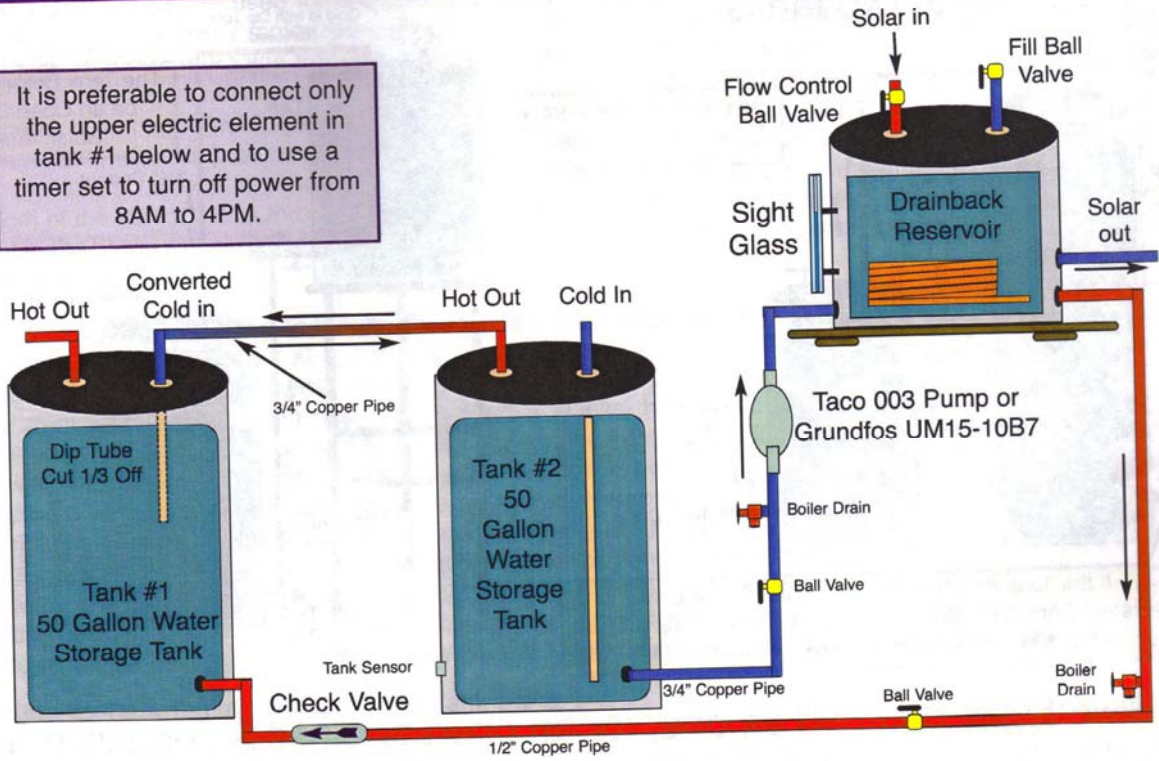


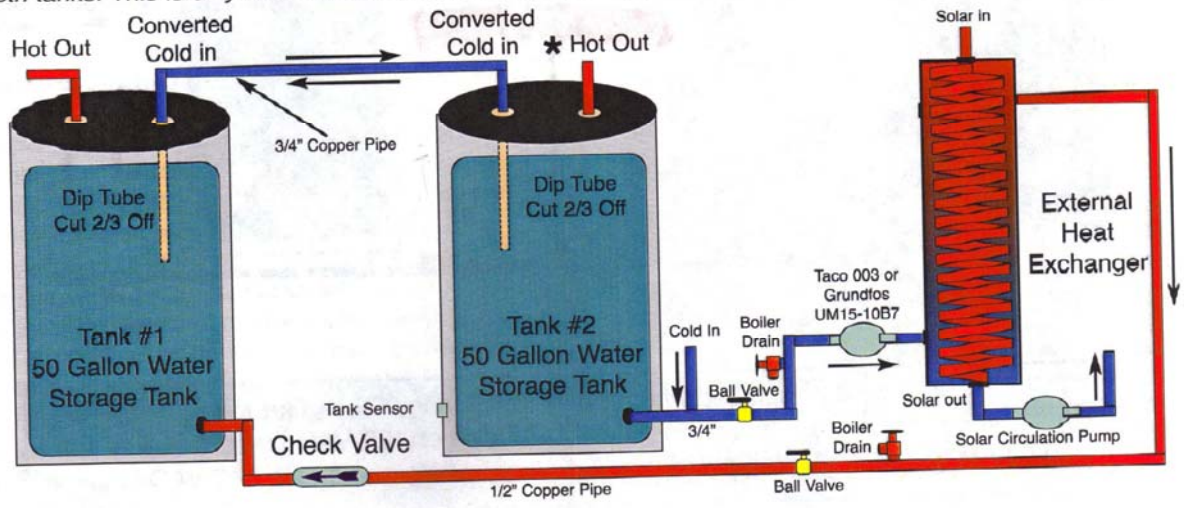


Pumping Two Water Heaters with an External Heat Exchanger Together as One System

It is preferable to connect only the upper electric element in tank #1 below and to use a timer set to turn off power from 8AM to 4PM.



Below: The upper element in both tanks must have timers while the bottom elements are disconnected. Tank #2 located at another location in the house can have the hot water out line (*) supply another section of the home. The cold dip tube is cut 2/3 off on tank #1 and #2. This system can be a drainback or closed-loop glycol system. The ball valves and boiler drains allow for descaling the heat exchanger. A unique option is to use a timer to power the Taco 003 water-side pump. This allows a single element in one tank to heat both tanks. This is only recommended if there is no backup power available for the second tank.



Matching DC Pumps to PV Modules for Glycol Systems

Never use one large PV module to run two DC pumps because if one fails, the other motor may burn up. You can install two 10 watt modules in parallel to get 20 watts, or a 20 and 10 watt module to get 30 watts etc. Do not use PV modules with a closed circuit voltage of less than 16.4 volts except for with the 12 volt 809 March DC pump. High pressure drops i.e. long pipe runs, heat exchangers etc., may reduce the collector area for the DC pump PV module combination listed below.

Recommendations for DC pumps for 50%Glycol/Water Mix, Collector Area and PV Modules

DC Pumps	40 - 64 sq. ft. Collector Area	75-96 sq.ft. Collector Area *
Laing D-5	20 watt PV Module	25 watt PV Module
March 12 volt	20 watt PV Module	20 to 25 watt PV Module
EI Sid PV 20	30 watt PV Module	35 to 40 watt PV Module
Hartell MD-10-HEH	20 watt PV Module	30 watt PV Module

* Pipe runs over 120' or high pressure drop in the heat exchanger may limit collector area to 64 to 80 sq. ft. Do not exceed 25 watts on the March 12 volt pump or Laing DC-5, 40 watts on the Sid PV20 or 30 watts on the Hartell MDHEH DC motors or their typical life expectancy of 15 years will be cut dramatically. Choose close circuit voltage of 14.5 to 16.5 volts for the March pump and 17 to 20 volts on the EI Sid, Laing, or Hartell pump. All three pumps require 3/4" pipe runs except on pipe runs of less than 60' where you can use 1/2" pipe for 30 to 50 sq. ft. of collector area, if you use two 45's or long radius 90° instead of a 90° elbow. Pipe runs over 60' require two pumps with 3/4" pipes for systems with 100 sq. ft. to 128 sq. ft. of collector area. I recommend two heat exchangers in the 120 gallon Sepco tank plumbed in parallel for 96 to 128 sq. ft. of collector area. Single crystal or multicrystal are preferred to amorphous PV modules.

Water-Side Exterior Heat Exchanger: The March 24 volt or EI Sid 10 PV are for double-pumping the water-side of heat exchangers with 10 to 12 watts, 17 to 20 volt PV modules, for up to 100 sq. ft. of collector area. The March 12 volt pump/20 watt, the Laing D-5/25 watt, the Hartell MD 10HEH/25 watts, and the EI Sid PV20/35 watts are used on the water-side of the heat exchangers with 100 to 240 sq. ft. of collector area

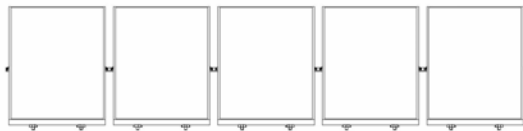
General Sizing Rules for AC Pumps with Pressurized 50% Water/Glycol Mix

AC Pumps	40-64 sq.ft.	75-96 sq.ft.	100-128 sq.ft.	150-256 sq.ft.	256-360 sq.ft.	360-480 sq.ft.
Grundfos UPS 15-42F ** Taco 008	1/2" pipe 1/2" pipe	1/2" pipe 1/2" pipe	3/4" pipe 3/4" pipe	N/A N/A	N/A N/A	N/A N/A
Grundfos UP 26-64F Taco 0014	N/A N/A	N/A N/A	* N/A * N/A	1" 1"	N/A N/A	N/A N/A
* Grundfos UP 26-96F Taco 0011	N/A N/A	N/A N/A	N/A N/A	1" 1"	1 1/4" to 1 1/2" 1 1/4" to 1 1/2"	N/A N/A
Taco 0013 Grundfos UP 26-99F Grundfos UP 50-75F Grundfos UP 26-116F	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	1 1/4" to 1 1/2" 1 1/4" to 1 1/2" 1 1/4" to 1 1/2" 1 1/4"	1 1/4" to 1 1/2" N/A N/A 1 1/4" to 1 1/2"

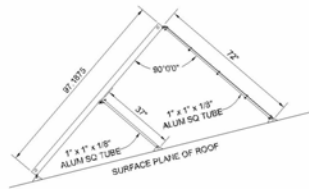
** Option: For lower power cost, use the Taco 006, Grundfos UP 15-18SU, or March 809 with 32 to 52 sq. ft. Heat exchanger minimum of 1.4 feet of head lost per 16 GPM and 10.7 feet at 36 GPMs per 64 to 128 sq. ft. of collector area. All pipe runs are for less than 120' in the tables. The Grundfos UP 26-64F and Taco 0014 should be used with 100 to 128 sq. ft. of collector area with 3/4" pipe if the total pipe run is over 120'.

* The Grundfos UP 26-99F should be used with 150 to 256 sq. ft. if the pipe run is over 120' total.

Water-Side Exterior Heat Exchangers can be double-pumped with the Taco 003, March 809 1/100 hp, or Grundfos UM 15-10 B5 for 40 to 150 sq. ft. of collector area. Collector areas of 160 to 280 sq. ft. should be double-pumped with the Taco 006 or Grundfos UP 15-18SU. Use the Grundfos UPS 15-42F or Taco 008 for 280 to 380 sq. ft./collector area. Use Taco 0014 or Grundfos UP 26-64F for 380 to 480 sq. ft./collector area.

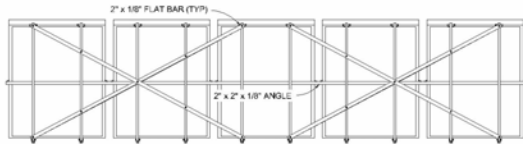


FRONT VIEW



1. EXISTING ROOF PITCH 3:12
2. COLLECTOR TO BE TILTED 49.5° FROM HORIZONTAL

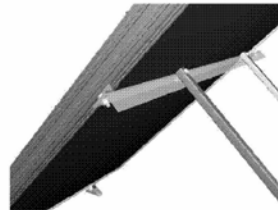
RIGHT SIDE VIEW



REAR VIEW

NOTES:

1. ALL MOUNTING HARDWARE (BOLTS, WASHERS AND NUTS) SHALL BE STAINLESS STEEL UNLESS OTHERWISE NOTED.
2. REAR/MIDDLE SUPPORT LEGS TO BE 1" x 1" x 1/8" ALUMINUM SQUARE TUBING.
3. COLLECTOR BACK BRACING TO BE 2" x 2" x 1/8" ALUMINUM ANGLE AND X-BRACING TO BE 2" x 1/8" ALUMINUM FLAT BAR.
4. COLLECTORS TO BE ATTACHED TO BACK BRACING ANGLE USING AET RACK MOUNT HARDWARE AND STAINLESS STEEL CONNECTORS.
5. ALUMINUM TO BE 6061 TEMPER MATERIAL.



General Notes

No.	Revisions/Issues	Date

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Project	Sheet
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pump on the collector loop be on the discharge side out of the heat exchanger, to push the water up to the collectors. **Mounting the pump volute vertically on the feed side to the collectors will help eliminate air lock problems in all types of solar systems.**

- **Add a 33% solution of propylene glycol to the system to prevent freezing** if the controller should ever malfunction and the pumps were to run due to a control malfunction when the temperature drops below freezing. This is not a common problem, however it can happen. All water/water glycol fluid film left in the collector, when the pump turns off, will vaporize back into the reservoir before 150°F. Some contractors add a normally closed 44°F freeze sensor in-series with the collector sensor if you use only water as the HTF fluid. The sensor opens at 44°F and it will not reset or close until it is 54°F.
- The water may return faster than it is being pumped to the collector with a return line running over 20' straight down from the collector. A ball valve above the reservoir may be necessary to slow the water flow. Water falling faster than it's being pumped can cause the piping to vibrate and/or cause the reservoir tank to be extremely noisy. In some systems the water falling from the collectors will not vibrate the pipes, however, this can stop the pump from circulation! A ball valve on the return line above the reservoir can *backup* the falling HTF fluid to create enough back pressure @12 psi to get the pump circulation flowing and/or stop this.
- Use a ball valve just before the reservoir with a temporary diagnostic flow meter, on the feed side, or 0-60 pressure gauge to create enough back pressure for the pump to create flow and not cavitate. See page 36 and 136. The ball valve will be partially closed after pump startup to set the correct back pressure.
- Use only low-pressure flow meters that permit back flow when the pump turns off. They are installed across from the upper level of the reservoir, to act as a fill level gauge, when the collectors are empty. The Letro LDF360B .5 -5 gallon/minute flow meter is recommended for 40 to 128 sq. ft. of collector area. Always make sure all external heat exchangers or heat exchange tanks are below the reservoir. (page 24)
- **Special Note:** Since drainback systems are unpressurized and are not exposed to corrosive HTF fluids, cheaper copper gas or refrigerant pipe can be used rather than copper plumbing pipe. Gas or refrigerant pipe 7/8" is equivalent to 3/4" ID plumbing pipe. Copper 3/4" ID plumbing fittings fit 7/8" OD gas pipe.

General Pump Requirements for Drainback Systems Using Water or 33-40% Glycol/Water Mixture

Square Footage of Collector Area	Pipe Size		Collector Loop Pump	Double-Pumping *** Waterside AC Pump
	Plumbing	Refrigerant		
0-100 *	3/4"	3/4"	** Taco 009 Grundfos UP26-96F	Laing SM-303, Taco 003 Grundfos UM15-10B5 or 7 March 809 1/100 hp
96-134	3/4"	7/8"		Taco 006 Grundfos UP15-18SU
134-280	1"	1 1/8"	Taco 0011 Grundfos UP26-99F	Taco 008 Grundfos UP15-42SF
280-360	1 1/4"	1 1/4"	Taco 0013	
360-480	1 1/2" to 2"	1 1/2" to 2"	Grundfos UP26-116F	

***Break the Rules:** If the pipe run to the reservoir from the collector outlet must be less than 60' and the collector area is less than 130 sq. ft. you can use 5/8" ID which is 3/4" OD gas or refrigeration pipe which is .66 ID and .042 wall thickness type L copper. The pipe run must be under 120 total feet. There must be no long lateral roof or attic runs where the pipe can "belly out". The 5/8" ID feed to the collectors must always have at least a 15° slope. The return line from the collector to the reservoir must always have at least a 10° slope. Transition with 3/4" OD to 7/8" OD or 5/8" ID to 3/4" ID adapters. Cast iron Taco or Grundfos pump modules can be used instead of brass or stainless steel pumps if the collector loop is not vented to the atmosphere.

** The Taco 008 or Grundfos UP15-42SF that use less than 100 watts can be used with up to 100 sq. ft. of collector area, if the static head is less than 14 feet from the reservoir to the top of the collectors.

The heat exchanger(s) should be sized to achieve the maximum of only 1.4 feet of head loss per 1 GPM and 10.7 feet of head loss at 3 GPM with 63 to 128 sq. ft. of collector area.

Water-Side Exterior Heat Exchangers: *** Double-pumped systems can use two AC pumps wired to the same controller, as noted above. A water-side option for external tube-and-shell thermosyphon heat exchangers is to double-pump them with a DC pump and PV module. **DC pumps and PV modules should be used in this situation ONLY with thermosyphon tube-and-shell heat exchangers.** Use the 24 volt March with 10 to 12 watts or El Sid PV 10 DC pumps with a 10 watt PV module with 40 to 96 sq. ft. of collector area. Use the Hartell MD-10-HEH with a 20 to 30 watt module. Use the March 12 volt pump, Laing DC-5 with a 20 to 25 watt PV module, or the El Sid PV 20 with a 30 to 40 watt PV module with 100 to 240 sq. ft. of collector area.