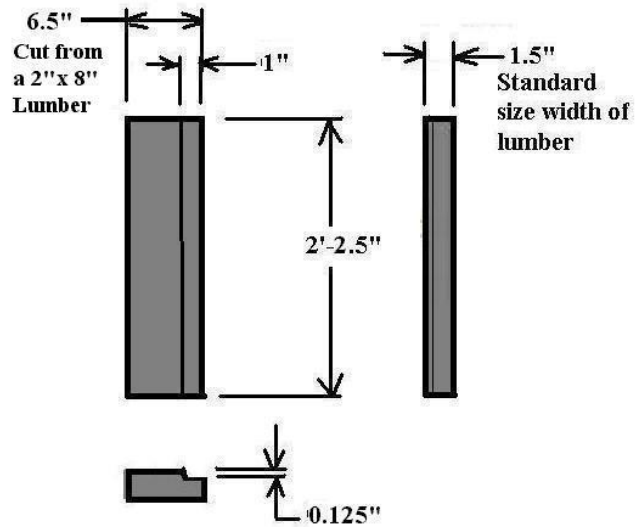


VERTICAL FRAMING
(2) Required

Note: In performance tests, a frame width of 4.5", 5" & 5.5" were compared and it was found that between 5" and 5.5" is optimum. It was decided to go with the 5.5" because it is a standard 2" x 6" lumber size.



TOP & BOTTOM
HORIZONTAL FRAMING
(2) Required

Note: For the vertical 2x6 framing, make sure you get high quality lumber that is nice and straight.

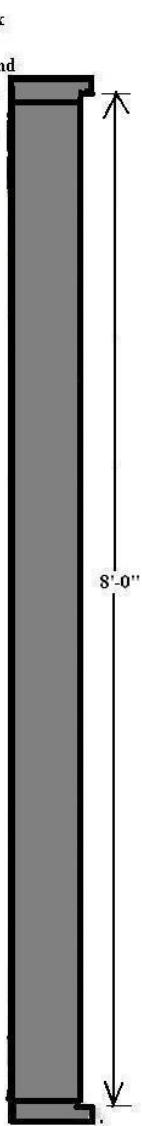
- Tools Required for construction & installation:
- Drill
 - 3/8" x 16" Bullet Drill Bit (Masonry/Wood)
 - 3/8" Standard Drill Bit
 - 3/16" Standard Drill Bit
 - 1" Counterbore Drill Bit
 - Philips Screw Driver
 - Caulk Gun
 - Carpet Knife
 - 4" Hand Grinder with Diamond Blade 4" Dia.
 - L-Square
 - Level
 - Rotary 7" Dia. Hand Saw
 - Electric Sawzall (usually not required)
 - Carpenters Hammer
 - Chisel
 - Paint Brush
 - Measuring Tape
 - Socket Wrench Set
 - Safety glasses (always wear them when working)

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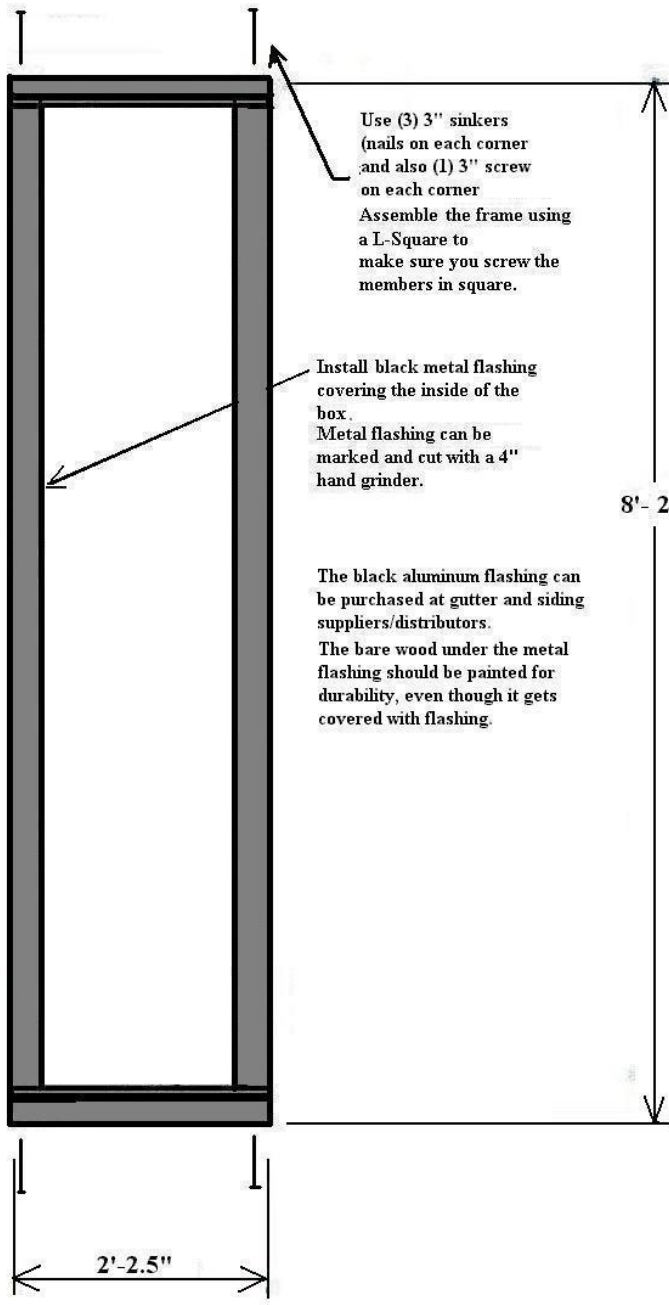
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Covering the exterior of the box with flashing or vinyl is optional and can be done even after the solar panel is installed. For now it will be painted with the same dark grey or black.



8'-0"



Use (3) 3" sinkers (nails on each corner and also (1) 3" screw on each corner. Assemble the frame using a L-Square to make sure you screw the members in square.

Install black metal flashing covering the inside of the box. Metal flashing can be marked and cut with a 4" hand grinder.

The black aluminum flashing can be purchased at gutter and siding suppliers/distributors. The bare wood under the metal flashing should be painted for durability, even though it gets covered with flashing.

For 1st timers: When nailing the frame together, I usually align them up with a L-Square and stand on both members while nailing the sinker in. You can also pre-drill and drive a 3" screw in first, then nail the sinkers in.

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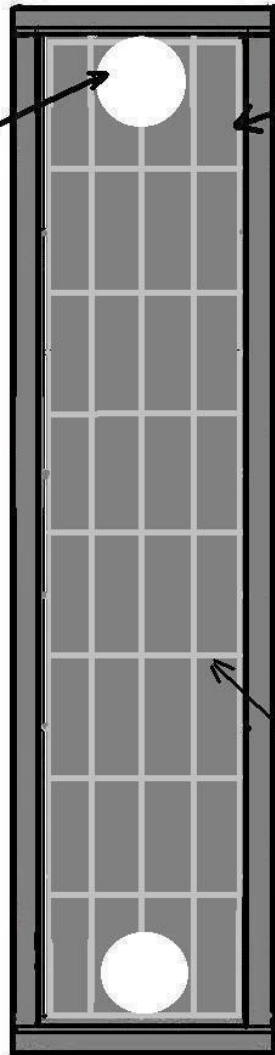
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Create 7" holes at the top and bottom center of the back panel as shown. Make sure the top hole is as far up as possible. The bottom hole should clear the bottom by at least 1 inch for some play room.

Make sure you check installation location and these vent holes fall in between studs of your home. The vent holes can be made to the left or right rather than the middle if necessary.

Note: Depending on installation location and height of interior ceiling and floor level, you may need to raise the bottom vent to make sure it is above the interior floor. The top vent should be as high as possible in the Solar Panel.



Cut 1/2" R Foam and press fit it in the rear. Caulk in place

Install black aluminum flashing over the foam. If you are on a budget, you can get away with just painting the foam black.

Note: In testing, there was no noticeable difference in performance by using aluminum flashing over the 1/2" insulation foam or not using it and just painting the insulation board. So it is a personal decision.

Optional white or silver stripe pattern. For appearance only.

Note: In heat performance tests, it was found that between 7" & 8" gave the most noticeable improvements in a total of volume, air flow, & peak heat. So 7" diameter is suggested, or 8" if desired. Around 7.5" would be perfect, so it is a personal decision whether to go 7" or 8" diameter duct for the vents.

The 8" will peak at a higher volume than the 7" but the difference is minor. If you want to make absolutely sure you get the absolute maximum efficiency, then go with the 8" Dia. duct.

Note: The Polycarbonate glazing by Suintuf is the best glazing to use because it is coated on one side for durability. It is super translucent, and virtually unbreakable, although it does scratch so handle with care. These sell at perfect 26" x 8" sizes at Home Depot or Lowes.

Parts List:

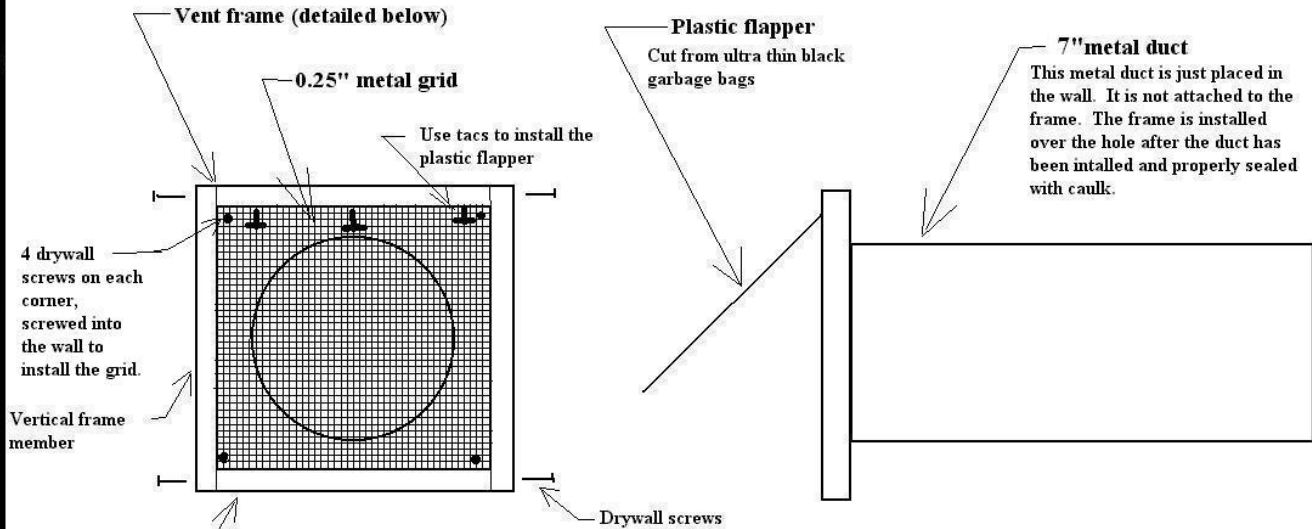
- (1) 2'x8' Corrugated polycarbonate panel by SunTuf
These are the clear panels for about \$17.99
These can be purchased at Home Depot or Lowes.
You can also visit SunTuf on the internet for info about ordering. Marked coated for durability.
- (1) Package of SunTuf 1" screws and rubber washers
- (2) 2'x8' black aluminum screen. You can buy this in the windows section of Home Depot.
Make sure it is Aluminum Metal Screen.
Get a 48" x 25' roll, you will have left over.
- (2) 2" x 6" x 8' Lumber for the vertical framing.
Make sure they are high quality lumber for the framing.
- (1) 2" x 8" x 7' Lumber for the horizontal framing
- (2) 1" x 1" x 8' Lumber for the glazing supports, the air shutoff and frames for interior vents.
- (1) Flat black exterior paint or other color of preference. Needs to be dark and flat color.
- (8) Tubes of clear caulk
- (4) 3/8" x 8" Lag Bolts
- (80) 2.5" & or 3" drywall screws
- (1) 1/2" x 4' x 8' insulation board
22' of 5" or 6" black aluminum flashing to line frame inside with. You will need to cut to size.
- 24" x 8' black aluminum flashing to line insulation board with. The black flashing will probably need to be bought at a siding and gutter construction supply store. Home Depot usually has un-painted flashing, or brown only.
- 7" or 8" Diameter x 5' metal duct for the upper and lower vents. You will cut these to length with a 4" grinder as you install them.
- (1) Ultra thin low quality black plastic garbage bag.
The thinner the better for better operation.
- (1) tube of white caulk for interior vent frame
- 2" x 4" x 8' lumber to slice the 0.625" glazing
Install strips and to cut screen blocks from
- (9) 1" screws and washers for the screen instalation, you can just use leftover screws and washers you have laying around your home.
- For the optional reflector panel, you need (10) garbage AOL or CD or DVD discs, and a spare piece of 1/2" or 3/4" plywood

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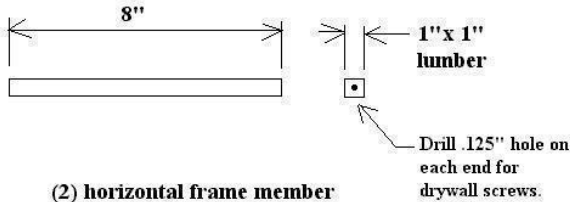
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Note: Each piece of the vent assembly is installed individually on location. The only part that is pre attached is the vent frame, which you will screw it together to create a square. The metal grid is installed on location, pre cut and then screwd in to the walls inside the frame. See color pictures for more clarity if desired.

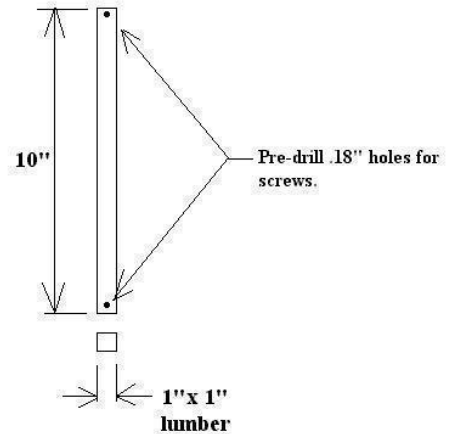


Horizontal frame member
Note: Using 1/2" insulation foam, cut a perfect 8" square to fit in each vent to use as a shutoff when not in use. Paint the back of the foam black and the front the same color of your interior walls. When the vents are sealed off, to open you will use something flat to pry them open, so then they will begin automatic operation with the flappers.



(2) horizontal frame member
Note: The interior frame of the vents & the foam cover to be painted the same color of your interior walls.

Upper and lower vent assembly
(2) Required



(2) vertical frame member

Interior Vent Assembly

(2) Required, one for the top and one for the bottom. Note the flapper will be placed on the top vent in the winter, then moved to the bottom vent in the summer for automatic operation.

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Note: Make sure you use black aluminum metal screen that is found in the (windows) area of Home Depot. Do not use plastic screen, it will not work, it needs to be metal.

Measure and cut to size (2) layers of black metal window screen
 Note: The screen will be installed after the frame has been installed on your home. It is easier to buy the black metal screen in 48" wide by 25 feet at Home Depot. Then cut to the length and fold to 24" and trim to size.

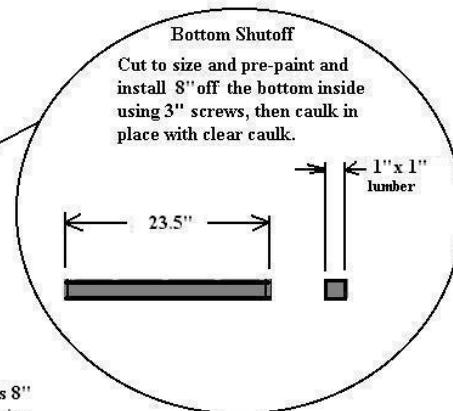
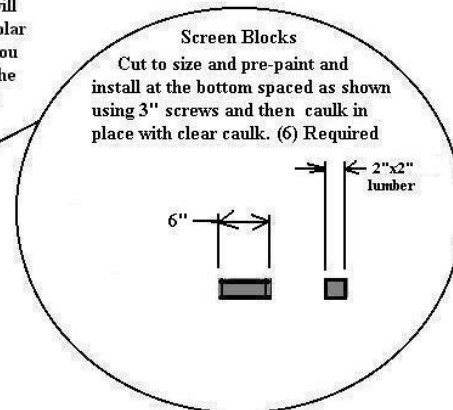
(34) 3" black screws, screwed into the backing and allowed sticking up 2.62" to support the screen. Spaced as shown.

Note: I was torn between 2.5" or 3" screws, you almost want to cut 3" screws down to 2.75". I actually use a combination of the two. The goal is to get the screen right down the middle depth.

(9) 1" screws and washers to install the screens. Installed so air will need to pass through the screens in order to get into the top vent.

Use screws and washers onto the blocks and bottom shutoff to install the metal screen. This will be done during the solar panel installation so you will be able to align the vent holes and caulk around the 6" metal duct

Evenly space the Screen Blocks as shown



Bottom Shutoff is 8" from bottom interior to allow room for the bottom vent

Make sure the bottom air shutoff is no larger than 1" to help cross sectional air volume. The screen will be angled a bit here as shown.

Note: When in doubt, pre-drill. Always wear safety glasses when working. When installing your 1st Solar Panel, do it in such a way that you can add more in the future. Keep in mind balance and appearance also.

Note: 2 layers of black aluminum screen is optimum and will give the best performance. 3 layers restricts air flow, and 1 layer does not give enough heat to air transfer. Use 2 layers, it is perfect.

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It is suggested to at least install metal flashing on the top surface. Cut a piece of aluminum flashing to size and caulk in place. This will give a cleaner look to the top and keep water and snow off the frame. Pre-painted flashing is best but you can also paint it.

Glazing supports installed

The (2) layers of aluminum metal screen are placed right in the middle of the depth of the Solar Panel.

Screen blocks, you will screw the screens down onto these blocks after the Solar Panel frame has been installed on your home.

Screws supporting the screen from collapsing.

These screws will support the screen from collapsing and at the same time allow air flow.

Evenly space the Glazing Supports as shown.

Keep the shutoff block at 1", or less to avoid loss of air flow.

Pre-drill to avoid cracking

When you find the studs at the installation location. Mark and drill the holes for the lag bolts, but do not counter drill them until you match them up on the wall and make sure you got the studs.

When you are sure you got the studs, counter drill the holes so you can get a socket wrench in there and tighten the lag bolts. You will counter drill these down to about 2" from the bottom so a 8" lag bolt will reach through the bricks and into the studs. If the location does not have bricks, then do not counterdrill so deep.

Glazing Install strips from page 7 will be placed on vertical framing then measured with the glazing and screwed in place. These take the place of SunTuf plastic installation hardware. Custom made install strips work out better and save money.

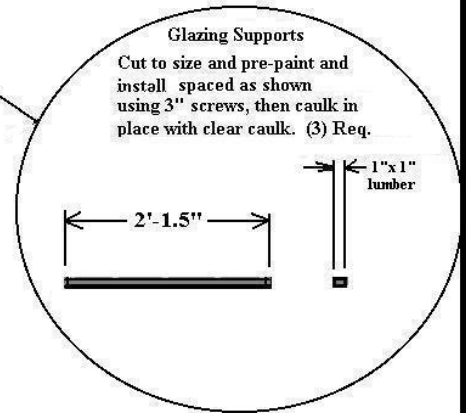
Caulk all joints inside and out that have not been done yet, with clear caulk.

Lay the corrugated polycarbonate glazed panels in place. Pre-drill holes partially in that are slightly smaller than the screws you will use. Evenly space 3 drilled holes on each glazing supports. Also drill holes at the top and bottom of the panels, these will be on the lower corrugated part touching the 0.25" groove.

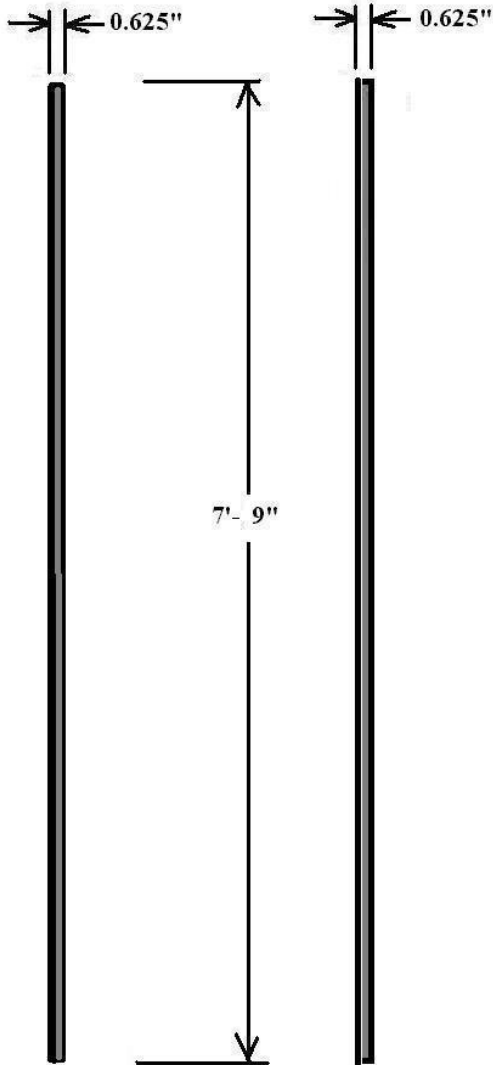
Note: Make sure you use clear caulk for all the caulking. This goes on white but when it dries turns clear and it gives a professional appearance.

Note: All holes in the glazing need to be pre-drilled to avoid cracking.

Now follow installation instructions to install. You will not install the metal screen or the glazing until the panel is installed on your home and everything is caulked including the 7" metal ducts.



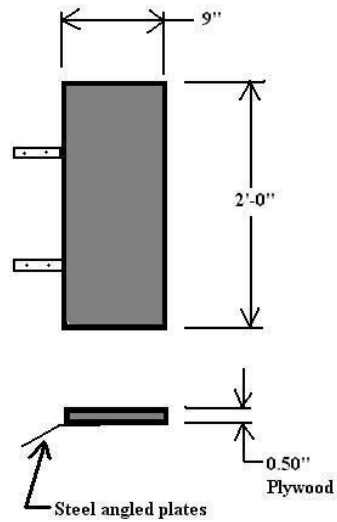
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Glazing install strips

(2) Required

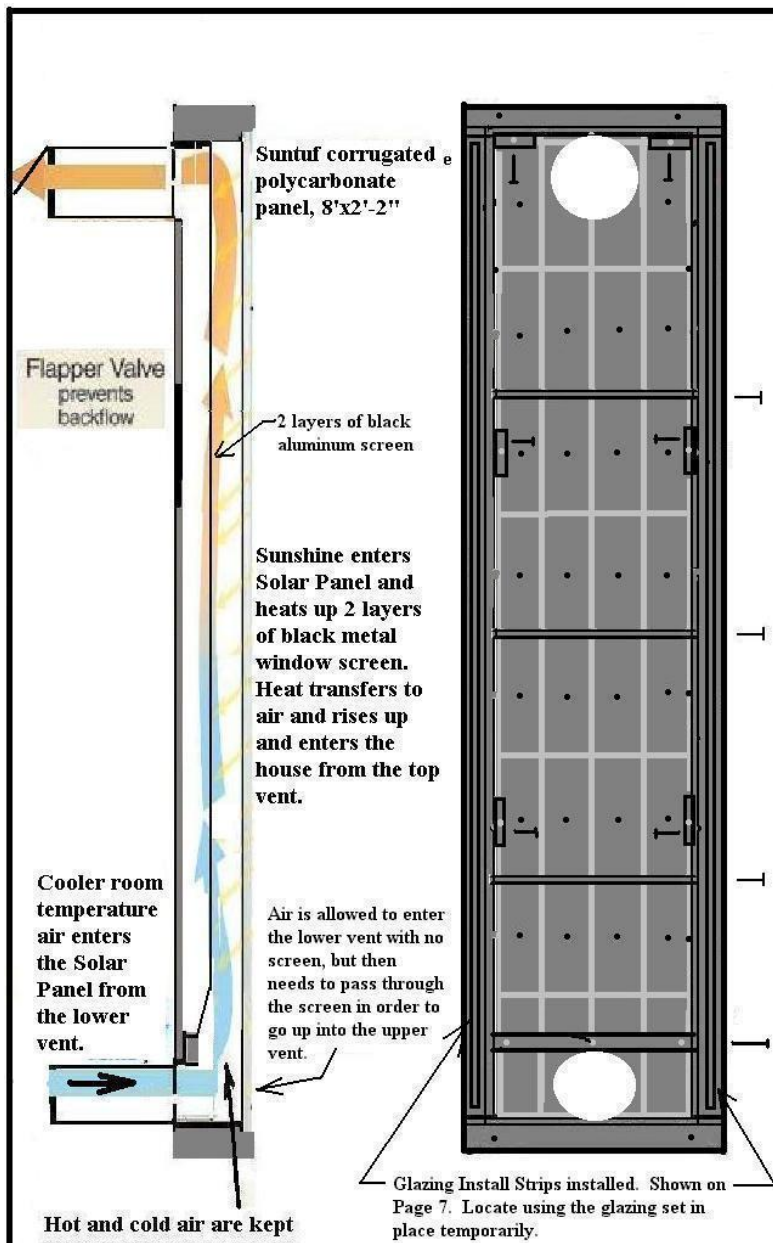
Note: These will be screwed in place over the vertical framing to allow glazing installation.
Location shown on page 6 & 8



Optional Reflector Panel

An acrylic mirror will be caulked in place over the surface of the reflector panel. Garbage AOL, CD & DVD discs can also be used instead of buying the acrylic mirror. This Reflector Panel adds about 5% to the performance of the Solar Panel.

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 Page 7



Hot and cold air are kept separate from each other with the screen covering the entire entrance. The air needs to pass the screen to get heated.

Note: When deciding on installation location, always place it so you can fit the maximum amount of Solar Panels on the wall. Keep in mind appearance also, which is just as important as function.

Finished Solar Panel Ready for Installation

Note: The polycarbonate glazing & the (2) layers of screen are not to be installed until the Solar Panel frame has been installed on your home. Make sure it is a south facing wall and clear of obstruction like trees.

Operation (See Page 9 for Installation Guide)

After you have the Solar Panel all installed:
 The operation will be automatic, the upper flapper will open when heating and close to avoid back flow when there is no sun.
 For better results, in the winter at night you should manually block the vents using a 1/2" foam piece that you made in the construction phase. If you do not do this, you may lose 5% of the heat it gave during the day. By manually shutting them with the insulation board, you will keep 100% of heat generated. If you are on vacation, then just leave them in automatic mode and they will take care of themselves.
 In the summer you will need to attach the flappers to the bottom vent and do the opposite of above. Leave them in automatic mode during the night, then shut them off with the insulation board during the day. The flapper will open at night to let in geo-thermal type cooled air, then close by itself when the temperature rises.
 This Solar Panel is primarily a heater, but as a bonus it is also used as AC in the summer. If you are in a warm climate where there is little difference between the high and low temperature of the day, then it will not work for you. For all others these Solar Panels will be used for cooling in the summer also.
 In the winter depending on air flow and temperature, you can expect the air coming from the top vent to be 50 to 70 degrees warmer than inside air. In the summer for example in Michigan you can expect the air coming from the bottom vent to be about 10 degrees cooler, so it is not as much of an impact but it is typical in this area to work every single night so it adds up. The operation of these Solar Panels will not interfere with your furnace or air conditioner.
 There has been no adverse affects of installing these Solar Panels, once installed and caulked there is no chance of leaks, no noticeable sound, not affected by strong winds since they are bolted securely.
 The house shown in the pictures in this blueprint with (3) Solar Panels installed has shown remarkable benefit. On a cold winter sunny or partly cloudy day, you can shut off the furnace and the interior temperature of the entire 3800 square foot house will maintain and on a sunny day will actually increase by 2 degrees. The family room where they are installed will rise about 7 degrees with no furnace on. Other home designs may see better or worse results, but this is all heat that you do not have to pay for, so whatever energy it gives is free forever.
 On a sunny day the vents open wide, on a partly cloudy day they open half way, on a cloudy day with the sun peaking out for a few minutes here and there, the vents will open and close by themselves all day. On a cloudy day they stay closed unless the clouds are thin, then they may open an inch. It's a great feeling to watch the vents open by themselves and give free heat.

Maintenance

Once a year in the late summer, check the caulk joints and touch up. If you painted the outside frame, check the paint every 5 to 10 years, or if you lined it with flashing or vinyl, you will not need to do this. That's all, little to no maintenance required. Long term internal maintenance may be required after many years or decades of use, a relatively simple job to do, basically caulking and touch up work.

See page 9 for the installation guide.

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Installation Guide

- * Find the location on a south sun facing wall where you want it installed. The location should be free of any obstruction, like trees. You may need to take down a tree or 2.
- * Locate the studs from the inside of your house, take measurements and drill the holes on the top and bottom horizontal framing of the solar panel.
- * Find the proper height where the panel will be installed and build a temporary base to support the panel during installation.
With the Solar Panel completely constructed but not having the glazing or 2 layers of screen installed yet, place it up on the temporary base in the installation position.
- * Drill the 3/8" holes into the bricks or siding of your house. Use a 16" bullet masonry drill bit while using the solar panel frame set in place as a pattern to get the holes drilled in the perfect place. The bullet masonry drill is good for masonry and wood and you need it extra long to go through the depth while the Solar Panel is in place. If you miss a stud or 2, you will have to drill a few more holes, then patch up the other holes with caulk.
When you are sure you got all 4 holes to match, (for 2 lag bolts on top and 2 on bottom of horizontal framing), drill a counter drill of 1" down to 2" from the back of panel so a 8" lag bolt will reach into the studs. Note: If you have a thinner type siding on your house then deduct about 3 inches of counter drill depth.
- * Locate the 7" vent hole for the top and bottom vents. You will need to locate the level of the floor and ceiling inside your house to make sure you position the vent holes correctly. Spray paint the 7" hole pattern on your bricks or siding while the panel is in place. Now remove the panel and create the holes.
To go through bricks the easiest, use a combination of a 4" grinder, and a hammer and chisel. With the grinder, cut the round pattern in as deep as possible then hammer and chisel it out. Keep doing this until you get through. Once you get through it, you can cut right through into the drywall making a nice round hole. I know some people may not like making holes in their walls, but it is worth the effort. You will be happy when it is complete and giving free heat.
Use a 16" bullet masonry drill bit to mark the center and you can cut a perfect 7" diameter circle in the drywall from inside.
- * Install the 7" metal ducts and cut to size with the grinder so it will be flush to inside wall and flush to the inside of the panel.
- * Make sure you insulate and caulk around the ducts and caulk an extra thick amount around both vents just before hanging the Solar Panel so there will be plenty of caulk to seal gaps around the 7" metal ducts.
- * Hang the solar panel and screw in the lag bolts, now you can remove the temporary base support. The hardest part of installation is now complete.
- * Caulk around ducts on inside of panel and do any touch up painting around the ducts for a nice clean look. Vacuum clean the inside of the Solar Panel.
- * Install the screens using screws into the screen blocks and screwed into the air shutoff. Caulk around the entire screen using clear caulk. Make sure the air entering the bottom vent needs to rise up and eventually go through the screens in order to go in the top vent, so do not leave any gaps around the screen. Using clear caulk is best for all caulking on this job, but especially inside the panel so the appearance will be clean and professional.
- * Install the glazing using the 1" screws and rubber washers made by SunTuf preferably. You need the rubber washers to avoid stress cracks.
The clear polycarbonate glazing by SunTuf can be purchased at Home Depot or Lowes. Get the one that is coated on one side for durability. This is usually \$ 17.99 for a 26" x 8' clear corrugated polycarbonate glazing. They sell the proper screws and rubber washers also, the rubber washers are most important. You can use regular screws but you will need the rubber washers to seal and avoid stress cracks. When you install the glazing it will already have been pre-drilled in the construction phase.
- * Caulk around the entire glazing, caulk around the entire solar panel frame, caulk any cracks and joints you find. You will need to keep checking the caulk for shrinkage for the first few months. The heat will cause the clear caulk to shrink at first, but after it settles you will only need to check it once a year. Little to no maintenance required.
- * On the interior of your house, install the vent frames that you built. Caulk around the ducts. Install 0.25" metal grid over the ducts, this will be a perfectly square piece that fits inside the vent frames. This 0.25" metal grid can be bought in rolls at Home Depot so you will have a lot left. It is required to support the flappers and avoid reverse flow. It is also a back up protection to avoid foreign entry of anything, although the outside is fully sealed so this cannot happen anyway.
- * Cut a perfect square piece of black plastic garbage bag to fit upper vent. Cut the plastic about a quarter inch longer to allow to tac it into the upper inside of vent frame as seen in the pictures included. You will have to work with this until it opens and closes perfectly. The plastic is preferably from a very thin cheap type of plastic garbage bag so it will be very sensitive to any air flow.
- * Cut (2) perfect pieces of 1/2" insulation board to fit the vent frames, so you will be able to shut them off entirely when needed. Paint the insulation boards and the vent frames the same color as your interior walls, paint the backside of the insulation boards black.
- * Installation is complete. Installation will take on average 18 hours for one person. Construction of each Solar Panel will take 3-7 days for one person.
With experience you can cut these times down.
A reflector panel is optional and is made of a 9"x 24" plywood painted the same color and installed at the bottom of the panels as shown in color pictures.
Use metal plates and slightly bent so the reflector will be on an angle as shown in color pictures. Then caulk an acrylic mirror on it or (10) garbage AOL discs which work good and look cool.
- * Note: Roof installation is not as efficient and is only suggested on roofs that lead directly into living areas. Roofs with enough pitch to allow natural thermosiphoning rather than a need for electricity to move the heat. You will need a \$25 ceiling fan to distribute the heat though, and also the installation difficulty will be at an expert level. You will also need to make the inside vents look exactly like the vents shown on the wall, basically vertical so the flapper valves work properly.
If your roof leads into an attic, then I do not suggest installing on this roof, due to increased expense and decreased efficiency.



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Reflector panel is optional, it adds about 5% more heat. Here it is shown with AOL garbage discs instead of an acrylic mirror.



This design has gone through extensive testing at a great cost and effort. Test engineers focused on the perfect materials and dimensions needed to achieve maximum efficiency over an entire range. Do not deviate from the overall proportions by very much, otherwise a loss of efficiency will result. Reminders: The SunTuf glazing needs to be clear. The one marked coated for more durability is suggested. The (2) layers of screen need to be aluminum screen.

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Glazing support strips

(2) layers of 6061 aluminum screen inside as you can see it gets darker where the screen is above the bottom shutoff strip.

Polycarbonate SunTuf® clear glazing. Highly translucent and coated on one side for durability.

Note: Here it is shown using SunTuf glazing install strips. It is recommended to make these yourself using lumber. The SunTuf glazing strips will have to be cut down anyway, so you are better off just using lumber and custom made to size.

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