

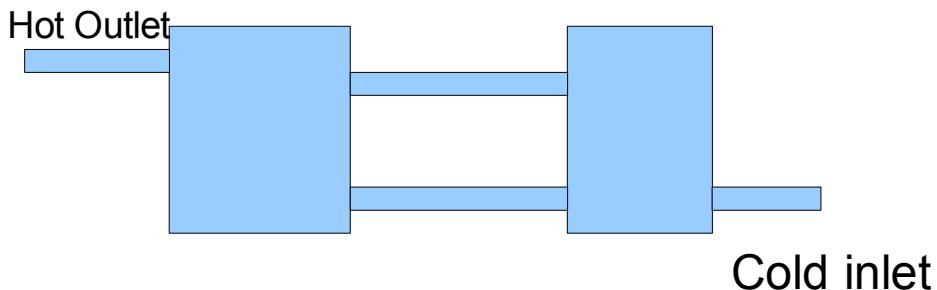
Here is how we constructed our solar water heater, and got the water into our system. You are free to modify our method as you like. The important keys are use thermosiphon if possible and keep it simple. Also don't let the panel get more than about 40 feet from your water tank or you will need to use much more insulation. Our system seems to be a little bit tolerant of imperfections so don't worry if everything is not perfect. However air bubbles and solder leaks will be the biggest things to watch out for. Make sure your pipes slope upward always so that air bubble problems are reduced.

**(a) The box:**

This is easy. You can take 2x4s and cut them to the appropriate lengths to form a square frame. Drill holes in the appropriate locations to permit water pipes / connections to come into the box. Place reflector insulating board on the back (we got ours from home depot). Attach it how ever you like, maybe sandwich it between strips of wood and the 2x4 edges and attach through the sandwich with screws. Place your panel inside with the appropriate connections sticking through the holes. Wrap the entire construction with plastic and seal (we used tape here but I am sure there are other alternatives). You might choose materials other than plastic also. Pipes inside the box do not need to be insulated. What you are making here is essentially a greenhouse and it will also provide some protection to the panel. We used long screws to connect our frame together. You may look at the shipping case to get an idea here: it is almost possible to use the shipping case (for 1 panel) as a case itself. But I can not make these shipping frames look good enough to sell so I don't advertise that. We made our stand out of 2x4's to hold the panels at the right angle. After that, I had a much better idea, which is to use the end of a picnic table to provide support for the panels at the right angle, and you can eat at the picnic table in addition. However we have also used sawhorses for support but you probably want to invent something a little bit better. These were shown in the eBay advertisement.

**(b) Connections:**

We connected ours so that the cold inlet is on the bottom furthest from the tank. The hot comes out on top and is closest to the tank. You might want to make your construction flexible enough so that later you can add additional panels if you like. The actual connections that we use are soldered onto the panels with screw threads on the other end. We connect our panel with the flexible hot water heater hoses which has worked just fine for us. It seems to be best to make the diagonal construction. The connections between the panels themselves are in series. The two blue squares below represent the solar panels.



We run two pipes from the panels to our water tank. The pipes should slope upward and the panel itself should slope upward also if you want to use thermal siphon. I can not give instructions on how to use with a pump an controller since we do not use these. You will need these though if you do not place the panels below your tank. Also on the cold outlet, at the lowest point, I have a valve which allows us to drain the water. The pipes from the panel to the tank are insulated. Note that this does not protect the panel from freezing. We drain ours at the first hint of the possibility of freezing. The panels will be destroyed if you allow them to freeze. And the panels will freeze more easily than the ground will freeze so be careful here. Again, we drain ours when freezing weather is even a slight possibility. We

also connected our copper pipes to a ground wire connected to our dish antenna system. I can not give further advice here.

**(c) Connections to our water tank.**

We connected our hot water line (from the solar panel) to the hot water outlet from our water heater tank. In our application we actually use a hot water heater. This is done by soldering a T connection and I have a picture of this. I also added a second connection which is what I call an automatic air bubble remover. This is made with a T connection, a piece of pipe sticking up and a valve on it. I also include a valve between the solar panel and the water tank inlet to completely isolate the solar panel when I want (at night, for example or when we travel). All pipes are insulated but you must be careful that the insulation has no chance of catching on fire if you have a flame present. We remove our insulation when we use a flame. The other connection is from the water tank drain valve. I also add a valve here. Although I did not use it, I think a dielectric coupling should be used between the water tank and the drain valve. All my valves are of the brass ball valve type. Be careful with outside valves in freezing weather to leave them open so that no water is trapped inside the valve which can freeze. I am including pictures of what we did. Again, our system works with thermosiphon and so that is the only thing that I can describe as what we did.



This shows the automatic air bubble remover (the fat line is the hot feed from the solar panel). The valve with the blue handle is the cold inlet and it remains untouched. Our valve which isolates the panel is covered here but it is positioned where the black tape is seen in the center of the picture.

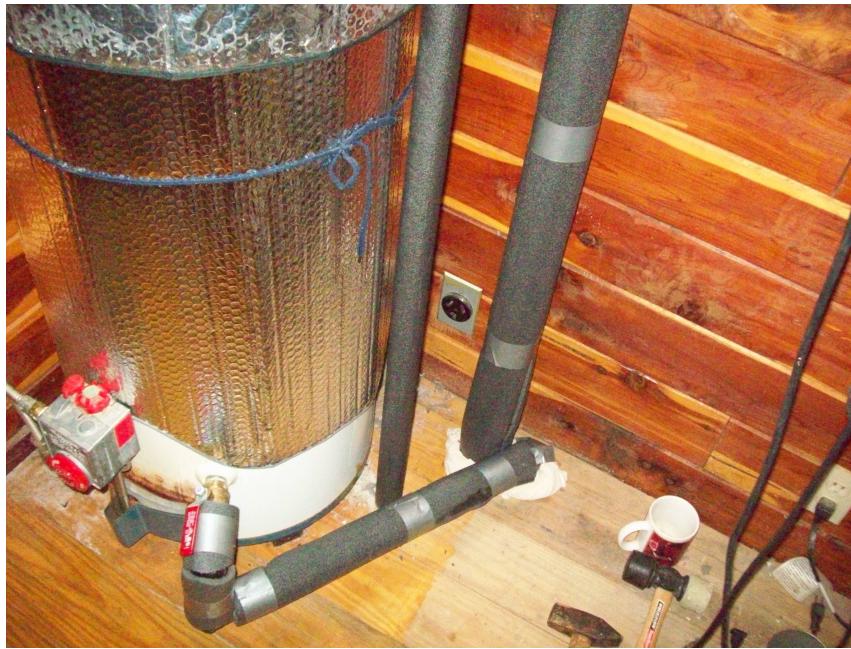


This shows the connection between the panel hot outlet and the hot outlet of the water tank. Again, the cold inlet is not bothered at all. The connection was made with a T.

Note that the connection is also fairly far from the water tank connections themselves. Our system is pretty old and newer ones just connect the tank with hoses so it might be easier.



View of the connections from a different angle. We insulate everything, but probably we should not insulate the pressure release valve. I advise not bothering at all with the pressure release valve stuff. The big key is to insulate the pipes but make sure there is no chance that the insulation can catch on fire. We remove ours when we use propane gas to heat our water.



This shows the cold side connection from the tank drain. It is probably better to have a dielectric union between the tank and the valve. I did not use one but I think I should have. This helps prevent corrosion of the threads.

The hole in the floor that our pipes come through is the dryer vent hole which we do not use. Both the hot side and the cold side are shown here. Also notice that the pressure release pipe is also shown here.



This is a picture that shows most of our construction. The big key I guess is keep it simple, make sure not to mess with the pressure release valve and get good solder connections. Be sure when you solder to the panel that you clean the pipe ends completely and if you have not soldered for a while, it is best to practice on something else. Make sure beyond belief that you clean all pipes before soldering, otherwise do something else and come back to solder when you are ready to do it right. I suggest soldering as much as possible indoors since it is a real pain to solder outside with propane.

