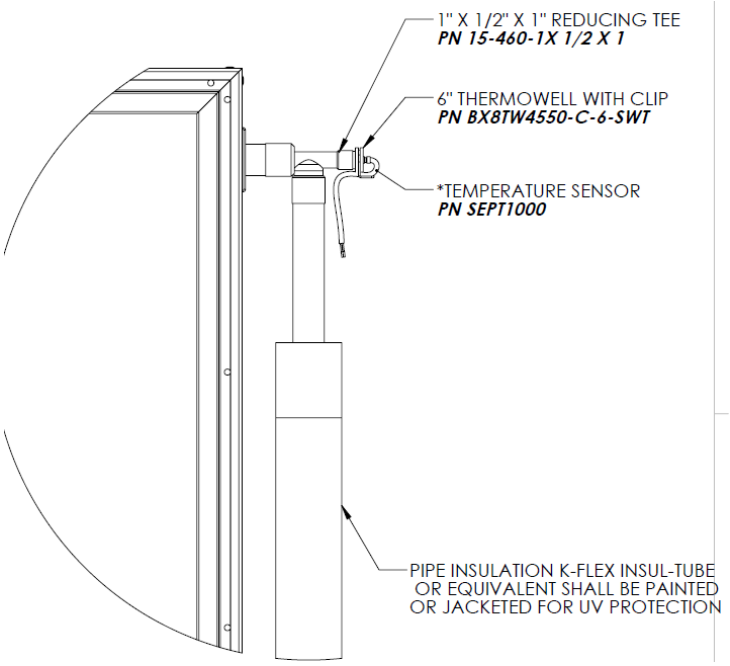


Figure 2.3.1: T1 Array Temperature Sensor Installation

All collectors and horizontal pipe runs plumbing should be supported to allow complete drainage of the system if necessary, the recommended slope is 1/4 inch per foot, sloped to drain.

It is recommended that an appropriately sized Tempering Valve be installed on the solar tank potable outlet connection per the manufacturers instructions.

2.3. ELECTRICAL CONNECTIONS

A 6 foot electrical lead is supplied from the SolarStation XL . An electrical supply junction box must installed using approved methods per electrical code for a 120VAC 1ph connection.

The 0503 controller front cover should be removed along with the controller electrical cover plate. The temperature sensor installed on the array should be connected into the T1 port in of the differential controller. The temperature sensor installed near the bottom of the solar storage tank should be connected into the T2 port of the differential controller. Ports T3 and T4 are occupied by the prewired heat exchanger temperature sensor and the potable feed temperature sensor. An optional upper tank temperature sensor can be installed in port T5.

The T1 array temperature sensor should be installed in a dry thermowell on the array outlet header connection as shown in **Figure 2.3.1**

The T2 tank sensor should be installed in a dry thermowell on the lower 1/6th of the solar storage tank.

3. SYSTEM COMMISIONING

3.1. CHECK THE ARRAY LOOP FOR LEAKS

1. Before the system has been charged, open all shut-off valves on the collector loop.
2. Apply 20 psi less than the pressure relief valve rating of pressure for 15 minutes. Any drop in pressure during that time indicates a leak.
3. Find the source of the leak and repair it. Repeat this procedure until the loop holds pressure.

3.2. FLUSHING THE SYSTEM

After installing the SolarStation XL the system should be flushed. Piping in new solar installations can be covered with dirt, grease, solder flux or other impurities that over time affect the quality of the propylene glycol HTF. A thorough cleaning is required before charging the system with propylene glycol water mixture.

Step 1 – Fill solar tank with water and ensure there are no leaks on the potable side of the system. Open the nearest hot water fixture and run to flush out any flux from the installation.

Step 2 -Keeping the two potable isolation/flush valves closed during potable circuit flush.

Open a flush/drain port allowing water to flush circuit to this point then close flush/drain port. Open other flush/drain port allowing water to flush circuit to this point then close flush drain port.

Alternate flush/drain sequence stated above until all air is removed from the potable circuit.

Step 3—Keeping the two solar isolation/flush valves closed. Flush array loop with water to clean out any debris or sediment from the pipes and collectors.

3.3. CHARGING THE SOLAR CIRCUIT

Once the system is flushed you are ready to fill the solar storage tank with water and to charge the collector loop with a mixture of heat transfer fluid (HTF) and water. Due to variations in municipal water quality throughout the country, distilled or deionized water shall be used to mix with the propylene glycol HTF. Refer to **Table 3.3.1** for percent concentrations.

Percent By Volume - Dow Frost HD	
Temperature (°F)	Freeze Protection
20	18%
10	29%
0	36%
-1	42%
-20	46%
-30	50%
-40	54%
-50	57%
-60	60%

Table 3.3.1: HTF Concentration

1. Connect the outlet of a transfer pump via a hose to the fill valve.
2. Open the fill valve.
3. Open the drain valve. Connect the drain valve to a bucket.
4. Fill the bucket with the appropriate mixture of propylene glycol and water.
5. Run the pump. Continue running the pump until you do not see air bubbles in the coolant.
6. Turn off the pump. Let the system sit for ten minutes.
7. Repeat previous steps until no air is discharged.
8. Close drain valve.
9. Continue charging until it reaches the necessary pressure for the system's configuration.
10. Close the fill valve.
11. Turn off and disconnect charging pump.

Note: It is recommended to install commissioning automatic air vents as provided in SunEarth Add-a-row and systems kits on each collector bank. Two weeks following system commissioning the solar circuit pressure should be verified and increased if needed with the automatic air vent isolation valves being closed and plugged with the commissioning air vents being removed .

4. EXTENDED NON-USE PROCEDURES

3.4. CONTROLLER SETUP

Once 120VAC powered via the master power switch the controller screen will illuminate and the time functions should be input per the SETR A 503 TTR instruction manual. No other setup of the controller is necessary for the system to function in automatic mode. Tuning of the system controller is possible referencing the SETR A 503 TTR instruction manual.

4.1. SYSTEM IDLING

Solar water heating systems can reach very high temperatures when there is no daily hot water usage on the system. If a short summer vacation is planned, the SETR A 503 TTR differential temperature controller has a vacation function which, when activated, will dissipate heat at night. See the control manual to activate this function. Remember to deactivate this function upon returning system to operation!

During extended idling 6 weeks or more it is advisable to either cover the solar collectors with an opaque material or to manually drain the collector loop HTF. SunEarth recommends that you cover the collectors if practical.

If you choose to drain the HTF in the solar array loop follow these steps:

1. Turn the system MASTER POWER SWITCH to the "OFF" position.
2. Attach a hose to the solar array loop drain valve. Secure the other end to a suitable storage container with volume capacity larger than the solar array loop volume. **WARNING!** Solar heat transfer fluid may be under high temperature and pressurized extreme care should be taken as HTF may turn to steam when exposed to atmospheric pressure.
3. Carefully open the drain valve.

Warning! DO NOT dispose of the heat transfer fluid on the ground or in the water system. Collect it in a container which can be sealed and dispose of it according to the manufacturer's directions.

5. OPERATIONS AND MAINTENANCE

5.1. EMERGENCY SHUT OFF

1. If there is a leak or other issue requiring the collector loop to be drained, turn the system MASTER POWER SWITCH to the "OFF" position.
2. Attach a hose to the solar array loop drain valve. Secure the other end to a suitable storage container with volume capacity larger than the solar array loop volume. **WARNING!** Solar heat transfer fluid may be under high temperature and pressurized extreme care should be taken as HTF may turn to steam when exposed to atmospheric pressure.
3. Carefully open the drain valve.

Warning! DO NOT dispose of the heat transfer fluid on the ground or in the water system. Collect it in a container which can be sealed and dispose of it according to the manufacturer's directions.

5.1 FREEZE PROTECTION

It is extremely important to monitor the quality of the heat transfer fluid (HTF) annually by bleeding a few drops from the solar array loop to verify pH is between 8-10 if outside this range the HTF must be drained and replaced. The chemical composition of the HTF may change over time. A high quality propylene glycol HTF capable of operating at high temperatures should be used. The water used to dilute the HTF is equally important, water containing salts, acids, calcium or other potential precipitates should not be used to dilute the HTF initially or during subsequent re-charges; de-ionized water is recommended. The recommended propylene glycol HTF is Dow Chemical "Dowfrost HD". Technical and engineering data for Dowfrost HD is available at www.Dow.com.

A high quality HTF diluted with pure water and properly maintained will prevent: appearance of deposits on the piping; corrosion of compo-nents; and loss of freeze protection. System pH must be maintained between 8 and 10 to avoid damage to the collector loop and absorber plate piping.

5.2 DESCALING THE HEAT EXCHANGER

1. Turn off your solar water system with the Master power switch.
2. Close the shut-off valves. Open the domestic water service ports and remove any sediment buildup from the clean out port.
3. Flush the heat exchanger with a weak solution of white vinegar and water.
4. Close and the service ports
5. Return shut-off flanges to the open position.