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SHINGLE ROOF MANUAL ADDENDUM – CONVENTIONAL ORIENTATION

Usually flow is up the roof when the roof is pitched. Manifolds are across the bottom and top. We call this conventional orientation as opposed to sideways where we run fin tubes horizontally.



WARNING: The rails that go top and bottom 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.

Conventional means the flow of water goes up the roof. Water enters at one bottom corner and exits diagonally opposite at the top.

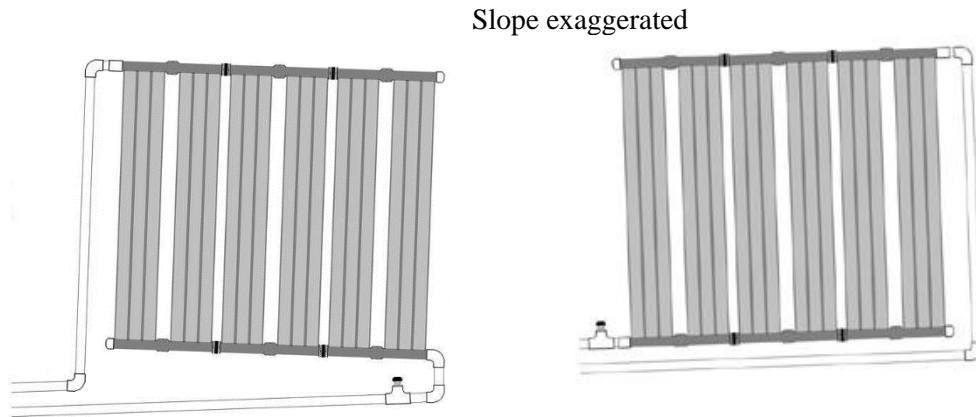


Fig. 2: Sloping panel banks and roof piping

In conventional orientation you have to provide a tilt to the top manifolds so the air doesn't get trapped. A corresponding slope on the bottom manifolds ensures the bottom manifolds drain. Note in the diagrams above, the diagram to the right is preferred so plan your piping to the roof accordingly. The vacuum breaker is teed off the pipe going into the solar collectors. Water feeds the bottom and rises up releasing the air to the return and back to the pool. If the flow is sideways, air is not trapped, and sloping like this is not necessary.

LAY OUT THE SYSTEM

The manifolds occupy 13" each. Leave at least one foot to the roof edge. This is because wind effects are strongest near the roof edge. Also esthetically you want to center the array of solar collectors on the roof space. Install the first roof bracket approximately 2 feet in from the roof edge. This roof bracket will normally be as high on the roof as possible without interfering with the ridge cap. Install the first mounting block at the side of the roof where the plumbing enters the roof space. Locate it low on the shingle so that you can create a sloped support bar angling up on one course of shingles (so you don't have to overlap the bottom of a shingle).



Position first roof mounting block low on the shingle. Before screwing it in make sure the flashing goes in.



A scraper can be used to break the seal between shingles so the flashing can slide in.



If the flashing doesn't go in far enough due to a nail just cut it shorter with tin snips



Apply roof sealant, black silicone or polyurethane roof sealant, to the underside of the block, then flip it over into position and screw into the roof using the supplied 2" long csk head #10 ss screws. Be careful not to strip the head of the screw. Stainless steel screws are soft and can easily strip. Make sure your bit is in good shape and apply straight firm pressure with your impact driver seating the 4 screws evenly.



Install the strap bracket, ss washer, ¼” ss nut and a #20 all ss gear clamp and tighten (the nut).

You have just installed the absolute best flashed and sealed roof connection for a solar pool heater. The bracket does not have to hit a rafter under the sheathing. The 4 screws grab the sheathing securely.



Next run a chalk line from the first roof bracket across the roof planning to use up the width of a shingle to create the slope we want. Any slope at all will do. In fact what is important is that air can rise up out of the system naturally. We don't want to trap that air so as long as the slope is at least zero we're alright. Sloping up left to right means the right side is where water will exit the system. You can reverse all this of course if you want the high point to be on the left instead. Generally what we want to do is make the low corner of the bank of collectors closest to the place where the piping comes onto the roof. This is because the return pipe is going to run down the right side (in this example) of the collector bank and parallel to and below the bottom manifolds. It's a cleaner look and easier to hang that return pipe from the bottom manifold rail. Hence the rule of thumb is that everything slopes up and away from where the piping enters the roof area. Note, this determines which pipe is which on the plumbing run from the pump/filter.



Install the second roof bracket approximately 6 feet from the first one. Assemble the flashing and clamp the chain link fence top rail (available at hardware stores (not included with Hot Sun kits)). The #20 gear clamps that secure the top rail should allow the top rail to expand and contract so

make the first one tight and the others slightly loose. Metal doesn't move nearly as much as plastic with temperature but over a long length the movement could stress the roof connection.



Next we roll the collector down the roof carefully. Don't let it get away on you otherwise you may have to solve a rubik's cube to untangle the 3 strips from each other. Use two loose #20 gear clamps to secure the top manifold to the cross bar. Make sure the connection of the top rail to the roof bracket does not interfere with the free movement side to side of the manifold. Straighten and make sure the collector is evenly spaced from the edge of the roof assuming the edge of the roof is orthogonal. The #20 gear clamps that secure the manifolds to the rails must be very loose leaving a gap between the manifold and the rail to allow relief so the manifolds can expand and contract freely.

Now that once we have one collector in position we can locate the lower top rail. We call the bar a top rail. This is short for chain link fence top rail. Note the collector can and should stretch into its final position.



Note that on this roof connection below the collector you want the strap bracket positioned up the roof opposite of the way you did the top connection. You are pulling the collector down the roof. This connection secures the bottom manifolds securely. This provides 100% of the structural requirement to keep the system on the roof.

Note that other collector types can not be installed this way because they are made of a rigid polypropylene or a flexible synthetic rubber. These materials will pull too hard when they contract as temperature drops. Only the Hot Sun system can be secured positively top and bottom ensuring wind can not lift a bottom corner and create a chain reaction ending with your collectors in your neighbor's yard. Position that roof mount so that you have to stretch the collector about an inch to clamp onto the chain link fence top rail. Remember to slope the chain link fence top rail to match the upper one.



Before installing the second collector, run a strap or straps across the roof. At Hot Sun we use a pvc coated stainless steel strap (we supply). Install this strap under the collectors (install it before the solar panels). Its primary function is to keep the collector strips arranged so they doesn't flip around on the roof and need to be straightened after a wind storm. It's much easier to install straps before collectors are installed. The collectors will be glued (PL premium 3x) to the strap as the last step once everything is perfectly positioned. The strap should be no more than 6 feet from the manifolds top or bottom and spacing between straps should also not exceed 6 feet. If the location is extremely wind exposed a spacing of 4 feet can be chosen. In this example case the collector is 12 feet long so we install one strap half way between upper and lower top rails.



First make a flashing using a 6" wide roll of aluminum roof flashing available at hardware stores. Cut rectangles about 3" x 6" and nip the sharp corners off. Break the seal between shingles as before and slide the flashing up between shingles at the location you want. Apply some sealant (black silicone or pl roof and flashing sealant- NOT the PL mastic used for gluing strap to fin tubes) under the flashing and screw the strap bracket through the flashing into the roof. This roof connection is sealed well because metal to metal is sealed with sealant easily and the flashing keeps water off the actual roof penetration. There is very little stress on this roof connection because it does not take any weight.



Position additional roof connections so that they line up between the collectors every 6 feet or so. Each collector occupies 13" so 6 collectors is 6'6". Install the end roof connections first, install the strap tight, then mark the position of the middle strap brackets with a pencil. Its not critical the strap brackets line up with the space between collectors but why not? Don't try to fish the strap through mounted strap brackets. Instead slide the middle strap brackets along the tight strap, rotate them so the screw can go in, then rotate the strap brackets perpendicular to the strap using a pliar or hammer claw. Note the strap can be perfectly horizontal. It doesn't need to be angled like the top and bottom rails.

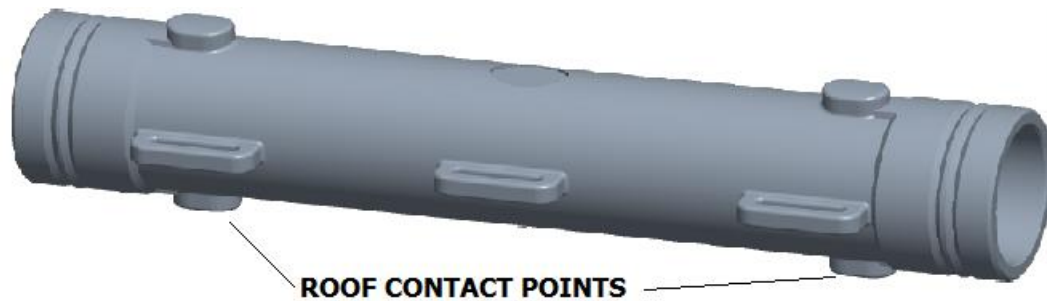


Roll the second collector down the roof carefully and assemble the removable 2" MJ couplings to join the manifolds. This is a standard mechanical joint coupling used in the plumbing trade available at hardware stores. Tighten the gear clamps alternately to a final torque of 30 inch lbs (hand tight with a 5/16" nut driver). Keep the shield positioned as you tighten and keep the gear clamp nut on top so it doesn't interfere.

Stretch the solar panels and clamp loosely to the bottom rail so everything can expand and contract freely side to side. One #20 gear clamp per collector, two on the first one and the last one in a bank. Do the plumbing before gluing the fin tubes to the underlying strap(s) with PL premium 3x construction mastic.

The manifolds will expand and contract side to side as temperature changes. To protect the shingles from this you can install flashing material under the manifolds at the contact points or slide 6" long spacers (Hot Sun supplied) under the manifolds between the manifold's contact points.





PLUMBING:

Note the inside of the manifold ends are standard 1.5" pvc sockets. If the system is plumbed in 1.5" the manifolds can be joined together with 2" long stubs of 1.5" pvc. To remove a manifold simply cut between manifolds through the stub and rejoin the new manifold with removable 2" MJ couplings. The roof contact points maintain the position off the roof so everything is still inline. Use heavy body grey pvc cement and don't use primer on the manifold connections. The only reason we don't specify other cements is we haven't tested thousands of them over 20 years. Usually on 1.5" plumbed systems we will choose to use removable 2" MJ couplings between collectors but corner connections to feed and return pipes are simply glued in with 1.5" pipe.

The vacuum breaker doesn't have to go on the feed pipe entering the collectors. It can go onto the opposite end of the lower manifolds with an 1.5" elbow glued vertically even on a 2" plumbed system.



Rule of thumb for vb placement is at the same elevation as the lower manifolds. If there are two banks, locate at the elevation of the bottom manifold of the upper (higher) bank.

Its not a bad thing to restrict flow into the system a little. This is because in high flow conditions the restriction is before the collector bank reducing collector pressure. High pressure stresses the solar panels so we are always looking for low pressure in the actual collectors. So even if the

entire system is plumbed in 2" pvc its often OK to restrict the flow at the inlet where water enters (bottom low corner of collector bank). When gluing into the manifold use heavy body grey PVC cement (2711) and don't use primer. This is because the manifolds are not PVC. They are ASA which reacts more aggressively with MEK, the active ingredient in pvc cements and primers. Use primer before cementing all pvc to pvc connections.

To maintain maximum flow capability on 2" systems there are some options.



Don't use the MJ coupling directly on pvc pipe. Hot Sun supplies a CPVC adapter.

The upper corner above the inlet (the low upper corner) is capped so use a stub of 1.5" pvc and an 1.5" cap. Easy.

The piping connections in and out of the collector bank can be done with a glued on 2" elbow or coupling. The outside of the manifold is the same size as 2" pvc pipe but the nipples get in the way of slipping the fitting all the way on. Just drill a 1/2" hole in the elbow to create a relief where the elbow would otherwise interfere with the fin tubes. Then cut away the excess pvc with a hacksaw.



Alternatively cut the fitting down by 1/2" to avoid interference with the first flow core.

Return piping running parallel to the bottom manifolds can be hung from the rail every 3 feet using a piece of pvc coated ss strap and a strap clamp as shown below.



Finally once the system is plumbed in straighten all the fin tubes, get them exactly where you want. Then simply apply a dab of PL to every fin tube strip tacking it onto the pvc coated ss strap underneath.

Don't forget to paint all white plumbing so UV doesn't attack the glue joints. UV goes right through white PVC pipe. Use a 6" roller and gloss black or flat black paint from a can. A 1" brush gets into the tight spots. Spray paint is faster but it'll fade over time.

Hot Sun spacers can be used under piping near elbows to elevate the elbows off the roof so they don't damage the shingles as the piping moves with temperature.

See Hot Sun installation manual for other details.