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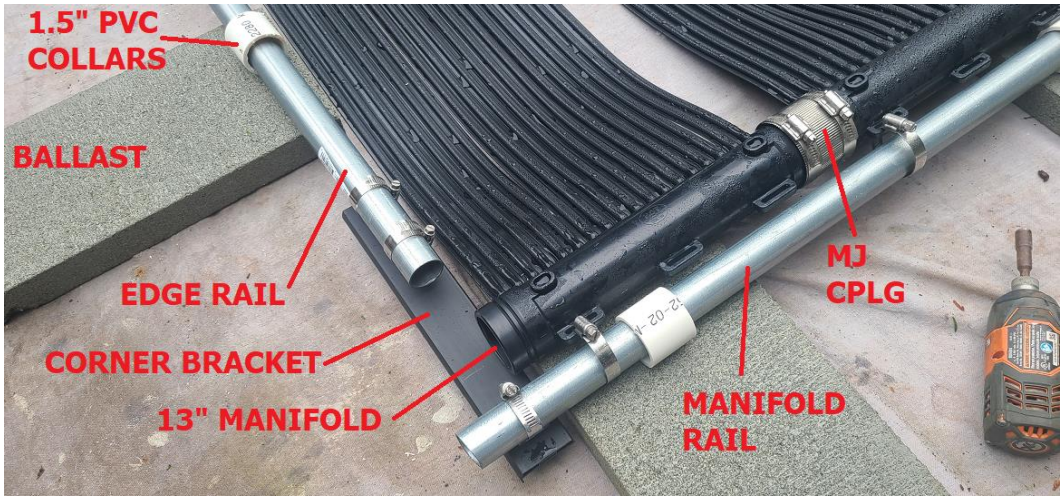
BALLASTED FLAT ROOF MANUAL ADDENDUM 2" MANIFOLDS

Refer to the General Installation Instructions. This manual addendum only covers specifics to flat roof mounting. Refer to drawings FLAT-1283 and FLAT-1283-LAYOUTS

Ballasted means weighted. A framework made up of 1-3/8" OD chain link fence top rail is weighed down to the roof with 1.5"x8"x16" patio stones or concrete block caps (ballasts).

WARNING: The rails (edge rails, cross rails and manifold rails) can roll if you step on them. The same is true of pvc pipe and even collars. This presents a safety hazard on a roof. Organize things carefully and bring these materials to the roof only as they are installed if possible. PVC cement is toxic. Wear eye protection and don't breathe the fumes.

This design has been field tested extensively and is rated by Hot Sun for 100mph winds. In cases where a separate engineering approval of wind load capability is required (if you are in Florida where there is a hurricane standard or under the scrutiny of a structural engineer) you have to glue some of the ballasts to the roof and in many cases, provide another means such as safety straps to ensure the system stays secure and safe in a major windstorm.



The pvc pipe collars (2” long 1.5” PVC pipe) are glued to the ballasts as the last step (PL) but first you must lay out the system so you know where the plumbing will run because on some sides the ballasts will be oriented perpendicular to the rail as in the diagram above. This way plumbing can be supported by the same ballasts. To save space orient the ballasts parallel to the rails if no plumbing supports are needed.

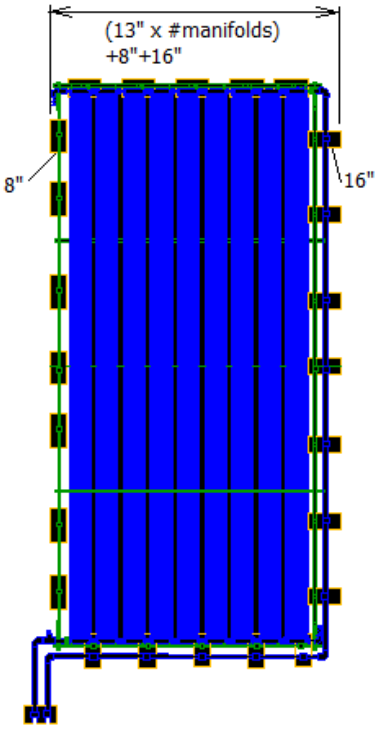
LAYOUT:

See DWG FLAT-1283 and FLAT-1283-LAYOUTS

Our fin tubing is made in 88’ rolls. This means that in order to minimize waste we want fin tube lengths to be factors of 88’. Try to lay out the system such that the lengths are approximately 15’,18’,22’, 29’8”, 44’ or 88’. We normally try to sell these systems prefabricated (fin tubes cut to length and glued to manifolds) to these standard lengths up to 29’8” plus manifolds equals 30’. For cutting and gluing on site to fit the space, refer to the ASSEMBLY section below.

Each manifold occupies 13” exactly when coupled together with Hot Sun 2” MJ couplings.

It is important to look at the elevations of the roof. Flat roofs will have some slope and near the edges of the roof slopes may change to direct water. The water should exit banks of solar collectors at high points in the roof. In other words the highest corner of a bank of solar collectors is the return. Flow through the fin tubes can go across the slope of the roof or up the slope of the roof.



Note ballast orientation to support plumbing Apply zinc paint on cut/filed ends of rails

In the above simple example of a single bank of Hot Sun collectors water leaves the system at the highest point, the top right. Note the orientation of the ballasts to accommodate the piping. Water usually goes in diagonally opposite where it comes out. Contact Hot Sun for help laying out a multi bank plumbing scheme. In multiple bank scenarios as in sloped roof plumbing all the water has to reach the common high point before exiting. Water from the high points of individual collector banks must flow uphill to the common high point. Roughly lay out all the ballasts to accommodate collectors and plumbing. Its important the ballasts are 1.5” tall because this will orient the cross bars to be above the fin tubes precisely. Spacers can be added to make up for variations in the roof along the manifolds. If the roof surface is sensitive glue or place 7.5” long pieces of fin tubing under the ballasts.

ASSEMBLE THE COLLECTOR BANKS

Refer to the drawings FLAT-1283 for the recommended ballast, cross bar and strap locations. The primary purpose of the cross bars are to hold the system down in wind. The purpose of the straps underneath the fin tubes is to keep the fin tubes arranged uniformly.

Cross rail over fin tubes last

Strap under fin tubes first

The Hot Sun PVC coated ss strap (strap) goes down first (under the collectors) at the right locations (refer to drawing FLAT-1283 LAYOUTS). The straps will be wrapped around the ballasts and tied off to the edge rail with strap clamps. All the gluing with PL adhesive happens once the system is complete. It can take a few days to set up fully.

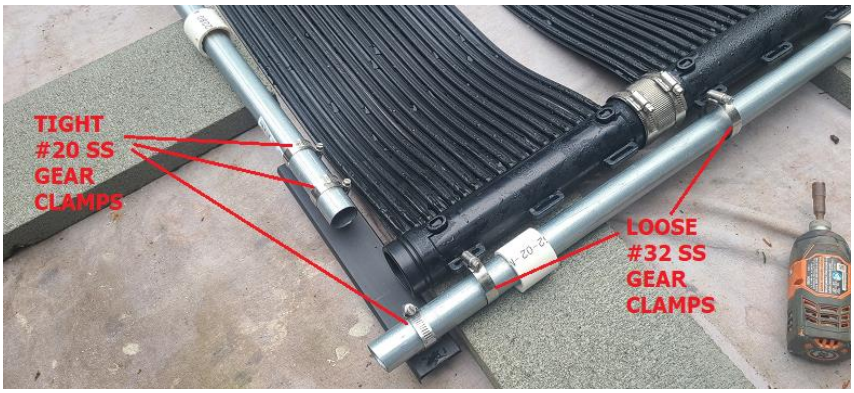
Note cross rails are located within 6 feet of the manifold assemblies and 10' max from other cross rails. Edge rails every 10 manifolds, 12 maximum.

With ballasts and straps located and positioned, lay out the Hot Sun solar panels and couple together with Hot Sun 2" MJ couplings. Separate the pvc/rubber sleeve from the stainless steel housing. Grooves on the Hot Sun manifold match the profile of the sleeve. Snap the sleeve into place on one manifold then slide the ss housing over, then pop the other manifold in. Torque the MJ coupling's two gear clamps alternatively to 30 inch pounds. Just snug. Its an incredibly effective seal. Don't overtighten. Perfectly aligned the stainless steel shroud will butt against the edges of the fin tubes. The screws of the MJ couplings must be on top the coupling so they don't interfere and ideally, oriented such that the 2 screws face inward. Use a 5/16 nut driver on a cordless drill to tighten the screws from the fin tube side.

Note, instead of removable 2" MJ couplings, you can glue 1.5" pvc pipe inside the Hot Sun manifold to space around obstructions and to add caps or drain points to the ends of manifold

runs. Heavy body grey pvc cement is recommended. Do not use primer on pvc connections to the manifold. The manifold is not pvc.

Next position the cross rails and install the edge rails and manifold rails starting with one corner. Corners joining manifold rails to edge rails are done using Hot Sun corner brackets and 3) #20 gear clamps. A corner bracket can also be made of 12" of shallow slotted Unistrut.



Hot Sun corners

Edge rails and manifold rails sit on the ballasts via short pieces of 1.5" pvc pipe (collars). These will be glued to the ballasts in the last step using PL. The purpose is to create a solid but slightly flexible connection to the ballasts that allows for the system to be taken apart and also to elevate the rails to the correct position. Secure the manifolds to the manifold rails using loose #32 gear clamps (Hot Sun supplied) around the manifold rails and through one of the 3 tabbed slots on each manifold. Very loose so that the manifolds can expand and contract. The plumbing piping and the manifolds will expand and contract in proportion to their length. PVC pipe will expand and contract a 1.5" over a 30' length over the temperature range we usually expect. The flexible fin tubes do not expand and contract because they are flexible. They just flex.

Cross rails can now be secured to edge rails to complete the frame. Cross rails can extend past the edge rails to provide additional support for piping so plan the plumbing carefully first. Plumbing runs need to be supported at least every 3 feet so plan ballasts accordingly.

PLUMBING

Drain points are installed at the low ends of manifold runs to eliminate water in winterizing the system. These are glued using 2711 heavy body grey pvc cement via 1.5"slip x ½" fipt bushings, an 1.5" elbow, and a 2" long stub of 1.5" pvc pipe. Tilt the elbow down so the drains exhausts more of the water left in the manifolds over winter. Note that when gluing into the manifold we do not want to use primer. The manifold material reacts more aggressively with pvc cement than pvc so the primer can damage the manifold if it puddles. You can use primer and pvc cement on all pvc to pvc connections of course. Install drain points at any other low points in the plumbing using tee fittings. Over 2" pipe use slip collars made of 2.5" pvc pipe. On 1.5" pipe the slip collars are 2". These collars glue to the ballasts as the last step using PL. Don't glue the collars to the ballasts that are near the corners. This allows the piping to expand and contract. Note the

piping connection to the cross bar shown below can allow for this movement. Plumbing must be supported at most every 3 feet to prevent the piping from sagging when the system gets hot.

The vacuum breaker tees off the pipe entering the system, the feed. It must be positioned vertically as gravity plays a role in its operation. Note that if the feed point on a bank of collectors is lower in elevation, then the far end doesn't have to be drained. That typically higher end of the feed is often good spot to elbow up to a vacuum breaker.

If you want to maintain 2" flow capacity, the connections to the feed and return pipe should be done with Hot Sun 2" cpvc adapters rather than gluing 1.5" pvc pipe inside the manifold.


Hot Sun cpvc adapter (grey) glues into a pvc fitting


You can not use a removable coupling (the 2” MJ coupling) directly on pvc because the pvc will neck down under the stress of the gear clamp when things heat up. The system will get very hot stagnating in hot summer sun with the pool up to temperature. CPVC can take the heat combined with the stress of the gear clamp over the seal (so can the manifold).


2” PVC fittings can be glued to the outside of the manifold but the manifold can only slip in 1”. 2” PVC fittings are deeper than the end of the manifold. Measure the difference and cut relief off the end of the fittings. Do not use a 2” elbow because it will cause interference with the edge rails and corners. You may use a 2” PVC coupling, because like the adapter, it will space the feed or return pipe outside the framework.


If the 2” plumbed system employs multiple banks of collectors then each bank can be plumbed with 1.5” pvc pipe. These PVC connections in and out of individual collector banks should be glued with 1.5” PVC pipe glued inside the manifold. Heavy body grey pvc cement, no primer.

Note that air pockets must be avoided. Manifold runs will have a slope one way or the other. Always plumb such that water exits the highest corner of each bank and travels uphill from there to a common high point. Air will rise through the water column to this common high point naturally providing a smooth start up. Feeds can be high or low end of the feed manifolds. Allow for drainage at the low end. Note ups and downs in the fin tubing including manifold down to roof level and back create air pockets that can be flushed out easily. What will block flow is water leaving a bank of collectors at the low end of that row of manifolds. Pay attention to high points for flow on the return side and pay attention to drainage on the feed side. Know where your piping is going.

FINAL TOUCHES

The solar sensor should see the same average sun as the collector array. A good location is glued right onto one of the ballasts. Do not mount the sensor to a pipe or to the solar panels as we want it to mimic the temperature the solar panels would be at when no water is flowing through them.


The sensor wire should be outdoor rated. Hot Sun sells it by the foot and soldered to the roof sensor. Alternatively you can use conduit. The wire gauge size should be less than 22GA (larger

is smaller in wire gauge). We use 2 wire 18GA stranded and shielded outdoor rated wire. Tie wire off to the piping using black nylon 10 ties.

Once the system is fully plumbed and wired paint all the white pvc piping black using flat or gloss black paint out of a can. Acrylic paint is best for PVC but a good rust paint also works well. Paint from spray bombs fades off over time. Use a small roller brush to get under the piping. Nothing is glued to the ballasts yet so it's easy to lift and move piping as you paint. The paint dries quickly enough that the second coat can be applied in order as the first coat is completed.

Next run the system and check for leaks assuming all the plumbing to the pump house is also complete. Refer to the general instructions for wiring and plumbing at the tie in and start up.

Finally glue all the slip collars to the ballasts using Loctite PL Premium 3x construction adhesive. In Canada its Lepages premium 3x (shown above). Rotate the slip collars a little as you apply the mastic to get better contact underneath. Remember not to glue slip collars on pipes at corners where expansion and contraction of piping must be allowed for. Glue down the slip collars, the roof sensor, and glue the fin tubes to the straps beneath them. A little dab of PL between each 4" wide fin tube and the strap below is quick and easy and secure and if you ever had to remove the system you can just cut the strap between the one foot wide sections. .Its messy. Carry a rag, wear gloves. It won't come off your clothes. It is better to use the smaller caulking tube size rather than the large tubes due to the fact once you start oozing it out it keeps coming. Have a rag handy. Buy the PL at most hardware stores. It is the most common and popular construction mastic.

Once the system is complete you can check that you plumbed correctly by feeling the collectors on a sunny day with water flowing through them. If you feel hot collector surfaces these are areas that aren't getting flow. First make sure air can rise up out of the system by checking that pipe does not slope down where air must be released up. If one bank is significantly larger than another you may find it gets less flow. You can add a ball valve before the smaller bank and adjust it to force more flow to the larger bank. Measure collector temperatures near the return manifolds with an IR thermometer or judge by hand. Adjust so that return temps are the same on multiple banks. Generally if the flow is sufficient to start the system up, the flow will be adequate and the temperature rise through the system won't be excessive. Collectors are less efficient in proportion to their temperature so we will have enough flow in a typical set up that the water temperature from solar to the pool will only be 5 or 6 degrees warmer than the pool. If it is much higher than that and its plumbed correctly increase the flow (close bypass further or turn up pump speed) to see if an air bubble is trapped in the return line coming down off the roof.

ASSEMBLY - MANIFOLDS TO FIN TUBING (UNASSEMBLED COLLECTORS):

For collectors longer than 30', assemble the fin tubes to the manifolds on site. See LAYOUT section above. Start at one end of the bank with edge ballasts in place. Trim the fin tubing square and attach to the fin tubing as described below. Complete the manifold and ballast assembly as that end, then straighten all the tubes out, run a chalk line and cut the fin tubes to final length. Do not assemble manifolds to each other or to piping first. The manifold's 18 nipples must be free to be fully wetted by the adhesive.

Use the supplied CA adhesive to connect the flexible solar tubing to the nipples on the header pipes. Start by cutting the fin tubing squarely with an anvil style cutter (Hot Sun can supply). Be careful not to nick the fin tubing. Then strip 3.75" wide strip of tubing into two tube wide strips so you can glue 2 tubes at a time. Not over the whole length - just strip about eight inches. There is a perforated tear between fin tubes. Nick it with the anvil cutter to start the tear.

Simply apply the Turbofuse adhesive to the nipples all 18 at a time unless its really windy. Fully wet the entire surface of each nipple all the way around and then slide the tubing on two tubes at a time. Wear gloves and be careful you don't glue yourself to the manifold. Read the warnings on the bottle of Turbofuse adhesive.

Make sure the entire nipple surface area is fully wetted before sliding the tubing on. Use the supplied smaller bottle and applicator (dauber) brush. Two dips of this brush fully into the bottle (note the depth it dips is adjustable) is the recommended amount of adhesive for all 18 nipples on one header manifold. If the CA adhesive skins over or dries, reapply. Always wear eye protection and gloves. For small jobs use a Q tip instead of the dauber brush.

Pushing fin-tubing onto manifold 2 tubes at a time.

CA adhesive

Work outdoors and keep your face upwind of the wet adhesive. The fumes sting your eyes. Eye protection is very helpful at keeping the fumes off your eyeballs. Push the tubing on 2 tubes at a time without hesitating because as soon as static contact is made, the bond occurs. Only apply the special adhesive to the nipple, not the inside of the fin tubing. The bond is instant when the CA bottle is fresh. Once its been exposed to air for a minute or two the adhesive is a lot easier to use. An aged bottle off gasses a lot less too however there is a short shelf life so keep it refrigerated and read the label.

Always glue the manifolds to the fin tubes before attaching the manifolds to each other or mounting them., Start at one side and finish that side. Straighten it out and then use a chalk line to mark the opposite end. Then cut to length and attach the opposite end's manifolds. Don't assemble all the manifolds together first and then try to glue the fin tubes on. That's a common mistake. Also you need to handle the manifold to see that you've fully wetted the nipples with the CA adhesive. Its very important you don't miss a spot. The seal requires the CA makes the seal. Its not just a stretch fit.

PARTS LIST:

HOT SUN SOLAR COLLECTOR:

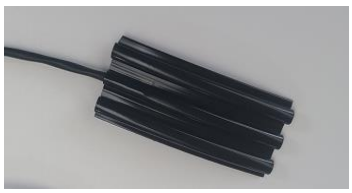

PART #1283 The Hot Sun MODEL1283 collector 13" wide by any length up to 88'
PART# 2MJ 2" MJ couplings

COLLECTORS IN BULK




PART#88GEON 88' long rolls of Hot Sun fin tube 3.75"wide.
PART#130MAN 2" Hot Sun manifolds
PART #AC Anvil cutter
PART# CA100 4oz CA adhesive w 1 oz dauber bottle
PART# 2MJ 2" MJ couplings

SYSTEM


PART#N36 vacuum breaker (one per system)
PART#AS-2-10 roof solar sensor with outdoor wire attached to specified length
PART# 2CPVC 2" CPVC adapters

Locally source hose bibs, pvc fittings, caps, pvc pipe, pvc cement

GENERAL HARDWARE


PART#SSSTRAP PVC coated ss strap 100’ rolls
PART#SC Strap clamps (At the end of each strap or to create a loop pf strap)


PART#CORNER Corners (between manifold rails and edge rails)
PART# 20GC #20 all ss gear clamp (use on edge rails)
PART#32GC #32 all ss gear clamps (manifolds to manifold rail)
PART#PAD Ballast pads (7”long pieces of 4”wide fin tube material go under ballasts for extra sensitive roof protection)

Locally source pvc pipe and fittings, PL construction mastic, PVC cement and primer or one part cement for plumbing. paint, chain link fence top rail, concrete ballasts ideally 1.5”x8”x16”concrete block top caps. Make pipe collars and rail collars from standard pvc pipe cut 2” long.