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Panel Installation

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IGP Panels

Other Components

Installing FAFCO IGP Solar Panels

The following information is offered to our dealers and their customers in support of their efforts to properly install FAFCO solar pool heating panels used for in-ground pools (and larger above ground pools) and to help answer potential questions that may come up during the installation process. These suggestions are the result of over 30 years experience working with FAFCO components including 17 years as a licensed solar pool heating contractor.

- SunSaver and REVOLUTION only (for [SunSaver ST](#) panels simply click on the name)
- These panels are meant to be permanently installed and so be able to drain
- For panels designed for above ground pools, refer to [AGP Panels](#)

STEPS TO PROPER PANEL INSTALLATION

1. Determine panel location
2. Connect panels together
3. Secure panels to their mounting surface
4. Install solar loop piping
5. Connect piping to pool equipment

1. determine Panel location

- **ROOF OR RACK.** Installing FAFCO solar panels is a fairly straight-forward process. The panels connect together the same way in all situations but **how they are mounted is directly dependent on what they are mounted to**; whether a **rack or a roof**. Racks can either be roof or ground mounted (see [Panel Racks](#) for aluminum racks designed for FAFCO panels). You can also build your own racks out of wood or other materials, but durability can be an concern. Remember, solar pool systems can last well over 20 years so the structure they are mounted to should too.
- **ROOF OBSTRUCTIONS** will determine panel layout
 - Remember **panel headers are actually 51" long**
 - Plumbing and/or roof vents, skylights, chimneys, etc. can interfere with panel location.
 - It's OK to put gaps between panels to go around such items
 - Also see "Plumbing Panels Together" below
 - Use four CPVC female adapters and necessary PVC pipe at every split
- **PITCH OF THE ROOF can be an issue at the extremes (i.e. too shallow or too steep).**
 - **FAFCO panels should not be installed on a flat surface anyplace where there is the possibility of freezing conditions. The panels will not drain completely laying flat. Pitch must be greater than 6 degrees or a 1.25:12 slope (1.25' vertical rise per 12' horizontal distance)**
 - Don't rely on using air to evacuate any water from flat installations.
 - Thus, **flat roof installations are out unless in warm climates** like Hawaii or racks are used to pitch panels. See information on aluminum panel racks ([ProRacks](#))
 - EPDM rubber panels can often be safely installed on flat roofs in some cooler climate situations because they can usually expand enough to avoid damage.
 - We offer a rubber system for these situations only, however, long-term durability of these products is an issue.
 - **Steep roofs (>6:12) can be a problem too**--safety needs to be prime objective in this case.
 - Otherwise, roof pitch is generally not an issue to system performance.
- **TYPE OF ROOF** is a major issue with regards to how the panels are mounted.
 - **Asphalt**-based roofing material
 - Comes in shingle or rolled configuration
 - Usually installed over a plywood sub-roof
 - **Best roof for mounting solar panels**
 - **Requires no special attention** if at least modestly pitched; >1.25:12
 - **Use 1/4" x 2" lag bolt** to secure cleats into plywood
 - Be careful not to over-tighten bolt and strip plywood
 - **Pitch and gravel** (or tar and gravel).
 - No longer common, thankfully
 - **Difficult to seal to** due the granular nature of the gravel
 - Gravel must be cleared wherever down cleat connections are made
 - Use corrugated sheets under panels to protect them from puncture from gravel
 - **Recommend re-roofing** with another roof type or contact us for more detail mounting instructions.
 - **Wood** cedar shake shingle
 - Usually installed over felt and 1x6" sheathing boards (~1' o.c.)
 - Watch for nail heads or staples pushing out of roof.
 - Clear any sharp objects off roof
 - Necessary to **pre-drill shake** only (but **not** sheathing boards) wherever bolts need to go to avoid splitting shingle.
 - Note and seal all split shakes or use flashing underneath
 - **Use 1/4" x 3 1/2" lags minimum**
 - **Use plenty of sealant since it is cheap insurance against roof leaks.**
 - Squirt sealant down hole of pre-drilled shingle before lagging
 - **Tile** -- concrete, clay, or composite.
 - Usually over plywood or sheathing boards depending on age of roof
 - **Some tile are difficult to walk on** without damage
 - Put weight on "toe" (front edge) of tile course where it is strongest
 - **Recommend strut channel** to minimize penetrations (see below)

- Need to pre-drill concrete tile with masonry bit
 - Clay tile probably needs to be removed and replaced with asphalt roofing where panels need to go.
 - **Metal** (steel or aluminum)
 - Usually over sheathing boards
 - Many designs and profiles.
 - **Screw head location is critical** to installation methods
 - To protect panel from screw heads, use corrugated sheets under panels
 - Can often mount directly but **strut channel is recommended** on many profiles
 - **Standing-seam roofs require special consideration**
 - Special **S-5 clamps** are available to attach to seam and avoid any need to penetrate roof
- **SUB-ROOFS are important too.** If you have an attic area under the panel location, you can always check out the type of sub-roof you have. You shouldn't need to get up into the attic to mount panels to roof unless using racks.
- **CEILING TYPE.** You need to determine **if you have standard flat** with attic, **vaulted, or open beam ceilings.** All these site issues need to be addressed before mounting procedure is determined. Open beam ceiling probably should use **strut channel** to secure to beams rather than the tongue and groove (T&G) boards across them, especially when only 1" thick.
 - **You don't want to use lag bolts that can potentially penetrate through ceiling**
- **SEAL ALL ROOF PENETRATIONS.** Be sure to seal all roof penetrations thoroughly with a good quality asphalt/plastic-based sealant like **Henry's 208** or urethane sealants like **Sikaflex or Vulcumseal** generally available at *Home Depot*. **Avoid silicone!** Use sealants in a tube that fits into standard caulking gun. **Remember, properly sealing the roof is the best insurance from future roof leaks. When in doubt, use more sealant.**

What is strut channel?

Strut channel is steel and comes in a low profile steel design (roughly 7/8" x 1 3/4"). It goes by many names but is readily available from electrical wholesale outlets, **Home Depots** (galvanized) or **Lowe's** (chromium (gold)-plated). We like the chromium type since it is more durable in adverse climates like Hawaii or coastal situations but galvanized is usually fine too. It cost about \$1.20/foot.

- Strong and durable with rounded edges
- Multi-slotted for ease of mounting as needed to roof rafters or rack supports
 - Slots are large so use fender washer when bolting
- Allows for fewer roof penetrations on tile and metal roofs or with open beam ceilings
- Uses strut-nuts that lock onto strut channel--**very cool**
 - strut nuts come with various threaded hole sizes. Use 1/4" since our cleats have only a 1/4" hole.
- Panel cleat attaches to strut nut using a 1/4" x1" machine screw
- **Click on following pictures for more detail**



cross-section of strut



top view



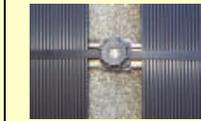
three types of strut nuts



nuts attached to channel



panel tie-down cleat with strut



strut shown under mounted panel



strut at end of panel



mounted panel



2. Connect the panels together

BE SURE TO REVIEW THE [MOUNTING HARDWARE COMPONENTS](#) BEFORE PROCEEDING.

REGARDLESS OF WHATEVER SURFACE YOU ARE MOUNTING YOUR PANELS ONTO, BE SURE IT IS FREE OF ANY SHARP OBJECTS (NAILS, STAPLES, TWIGS, pebbles ETC.) THAT COULD PUNCTURE THE PANELS FROM UNDERNEATH. VERY IMPORTANT. SIMILARLY, BE CAREFUL BRINGING THE PANELS ONTO THE ROOF TO AVOID ANYTHING SHARP. IF YOU DO PUNCTURE OR CUT A PANEL TUBE, IT CAN usually BE PLUGGED USING A REPAIR KIT AVAILABLE FROM YOUR DEALER.



2" panel header with barbed end



Slide rubber coupler completely onto header



Install and tighten stainless clamp onto coupler just inside barb (about 1/2" from coupler end)



Slide next panel into coupler



Position and tighten second clamp



Couple the other header together the same way



Unsecured panels laying on shake roof



Lay connected panels on roof where they are to be mounted or over crest so they don't slide off.

IF WINDY, BE CAREFUL HANDLING PANELS SINCE THEY CAN ACT AS A SAIL. IN SUCH CASES IT MIGHT BE NECESSARY TO MOUNT ONE PANEL AT A TIME OR WAIT UNTIL WIND DIES DOWN.

3. Secure the panel to their mounting surface

- **Refer to roof type above for mounting technique**
 - Roof type will determine how panels are mounted

upper-header straps

- Once the panels are connected together, and if the roof pitch is 5:12 or less, it should be possible to slide the bank of panels to their mounting location.
 - **Be sure not to drag them over anything sharp.**
 - **Make sure the headers are horizontal or very slightly pitched towards the feed port so that they can drain thoroughly in the fall.**
 - **I personally like horizontal headers for aesthetic reasons.**
 - **They will still drain just fine if piping done to allow it.**
 - Once in place, have someone hold them from shifting, if necessary, until upper header is secure.
- **Seal and secure tie-down cleat base above every upper header coupler.**
 - Location of cleat is dependent on roof type above (whether it has sheathing boards or plywood sub-roof).
 - Generally, it can be within 6" from the coupling.
 - Remember to **pre-drill shake shingles.**
 - **Use enough sealant** so that there is a bead of sealant around all four edges of the cleat base when secure. See pictures below.
- **Cut short Dacron straps from the big roll anywhere from 24-36" long** depending on how far tie-down cleat can be from the upper header.
 - If your straps are precut in **panel packs**, use the short (32") Dacron straps
 - Remember, these straps need to be long enough to wrap around each upper header coupler and then be secured using the tie down cleats.
 - **Always put a single knot in all Dacron strap ends.**
 - This will keep the strap from coming out of the cleat if it might loosen somewhat over time.
- **Wrap strap around each coupler, lay in groove of base, and hand-tighten the tie-down cleat cap onto the base.**
 - These caps can easily cross-thread so be careful when threading them on. They should screw on easily.
 - **If the base moves when threading on the cap, it is not tight enough and should be redone.**
 - **Remember that these cleats are all that is holding your panels from sliding down your roof. Take care to do them properly.**



Tie-down base sealed and bolted to asphalt roof



Upper header tie-down cleat with strap and cap. Note knots in strap.



Cross section of header attachment

panel body (belly-band) straps

- Once the upper headers straps are all secure, it is necessary to install the "belly band" straps across the panels (unless you used the ST panels that don't require them).
- If you need to, **you can walk on the edges of the panels** if you have on soft shoes and the roofing material is not abrasive or sharp underneath.
- Secure tie-down cleats between each panel and the sides about **12-18" below the upper header.**

- If you are using strap in a roll, tie a knot about 4" from the end of the strap, lay in at one end of the panel bank and secure the strap with a tie-down cleat cap as you go. Put slight pressure on the strap with one hand as you tighten the cap with the other.
 - If your strap came pre-cut in packs, overlap two 62" straps together for all inside cleats
- If you are using 62" pre-cut straps, do the same as above but put knots in both ends and overlap the straps together for all interior cleats. See picture below.
- Do the same between **12-18" above the lower header.**
- **For 10 and 12 foot panels, put a third strap at the center of the panels.**



Put gobb of mastic onto roof



Set 1/4" lag bolt into base over mastic



Screw-down lag bolt slowly until tight



Secure tightly to roof so mastic squeezes out around the cleat edge



Do the same for all cleats



Leave excess strap at each end



Put single-knot in all strap ends



Another view of strap end



Another view of cleat between panels on shingle roof



Belly-band using short 62" straps overlapped at cleat - note knots in both ends



View showing upper belly-band strap across panels



Bottom belly-band

LOWER-HEADER STRAPS

- Honestly, the **lower-header straps are often unnecessary.**
 - Made of flexible **vinyl** to allow for panel expansion and contraction
 - **No knots required**
 - Recommended wherever windy conditions are common. **Use as needed.**

- Between every panel
- Between every other panel
- Only at the bottom corners



Standard bottom-header strap

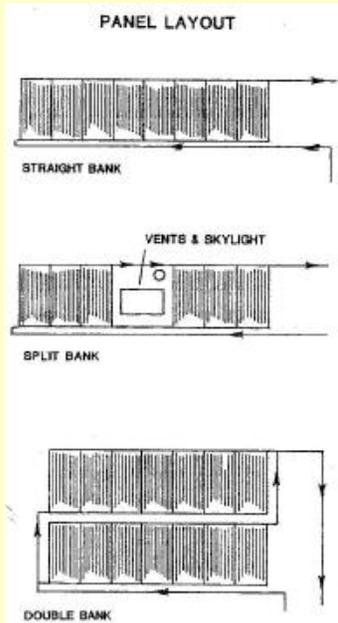


Bottom-header strap on pipe between two panels

4. INSTALL SOLAR LOOP PIPING (see pictures following text)

- All panels should be plumbed together using **2" Sch. 40 PVC**.
 - **Never use ABS** piping for solar systems.
 - ABS does not hold-up well to UV and is not designed for pressurized systems
- **Properly and carefully glue all your pipe/fitting joints** with glue less than 6 months old
 - We are "old school" and prefer you **use a primer and glue combination**
 - Instead of "hot" glues that *supposedly* do both.
 - Use glue that is as slow to set-up as your skill level requires.
 - Clear glues and primers are nice since drips are less visible
 - Clear glue is easy to find at Home Depot but clear primer is not.
 - Purple primer is easy to see on your pipe but difficult to remove if spilled-BE CAREFUL
- Where necessary, **always lay-out your roof piping with drainage in mind.**
 - You want to **make sure the panels and the piping can drain completely either manually or automatically** as needed.
 - Install drain valves (hose bibbs) as needed
 - Recommend installing drain valves so they can be accessed from ground
 - run 1/2" PVC from roof
 - **Freeze damage is avoidable and NOT covered by manufacturer's warranty**
- **Use FAFCO CPVC female adapter at every pipe/panel connection.**
 - Otherwise, pressure of clamps at panel rubber couplers can deform the piping during stagnation conditions allowing pipe to push-out of rubber couplers at any time.
 - You need four female adapters wherever panels need to split around roof obstructions such as sky lights, chimneys, roof vents, etc.
- **Plumb panels in parallel** to equalize flow per panel and maximize performance
 - Never run outlet (return) of one panel or bank into input (feed) of another--series flow
 - See pictures below showing piping diagrams
- **Diagonally feed and return single banks** if possible (see diagrams below)
 - That is, ideally, **feed each panel bank to the far lower corner and return from the closer upper corner**
 - This shortens the return piping and thus reduce any potential heat loss
 - Ensures every panel gets the same flow
 - No possibility of short-cycling of flow
- For multiple panel banks, USE "**common high-point return**" policy
 - That is, return all panel banks to a common high point before final return to pool
 - See example of double-banked panels below
 - **Never rely on valves at roof to balance flow on residential systems**
- **Put vacuum relief valve in upper unused corner.**

- Use end caps to plug any remaining unused panel corners.



Common panel configurations and how they should be plumbed if possible.

Note that the feed pipe should be taken to the far lower corner of the panel bank so that the return pipe is shorter going back to the pool thus reducing heat loss.



Example of series flow that should be avoided



FAFCO CPVC Female Adapter



Pipe/panel connection with female adapter



Female adapters used at split around roof obstruction



Piping at panel return



End cap



Vacuum relief valve

5. CONNECT PIPING TO THE POOL EQUIPMENT

The solar loop piping should be connected to your pool circulation equipment after the filter and before the heater (if you have one).

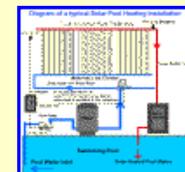
- You want **only filtered water going through your solar panels**
 - So there is no chance of debris clogging panels

- You want the solar system to **preheat** your gas or electric heater if you want to use them simultaneously.
- If space is an issue, you will have to adjust the existing plumbing to suit the following requirements:

Manual vs. Automatic Operation

Solar systems can only add heat to the pool if the panels are operated when they are warmer than the pool water. Otherwise, the panels will radiate heat from the pool into the atmosphere and cool the pool down. So, generally you want to have water going through the panels only when the sun is shining - between 10am and 4pm (give or take an hour depending on panels orientation). You can accomplish this several ways:

- **Put your pump on a timer** so the system could only operate between 10 and 4.
- Or, if you run your pump 24 hours per day, you would have to:
 - **manually bypass the solar every evening** and turn it back on every morning
 - Depending on weather conditions, you may need to do this during the day as well.
 - **use an automatic control** mechanism so the system turns itself on as needed--**recommended**.
- **Manual operation uses a manual gate or ball valve between the solar feed and return tees that can be closed to force water through the panels or opened to bypass the panels.**
 - We always recommend a good plastic ball valve over a plastic or brass gate valve
 - **We suggest using a Compool, Jandy, or Hayward three-way valve** instead of either the feed or return tee as your manual diverter valve so you could motorized it later for auto operation if you wanted to later without needing to replumb anything.
 - Manual system can be relatively hassle-free in sunnier climates where it is normally sunny during daylight hours.
 - **We never recommend manual systems west of the Cascades** because weather conditions can dramatically affect system performance.
- In most situations, **we highly recommend control systems** to automatically monitor the operation of your solar system
 - **Controls maximize performance** of any solar system in any climate
 - **Controls offer high limit protection** through thermostatic control
 - You can set the temperature you want to solar system to achieve
 - Follow the instructions that come along with the control.
 - Click on the diagram to the right for a basic schematic of control components.



COMPOOL LX-220 control box



COMPOOL motorized 3-way valve



Example of piping at pool equipment area

Solar loop Isolation and drainage requirements

- Care should be taken to ensure the solar panels and piping is protected from potential harm.
- If you run your pool equipment at all during cooler weather, you should **install ball valves in both the solar feed and return lines to be able to isolate the solar loop completely**. Don't rely on the 3-way valve in the feed and a check valve in the return line. Check valve are notorious for letting water by under low pressure.
 - **Install drain valve downstream of these ball valves** so the loop can be drained

- Leave these drain valve open all winter.
- **Be sure to shut-off your solar control when not in use during the off-season**

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