Hooper CORPORATION

LA CROSSE COUNTY SOLAR HOT WATER PROJECTS- LAKEVIEW HEALTH CENTER

PLUMBING OPERATIONS AND MAINTENANCE MANUAL

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Building Strong Partnerships Since 1913

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Solar Thermal System

Owner's Information Manual

La Crosse County Lakeview Mental Health Center
Closed Loop Pressurized System

The Solar Thermal Collectors installed on this system meets the standards established by the Solar Rating and Certification Corporation (SRCC).

Hooper CORPORATION

Safe Quality Construction. Today. Tomorrow. Every Day.

608-249-0451
2030 Pennsylvania Avenue
Madison, WI 53704-4746

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System Overview

We would like to extend our congratulations on your purchase of a Solar Thermal System. Years of research and development, backed by critical engineering, has brought you the finest solar products you can buy. Please take time to read this booklet thoroughly.

The Solar thermal pressurized system has been designed to be a complete solar appliance that incorporates ease of installation and maximum efficiency for years of trouble-free service. The system uses the sun's energy to heat your water, reducing your natural gas or electricity consumption. Solar will pay for itself many times over the life of the system. All installations require a connection to your conventional hot water heating system.

The system collects heat by circulating heat transfer fluid between the reservoir, collectors, and heat exchanger. Since the closed-loop system utilizes a water and food-grade antifreeze mix, safety and performance is assured.

YOUR SOLAR THERMAL SYSTEM

Your system consists of a collector array(s), expansion tank, storage tank(s), heat exchanger, circulation pump and a system controller.

COLLECTOR TYPE: SS-40 Flat Plate, 4' x 10' - Solar Skies, Inc.

SOLAR STORAGE TANKS : ASME, Glass-lined, 310-gallon, 36" x 82" - Badgerland (620 gal total)

EXPANSION TANK: 7 gallon solar expansion tank, Caleffi USA

HEAT EXCHANGER: LB31-60, brazed plate, Advanced Industrial Components

SOLAR DIFFERENTIAL CONTROL: SOLR-2ELC-10, Eagle 2. IMC Instruments, Inc.

CIRCULATING PUMP: UPS26-99 , CI, 115V, 3-speed, Grundfos

COMMISSIONED: Fall 2010

System Overview

There are four major components to your Solar Thermal Hot Water System.

Solar Collector – The Solar Collectors are designed to capture and transfer the sun's energy. The system is typically mounted on the roof facing south and tilted in a manner to optimize the solar radiation. Solar collectors come with an industry leading warranty.

Solar Water Heater/Storage Tank System – The solar water heater or storage system is designed to serve as the reservoir or preheating system for your domestic hot water system or as a supplement for space heating. This system will have either an internal heat exchanger or an external heat exchanger. The exchanger is determined by the parameters of the designed system. The solar water heaters supplied by Hooper Corporation will be either;

1. Superstor Ultra (internal heat exchanger)
2. Superstor Ultra Solar (with electric back up)
3. Superstor Ultra Solar (with boiler exchanger)
4. Superstor Contender (internal heat exchanger)
5. Superstor Contender Solar (with electric back-up)
6. Superstor Contender Solar (with boiler exchanger)
7. Superstor GL Storage (with external exchanger)
8. **Badgerland Large Volume Storage (external exchanger)**

Solar Differential Control – The role of the differential control is to sense temperatures in the solar collectors and solar water heater/storage tank. Simply put, if the collectors are capable of producing hot water and the tank is not satisfied or up to temperature, the solar differential control will activate the pump and begin circulating solar fluid through the collectors.

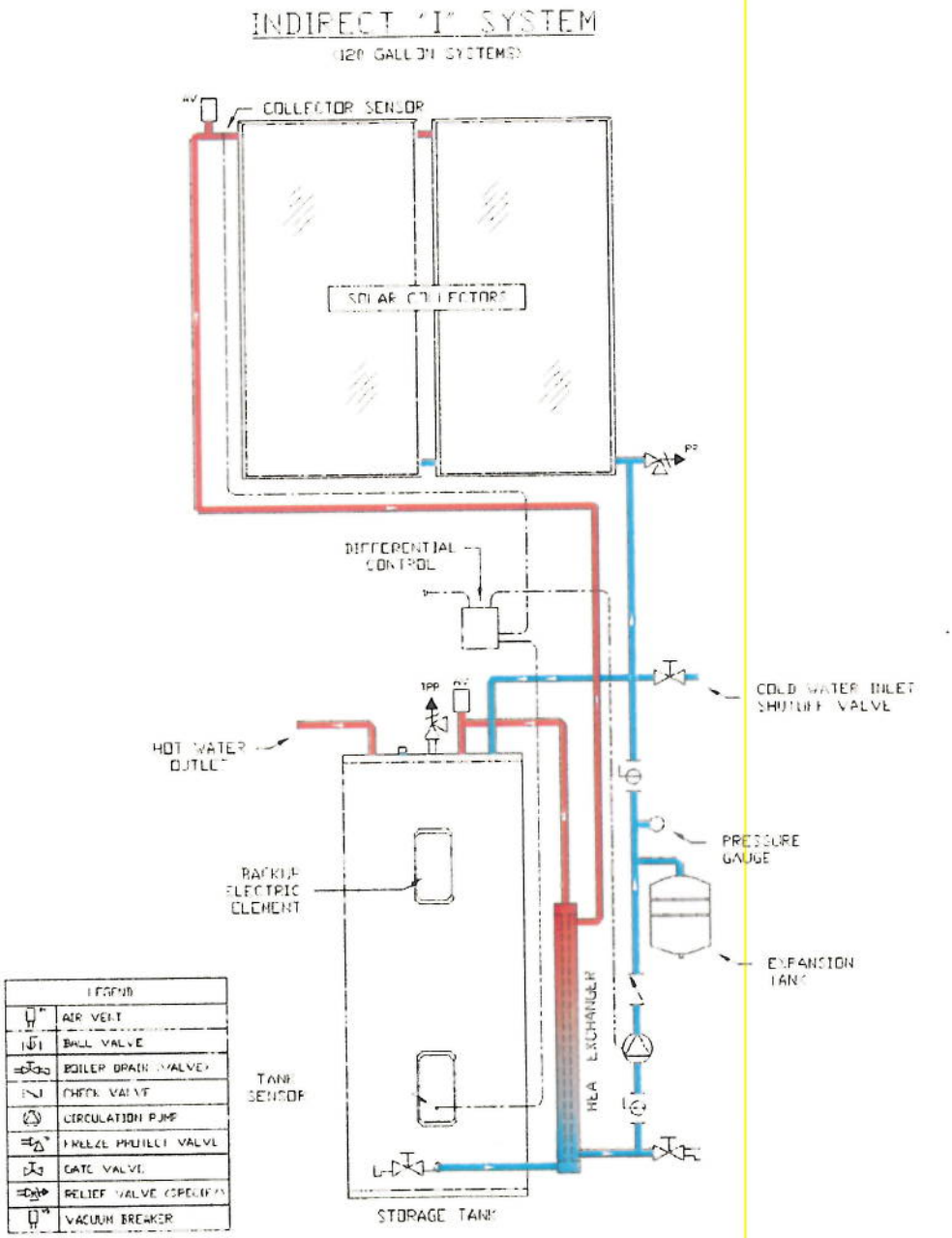
Solar Circulation Pump(s) – The pump(s) lift and circulate the solar fluid in the closed loop system through the collectors and either through an internal or external heat exchanger.

SOLAR WATER HEATING SYSTEM TYPE

Indirect Pressurized System
(Differential Controlled – Closed Loop)

A pressurized system is designed to accommodate climates where freezing weather occurs more frequently. Instead of water flowing through the collector, an antifreeze solution is circulated. Either an internal or external heat exchanger is always used. This allows the heat to transfer from the antifreeze solution to the coldest water in the storage tank. This type of system is known as an indirect pumped system because the heat transfer solution, I.e. food-grade antifreeze, is pumped through the collector in a closed loop. It never comes in direct contact with the potable water in the storage tank. The closed loop includes the collector, connecting piping, pump, expansion tank, and heat exchanger. The differential control determines when the pump should be activated and deactivated.

Please note: Drawing is generalized and does not represent installed system design.



OPERATION INSTRUCTIONS

THEORY OF OPERATION

As the sun comes up in the morning, and starts to shine on the solar collectors, the collectors will begin to heat up. This system has a differential controller that senses temperature differences between water leaving the solar collector and the coldest water in the storage tank. When the water in the collector is about 12° F warmer than the water in the tank, the controller turns on the pump. When the temperature difference drops to about 3-5° F, the pump is turned off. In this way, the water always gains heat from the collector when the pump operates. The solar installer manually sets the differential temperature of the controller at the time of the system installation. The pumps are quiet, so you may not notice when they are on and when they are off.

When the pumps turn on, the solar fluid in the collector loop is circulated through the collector and gets heated. The return heated fluid from the solar collector heats the heat exchanger through which potable water from the solar storage tank is circulated. The heated potable water is then circulated back to the storage tank. When there is no longer a marked difference between the temperature at the solar collector and at the solar storage tank (4° F) the controller automatically turns the pumps off – since there is no heat to be gained. This process is repeated continually throughout the day, so that by the end of the day, the water in the storage tank is hot. This is all done automatically and requires no interaction on the part of the system owner.

All solar systems will have a backup source of heating. A common backup source is gas or electric water heater. Backup sources are used because on some days, when it is very cloudy, the solar contribution will be very small. On days when there is plenty of sun, and the sun is doing the work of heating the water automatically, the resulting high water temperature in the tank will keep the internal hot water heater thermostat from turning on the gas or electric heat, thus saving fuel and money.

THE SOLAR COLLECTORS

The collector array consists of solar collectors of sufficient size to meet the design criteria for the building's needs and geographic area, plus a set of 4 mounting brackets for each solar collector. The collectors use Thermafin absorbers with Selective Crystal Clear Black coating. The Crystal Clear Black surface has been proven to withstand very high temperatures for long periods of time and will not flake or chip. It is a revolutionary coating, which is actually a crystalline structure that is "grown" on the surface of the copper plating material. Crystal Clear Black coating is a leading edge technology that allows the maximum amount of solar energy to be absorbed at the lowest light level and virtually eliminates the amount of energy reflected to the sky.

The absorber plate within the collector is made of Thermafin risers. Using a high frequency forge welded molecular bond between copper tube and copper fin to form the risers that make up the absorber plate. Thermafin is designed to conduct the maximum amount of heat absorbed to the fluid that passes through the tube and returns to the storage tank. Unlike other methods, that solder or braze the tube and fin, Thermafin has only copper to conduct the heat and is therefore the most efficient product available.

The glass on the solar collector is a low iron tempered glass of exceptional clarity. This means that sunlight coming into the collector loses very little energy and transforms almost all of the light into heat. The tempered glass is very strong and resists damage that ordinary window glass could never withstand. A high-density foam material is used to provide insulation and minimize heat loss in cold weather. All copper piping is externally sealed with high temperature silicone grommets. All of this ensures that the maximum heat energy is transferred to the water, which is stored for use as needed.

The aluminum frame of the collector consists of extruded aluminum, with an integral quick lock-mounting rail for ease of installation with our patented "Quick lock" mounting hardware. The mounting brackets come in a set of 4 per solar panel, and all hardware is included except for the actual bolt used to attach to the roof or mounting surface. All fasteners and bolts are made of high quality and long lasting stainless steel.

THE CIRCULATION PUMP/CONTROL COMBO

The collector loop pump is selected for its head pumping characteristics. The potable loop pump pumps water through the heat exchanger and into the storage tank. These pumps are very quiet, efficient, and reliable. If this pump needs to be replaced all moving parts are contained inside a replaceable cartridge. The outer pump body may be removed by unbolting the pump flanges, and the inner cartridge may be replaced without having to disturb any of the plumbing.

A differential controller (and its accompanying sensors) is used to activate the pumps. The controller is preset by the manufacturer to turn the pumps on and off at a specific temperature – usually on a t 10° F Difference between the sensor at the water heater and the sensor at the collector, and off at a 5°F difference.

THE STORAGE TANK

The ASME glass lined water storage tank used in this system is similar in construction to that of a standard water heater. This water heater is equipped with additional inlet/outlet ports to accommodate the solar interface. The water storage tank, stores the heat energy generated by the solar system. As the pumps circulate the fluids throughout the system, the fluids become hot and this heat energy is transferred to the water in the storage tank. This large volume of heated water used as the hot water source for the fixtures in the building.

SYSTEM PROTECTION VALVES

The system is equipped with several thermal protection valves. A temperature and pressure relief valve, on the storage tank, insures that excessive temperatures and system pressure is adequately relieved as needed. A pressure relief valve nsures the tank does not exceed the design pressure of the system. Isolation valves are required to isolate the system when the system is need of maintenance of repair. An anti-scald valve is required to insure that the water delivered to the fixtures does not exceed scalding temperatures.

FREEZE PROTECTION

The solar heat transfer fluid is a mixture of propolyne glycol and water. At proper concentrations, the propolyne glycol, or food grade antifreeze, is designed to protect any small amount of fluid that may be left in the solar panels after the pump has shut off.

"Freeze tolerance limits are based upon 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." Please check with your installer.

OPERATING INDICATORS

Thermometers are installed on the feed/return lines, to/from the collectors to allow the system owner to easily identify the when the solar collectors are working properly. The return line from the collectors should be hotter than the feed line.

The Differential Solar Control comes complete with a digital display that indicates when the system is on or off. It also shows a range of data from the solar system, such as peak high temperatures in the collectors and storage tank.

ESTIMATED COMPONENT LIFE

When installed and maintained as directed in this manual, one can expect many years of trouble-free service from this system. All components in this system are subject to the conditions of the installation. In locations where hard water is present, mineral deposits can prematurely foul-out the design life of these components. Periodic maintenance is required to insure that these components are well protected from such damage. The solar collectors used in this system have a design life of 30+ years. Water storage tanks are designed for 12-20 years of use. The lesser components, such as pumps and valves are designed for 5+ years, however, are more likely to foul, as described above, if not maintained properly.

START-UP PROCEDURE

Solar Tank

Fill the solar tank with water. Do this by opening the cold water isolation ball valve to the solar tank. Inspect all fittings for leaks. The solar collector loop should be pressure tested with air before you pressurize the solar collector loop with glycol. Mix the propylene glycol and distilled water in accordance with the instructions for any State approved propylene glycol product. The charging process will require a low flow diaphragm pump to fill and pressurize the collector loop.

Solar Collector

Connect the discharge side of the pressure pump to the fill valve. Place the pump suction side hose in the glycol solution. Close the ball valve. Connect a second hose to the drain valve and place the other end of the hose in the empty bucket. Open the upper fill valve and allow the pressure from the expansion tank to push the water in the glycol loop back to prime the pressure pump. When the hose in the bucket containing the glycol mixture stops bubbling, you may begin charging the collector loop with glycol. With both fill and drain valves open, run the low flow diaphragm pump until the glycol mixture begins flowing into the empty bucket. Quickly switch the hose from the empty/return bucket to the bucket containing the glycol mixture. Continue to circulate the fluid using the pressure pump until the bubbling has stopped and the air has been purged. After charging the collector loop, shut the lower drain valve and let the pressure pump drive up the loop pressure to the appropriate level. To more accurately calculate the proper pressure, measure the height of the solar collector above the solar storage tank(s) and divide this number by 2.31, then add 20 PSI to this number. After pressurizing the solar system, run the circulator and allow the air to purge out of the air vent. Once purged, monitor pressures and check for leaks before insulating pipes.

All piping, insulation and piping supports must be insulated in accordance with Local, State, and Federal Codes.

COMMISSIONING THE SYSTEM

After the glycol loop has been charged and system is up to the appropriate pressure, set the solar control to the desired settings. Solar controls come with default settings that will work in most installations. If it is a cloudy day, you may have to activate the circulator pump. Once the pump is running and the system is fully purged, set the control to the desired settings. It is recommended that the storage tank high limit set point is not set any lower the 160° F. A lower set point could lower the performance of the solar water heater and could cause over heating of the collector system. You must install an anti-scald valve on the hot water outlet as temperature within the storage tank can cause injury – please see warning below on temperature outlet temperature restriction.

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 manufacturer instruction manual before setting temperature at water heater.

MAINTENANCE/TROUBLESHOOTING

A properly maintained Solar Water Heating system can provide years of dependable trouble free service. It is suggested that routine preventive maintenance program be established and followed with Hooper Corporation. Listed below is the maintenance check list that outlines the primary components of the solar system that should be inspected.

Propolyne Glycol - It is very important that the quality of the Glycol is maintained to avoid damage to the collector loop and related components which come in contact with the fluid.

Water Quality can effect the operation of the solar heat exchanger over time. In very hard water areas, it is recommended you drain a few gallons from the water to keep the bottom of the water heater free of sediment.

Clean and inspect the solar collector. Dirt or film may have settled on the surface and may effect the performance. Check Collector supplier for clean procedures. Please contact your installer for any rooftop related maintenance.

Check Solar Temperature Sensors to insure that they are secure and have not moved or loosened.

Inspect the T&P on the water heater. Lift the release handle lever and make discharge is directed to an open drain.

The area near the water heater must be kept free of flammable liquids such as gasoline, paint thinners, adhesive or other combustible materials.

The storage tank should be flushed on an annual or bi-annual basis following the installer's recommendations.

Exterior pipe insulation should be treated as required with an exterior UV inhibitor paint. Contact your installer if you feel insulation needs re-coating or replacement.

WARNING

Following installation of the T & P Relief Valve, the valve lever MUST be operated AT LEAST ONCE A YEAR by the water heater owner to ensure that waterways are clear.

Certain naturally occurring mineral deposits may adhere to the valve, blocking waterways, rendering it inoperative. When the lever is operated, hot water will discharge if the waterways are clear. PRECAUTIONS MUST BE TAKEN TO AVOID PERSONAL INJURY FROM CONTACT WITH HOT WATER AND TO AVOID PROPERTY DAMAGE. BEFORE operating lever, check to see that a discharge line is connected to the valve, directing the flow of hot water from the valve to a proper place of disposal. If no water flows when the lever is operated, replacement of the valve is required. TURN THE WATER HEATER "OFF" AND CALL A PLUMBER IMMEDIATELY.

This device is designed for emergency safety relief and shall not be used as an operating control. A relief valve functions, in an emergency, by discharging water. Therefore, it is essential that a discharge line be piped from the valve in order to carry the overflow to a safe place of disposal. The discharge line must be the same size as the valve outlet and must pitch downward from the valve and terminate at least 6" above a drain where any discharge will be clearly visible.

SHUT DOWN PROCEDURES

The Solar System is designed to be easily isolated for emergency repairs or routine maintenance. To isolate the water heater, simply shut down the supply water shut off valve which isolates the water heater from the pressurized cold water supply.

The collector loop can be isolated from the solar storage tank. If the pressure in this loop drops or you find a glycol leak, close the isolation valves then turn the circulating pump off by shutting down the power to the solar control and contact your installer immediately.

VACATION SHUT DOWN

Solar water heaters can build up very high temperatures when there is no daily draw on the system. The best way to dissipate heat in the system is set the control to run your circulator pump 24 hours a day to cool off the storage tank at night. The collector will radiate heat back to the atmosphere at night, preventing the system from stagnating at very high temperatures.

CAUTION
If the heating element needs replacement, it is VERY important to use the same voltage, wattage and construction. This element must be stainless steel and the hex plug be made of brass. This replacement part is available from the manufacturer and should not be purchased from outside sources.

OTHER PROBLEMS

A noisy pump is an indication of worn bearings, obstruction or loss of prime.

The system can be checked to determine that it is operating by noting the temperature difference between the collector feed and collector return lines. The return line should be hotter than the feed line.

The table below lists some of the possible problems, their cause, and their remedy. System owners are advised to contact the installer whenever a remedy requires some type of in-depth interaction with the solar system.

PROBLEM	POSSIBLE CAUSE	REMEDY
Insufficient Hot Water	Insufficient Solar Energy Back up source Excessive hot water consumption	Check system size, location & orientation Check / Replace Reduce consumption
Pump does not start	Controller switch in "Off" position Controller unplugged or blown fuse Defective sensor	Turn to "Auto" Return power to controller or replace fuse Replace sensor
Pump runs continuously	Controller in "On" position Defective sensor	Turn to "Auto" Replace sensor
Pump operates but no fluid Flows through the collectors	Flow tubes clogged Loss of fluid in drainback system	Flush collector tubing Cool system, locate air leak, refill properly
No water	Isolation Valve closed	Open valve
System leaks	Pipe burst due to freezing or defective joint Defective seals or piping	Repair or replace Check pipe insulation Repair or replace
System does not drain	Collector installed at incorrect angle Piping insufficiently sloped for draining	Change so draining can occur Check and ensure that piping slopes 1/4" per foot

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