

# Streamlining

By Chuck Marken and John Patterson, with Suzanne Olsen

Proper **planning** and well-coordinated crews minimize solar water heating system **installation time** and maximize **financial returns**.

**E**very contractor knows the formula for success: Efficiency, organization and preparation equal a job well done, a satisfied customer and a profitable bottom line. Solar installers who help their companies flourish reap the rewards of a profitable company, including better pay, benefits, tools and company vehicles. The less time you spend on steep, hot roofs and in super-heated, confining attics, the better. A well-rehearsed road show is only the tip of the iceberg. Optimized logistical planning and preparation behind the scenes make it all happen.

While finishing a residential job in a single day is not always possible, it should be the goal. Installations get increasingly difficult with multistory buildings, but often the job can still be accomplished in a day. The key ingredients are starting early; an organized, well-stocked truck or trucks; an experienced crew and preassembled equipment.

## CUSTOMER CONSIDERATIONS

Too often, new contractors, dealers and installers do not put enough emphasis on the customer's convenience. The first foot forward is punctuality: From the sale, site visit, communications and scheduling of the installation, being on time



Courtesy: sunwatersolar.com

# Solar Water Heating Installations



sets the stage. Professional installers are always on time, every time, and if an unforeseen circumstance such as traffic prevents this, they always make sure their customer is promptly informed. Being a half hour late for an installation is not a big deal if the customer knows about it instead of wondering what is going on.

Customers nearly always appreciate your being there early. Most of them work, and this enables them to let you in and start the job before they have to leave. In other cases, the client may schedule a day off to be at home during the installation. Having to reschedule time off can be a big inconvenience, and postponing an installation should be avoided unless absolutely necessary.

## STAYING ON SCHEDULE

Imagine a crew that arrives at the shop at 8am, loads the truck and talks with administrative staff about the day's project. The installers are ready to leave the shop after 9am and perhaps arrive at the jobsite a little before 10am. Two hours later they break for lunch and then return at 1pm to a blazing-hot roof. Production efficiency slows down in the heat. They realize they will not be able to finish in one day, so they decide to leave the job at 3:30 to beat the rush-hour traffic. A one-day job turns into two days simply because of a late start. The consequences are an inconvenienced customer and additional hours spent loading and unloading tools and ladders, plus double the amount of travel time. All of this reduces the profit margin of the job. The bottom line: Start early to cultivate happy customers and save time and money.

Most codes in the country allow for construction activity to begin at 7am, which means arriving at the job at 6:50, greeting the customer and giving an installation overview so that at 7am sharp drills start sounding. For solar installers working on hot roofs and in sweltering attics, it is especially important to get the work in those locations finished before the heat of midday. Afternoon temperatures in attics can easily exceed 120°F. Increased heat slows you down and makes for unpleasant working conditions. This can be minimized if you start early and beat the heat.

Another benefit of starting early is reduced travel time. Leaving the shop at 6am means you will do your driving before rush hour, possibly cutting your road time in half. Of

course, in winter it may not be light at 7am when you arrive on-site. You can use the time until sunrise doing work inside, such as running pipe to the attic or setting and strapping the tank in place.

Packing a lunch and having lots of water on hand helps keep an installation on schedule. This may seem obvious, but it is not always common practice. Leaving the job to go to a restaurant, even a fast-food restaurant, can waste an hour or more in the prime time of the day.

### PLANNING AND COMMUNICATION

Often, time spent preparing for a job can equal or even exceed the installation time. Job preparation is not just about parts and equipment. It also involves a coordinated effort to plan the right number of installers for the job; line up any contract services, such as crane operators or other subcontractors; have permits and manuals ready; and completed warranty forms and incentive paperwork prepared to give to the customer. Being prepared greatly affects the amount of profit to be made.

It helps to think of a solar project needing to be “built” three times. The first occurs when salespeople visualize how the system will be installed and build it in their heads with all the necessary specifications. The second occurs when solar contractors imagine the steps needed to complete the system, order all the parts and coordinate the activities and

**Coordinated** Good communication, planning and project work flow among sales, design and installation staffs enable clean, fast and trouble-free installations that are pleasing to the eye and the client.

paperwork prior to beginning the project. The third is the actual physical construction of the project. Communication among the sales consultant, designer, contractor, administrative staff and the installers prior to beginning the job helps installers avoid time-consuming surprises when they arrive at the jobsite.

When jobs are not completed on time, a common excuse is, “I had Murphy in my back pocket all day.” Whatever can go wrong will go wrong unless you are ready for it. Good planning and communication keeps Murphy at bay. Even in startup solar thermal businesses, specialized employees or work groups generally accomplish dedicated sales and installation activities. Facilitating communication between the two gives installers what they need to be prepared for a given project. The more information they have about a job, and the better it is organized, the faster the installation will be accomplished. A higher-quality installation is another obvious benefit.

A detailed job card, filled out by the salesperson, should be associated with each project. The ideal job card contains all the pertinent information an installer needs. At a minimum it should include contact information, job type, building orientation, roof type, roof pitch, attic access and the type, location, access and size of the existing water heater. Reports generated from site-survey tools enhance communication among the staff. Digital photos of all the work areas

can be a great help in planning for the job. In fact, in the age of digital cameras and Google Earth views, some jobs may not require a preinstallation-site visit by a qualified installer.

In many jurisdictions, a trip to the planning or building department for a permit is part of the planning process. This can be accomplished online for simple mechanical permits in some locations. Larger jobs typically require a detailed plan set before a permit is issued. These plans will need to be stamped by a professional engineer in most cases, and the associated time frame should be accounted for during the system planning process. Detailed plans will save time in the field and minimize installation errors.

Finally, regular safety meetings and a safety orientation for new installers are important components of the planning stage. Time should be taken to ensure new crew members are familiar with overhead safety, fall protection, the proper footwear

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Courtesy joewalshcontractors.com

*We asked four solar thermal experts for their advice on streamlining solar thermal project planning and installation.*

### **JUSTIN WEIL, PRESIDENT, SUNWATER SOLAR**

Richmond, CA / sunwatersolar.com

**PLANNING.** Correct materials procurement prior to an installation's start date is critical. Parts-runs often represent the most significant time loss on a job and can easily be avoided with proper planning. The farther the job is from the supplier, the more parts-runs hurt. Having a well-stocked shop is important, as is sourcing special-order parts before a project begins. Along with materials procurement, having regular preconstruction meetings with the foreman enables him or her to develop an efficient build strategy before the installation crew sets foot on the jobsite.

**EQUIPMENT.** In my experience, preassembled pumping stations provide the biggest labor savings. In the past it would take an installer about half a day to assemble and solder all the components and fittings that are included in a solar pumping station. It should be noted that specifying preassembled pumping stations does not always amount to significant savings for the client, because most predesigned and preassembled equipment includes the cost of labor. However, the clean and professional-looking end product is a real benefit. In addition, since they are compact, pumping stations also help to conserve space in crowded mechanical rooms.

**TOOLS.** Well-designed and thought-out charging stations are definitely an installation time saver. They keep the glycol-filling process fast, clean and easy to set up and break down. For commercial-scale systems, heavy equipment, including excavators and cranes, is worth every cent.

**TECHNIQUES.** While there are numerous installation techniques that streamline projects, on the top of my list is hiring hard-working people to do them. Having a crew that is highly motivated to install a quality product the first time, and that works as a team, is invaluable and should be recognized as such by company owners and management. ●

for roof work, the precautions necessary for working with soldering tools, attic protection and electrical safety. Nothing will slow a job down more than an accident or injury on the site.

### **THE INSTALLATION TEAM**

To keep the installers organized and working efficiently, a seasoned crew chief or lead installer is essential. More than any tool, planning procedure or technique, an experienced lead installer who is skilled in keeping the crew on track is the biggest factor in reducing installation time in the field. This is a management position and should be recognized as such. A good crew chief also assigns new hands to seasoned crew members who are best at teaching others. This promotes increased installation efficiency for future jobs. The crew chief should be licensed in the jurisdiction where

the job is located and have a solid understanding of national and other codes that have been adopted or written by the local administrative authority. Examples are rules and guidelines for fractional HP motor installation, gypsum wall spaces, spacing requirements for gravity vents on the roof and potable water connection details.

The crew chief should discuss the system installation in general terms with the customers. Any misconceptions or conflicts with what might have been promised by the sales staff and the reality of what can be done should be ironed out with the customer prior to loading the roof and starting work.

Most solar water heating installations have three work areas: the roof, the attic and inside the mechanical room. A crew of three works well for most small jobs. While two installers accomplish many installations, a third person is valuable from a time-to-benefit viewpoint. It is also an opportunity to train new crew members. Mounting collectors and sealing penetrations do not have a steep learning curve, and new hands are most valuable here.

It is usually worthwhile to have more people on large jobs if the effort is well-organized. Using more than one crew for large jobs can help keep costs down. Two lead installers are

better than one because of the added experience, but, if necessary, one crew chief should be able to handle a crew of five or six without a problem. If multiple crews work in dedicated areas, they will be able to work effectively without getting in each other's way.

### **EQUIPMENT CONSIDERATIONS**

Solar thermal equipment manufacturers have developed components and system packages that can efficiently be integrated with each other in the field and speed installations. When systems are designed using components from various manufacturers, additional design time is required until integrators develop regular component sets. With either approach, sales, design and installation staffs should be thoroughly familiar with the equipment specified.

**Collector size.** The important thing about collector size is square footage. The number of collectors is incidental. Generally, on both residential and commercial systems, it is best to go with a fewer number of larger collectors. With residential systems in the sunnier parts of the country, a single 4-by-10-foot collector can often be used. Since single-collector systems of any size do not require racking, they have an advantage over multiple collectors. Most collectors are strong enough to support themselves. When two or more collectors are combined, a rack is needed to support the collectors and reduce the number of roof penetrations. Therefore, single-collector systems require less labor and materials to install.

**Mounting racks.** There are two basic options for collector racking: factory mounts and custom-built mounts. Racking systems designed by manufacturers to interface with their collectors are easy to install and can cut installation time significantly. However, missing rack parts are notorious for holding up installations. If you use factory racking, it is a good idea to make sure that the installation truck is well-stocked. Carry extra clips and leg stock to keep the installation moving if parts happen to be missing. Because of the added expense and shipping lead time associated with factory racking, many installers prefer to build their own

mounts. In most cases, racking is easy to construct on-site with standard angle, pipe or square stock, and materials are locally available.

**Photovoltaic pumping.** In the last decade or so, using a small photovoltaic module to run the circulator has become popular with some installers and system designers. The principle is the same for all PV-powered circulating pumps: If there is sufficient sun to warm the water, there is sufficient sun to power the pump. When the equipment manufacturer integrates PV-powered pump components into the system design, the installer can realize labor savings during installation.

**Pump stations.** Many manufacturers and system integrators are moving toward pump and control stations that incorporate all the needed parts for antifreeze systems into a single, off-the-shelf component. Secure the pump station to a wall or a tank, hook up two to four pipe connections and much of the inside work is done. Be sure to thoroughly review documentation on this preassembled equipment, and keep in mind that currently it is available for antifreeze systems only.

#### PREASSEMBLY IN THE SHOP

Many components of a solar water heating system can be assembled at the shop. Pumps, valves and the fittings that



shawnschreiner.com (x3)



**Factory-built** Racking systems designed by manufacturers to interface with their collectors can cut installation time significantly. Here, the SunWater Solar team installs an integrated Heliodyne system.



Courtesy Solar Collection (x3)



**Custom-built** Many installers prefer to fabricate mounting systems, such as this one by Solar Collection. Necessary parts and materials can be conveniently procured at the local supply house.

**Pump module** Preengineered and preassembled pump stations, such as this Helio-Pak unit from Heliodyne, reduce installation time in the field and eliminate the need to source or stock a multitude of components and fittings.

go on gauges can be assembled ahead of time. There are several advantages to doing this. Prefabrication not only gets work done in a more efficient way, but it also serves to make the installer aware of additional parts that might be needed. You have to locate every part to prefabricate the assembly, and it is better to hunt it down in the shop or order it in than to leave the jobsite and go to the supply house. If you are working out of town or out in the sticks, it is even more important to be sure you have everything ready to go beforehand, because parts-runs hurt even more.

Often there are repetitious tasks that are basically the same from one system installation to the next, and these can be done at the shop in a production fashion to save even more time. You can make perfect cuts on insulation, for instance, and pressure-test entire plumbing assemblies in advance.



Courtesy heliodyne.com

Periods of inclement weather are ideal times for equipment and parts preparation and preassembly in the shop. This approach will save countless hours and dollars over the years.

Some installers might prefer not to preassemble, because field conditions may dictate something different. However, many installers agree that 80% to 90% of projects can be preassembled. For insurance, take a duplicate set of individual parts in case on-site conditions require changes.

Finally, labeling parts of the system, which enhances the professionalism of any installation, is sometimes an afterthought for installers. It is easier to produce quality labels in the shop with

office resources nearby, and it allows you to identify any special labeling required before heading to the jobsite.

### TOOLING UP

Most of the tools required for solar water heating installations are readily available, a few are specialized, and some, like glycol charging stations, are typically custom built. A smart business owner or operations director pays attention

## BOAZ SOIFER, GENERAL MANAGER, CEDAR MOUNTAIN SOLAR

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**PLANNING.** There are two critical points in conveying project details. The first is between sales and design, and the second is between design and installation. Cedar Mountain Solar addresses each using the following tools:

- **A detailed site assessment form.** When salespersons or technicians survey an installation site or project plan set, they fill out a site assessment form to collect and organize as much pertinent data as possible. The document is updated each time a new logistics issue is raised. The assembled data is then used to produce a proposal and is reviewed by the lead installer when preparing for the job.
- **Project turnover.** Once a project is sold, we hold an internal meeting with the salesperson, the system designer and our construction manager. This meeting is used to define project scope, ensure the customer's expectations are well understood, and most importantly, to convey any perceived risk factors associated with the job. These could include a unique technical detail, a difficult personality in the project mix, the distance to the jobsite and the resulting inaccessibility of parts—anything that could throw the job off scope, schedule or budget.
- **Detailed project management.** One of the important things we learned in managing solar heating projects is that typically more than half the project timeline takes place before the installation crew is on-site. Sufficient time for system design, materials procurement and project planning needs to be accounted for well in advance of installation. Critical Chain Project Management (CCPM) theory has been useful in staging jobs accurately.
- **Design methods.** We've developed a modular design method that enables quick design of complex systems. The key elements are sticking to proven methods and limiting choices. In

**H**ere's an example of how careful preparation saved time and money. My company was doing four jobs for four different homeowners in a town 300 miles away. We spent 2 days fabricating each of the tanks and a day loading up the Sprinter Van for the job. We checked, crosschecked and rechecked everything in advance. We drove out on Monday, completed the four jobs in 4 days and were back home for a long weekend. We never had to leave any of the jobs to hunt down a hardware store or supply house in unfamiliar territory.

—John Patterson, Mr. Sun Solar

to tool requests coming from the installers and takes the time to weigh the expense of new tools against the expected ongoing labor savings.

**Cranes.** For large collector arrays, cranes usually pay for themselves in time savings. They are essential for some installations. For example, Mr. Sun Solar recently installed nine 4-by-14-foot collectors on nine row homes that have 45° pitched roofs 35 feet in the air. Without a crane, loading the roofs would have taken 2 to 3 days and posed safety risks. With a crane on-site, the task was accomplished in

half a day for \$700. Often, smaller projects can be completed for the minimum a crane company would typically charge, somewhere in the \$250 range. The key is to be absolutely ready so that the crane is in and out in the least amount of time.

**Charge pumps.** If you are installing antifreeze systems, a powerful charge pump is a big time-saver. Charging



Courtesy mrsunsolar.com

**Preassembly.** Many system components can be preassembled in the shop in a production fashion to save installation time on the jobsite. Preplumbing storage tanks is one example.

addition to short design lead times, this approach also gives installers consistency in piping layouts that enables more pre-assembly in the shop and reduces confusion in the field. We close the loop by having design staff commission the system, ensuring that the intended scope is installed and functioning properly and providing checks and balances for quality control to reduce costly callbacks.

**EQUIPMENT.** We have not found any whole-system packages that suit our design and installation philosophy and methods, but we do tend to specify specific components that save installation time and enhance quality control. We use Caleffi pump modules in some cases, which each provide a preassembly of about 15 parts, saving soldering time. On a given job we might have four of these, saving about 60 connections, or 12–16 hours of installation time. Over the past 2 years, we have been adapting flow centers (hydraulic separators) to our design. Those made by Caleffi, PAW and

Precision Hydronic Products have different features, but each eliminates the fabrication of copper primary and secondary manifolds. Combining these equipment-related measures, we have reduced our installation time by about 20%.

**TOOLS.** We use tools typical to heating contractors. However, each installer having a digital camera has done wonders for promoting continuity on jobs and facilitating communication with the design team.

**TECHNIQUES.** Where possible, preassembly has helped reduce installation time. We even went through a phase where we'd mock up the mechanical room in our shop and build the system in parts, then haul it to the jobsite, assemble and charge it. We always preassemble and prewire our control systems. Our shop is close to supply houses and just as importantly, close to the design staff, making shop labor less costly than field labor through reduced downtime. ●

Courtesy mrsunsolar.com



**Cranes** Utilizing a crane for roof loading is often essential for installations on multistory buildings. This Sol-Reliant system, manufactured and installed by Mr. Sun Solar, uses S-5! clamps for penetration-free attachments on standing-seam roofs.

Courtesy sunwatersolar.com



**ProPress System** Tool manufacturers such as RIDGID manufacture equipment that compresses ProPress system fittings, allowing for solder-free connections. Compared to torch and solder, labor and time savings increase with pipe diameter.

**O**ne of my best installers would spend Saturday morning cleaning out the truck, restocking parts he used on jobs, recycling the cardboard and scrap metals, and cleaning out his toolbox and soldering kit. The regular workweek was just too busy, and he was too tired at the end of each day, so this was his approach to taking care of accumulated mess. That extra time on Saturday enabled him to start the new week fresh and organized on Monday.

—John Patterson, Mr. Sun Solar

closed-loop pressurized glycol systems requires a pump strong enough to lift fluid from a bucket at the solar tank to the top of the solar collectors. Generally, a powerful charge pump on the order of 0.5 horsepower is needed. Use a Y fitting so that two different source hoses can feed into the solar loop with a shutoff on each line. Use a pressure gauge to make the process of pressure testing, flushing and charging much simpler. A good charge pump can easily save an hour on any given installation and sometimes more. Pumps at 70 PSI with high flow are recommended—this amounts to more than 160 feet of pump head, which blows the air out of any but the largest systems in a few minutes.

**Corded versus cordless.** Most corded installation tools now spend their days gathering dust in the shop. While it is still a good idea to have a powerful hammer drill on the truck for blowing holes in concrete and block work, it will not be used much in normal installations. In the past, corded ac half-inch drills were used for heavy work such as driving lag screws and drilling through double top plates, but newer tools have pretty much retired them. A modern cordless impact tool will drive 5-inch lag screws in one trigger press and reduce the chance of breaking bolts. The newest lithium-ion battery cordless tools are significant time-savers. They are lightweight, have a low self-discharge rate and ample power.

**ProPress.** One specialty system that is gaining popularity with both plumbers and solar water heating system installers is the ProPress. The system uses compression fittings with O rings. The rings are made from high-temperature material suitable for solar thermal piping systems. The fittings are expensive, but the time savings increase with pipe diameter and system size. Using

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### TIM COATS, SOLAR TRAINER AND CONSULTANT, ONTILITY

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**PLANNING.** I cannot put enough stress on the importance of a detailed site survey. Being able to anticipate the challenges that a job may present and having a plan for addressing those challenges are the keys to a smooth and efficient installation. If the salespersons have little or no installation experience, they must be trained to know what questions to ask and what to look for, and be directed to take plenty of photos. For more-complex systems, it may be worthwhile to have an experienced installer perform the site survey. Unfortunately, poor planning may require installers to design a system while they are installing it. This will usually result in plenty of trips back to the shop or supply house and increase installation time significantly. In general, knowing what to expect on a particular job and starting that job fully prepared will save hours and labor. Sending the appropriate number of people to do the job can also make a big difference. A job that should take three people a combined total of 24 person-hours may end up taking two people 36 person-hours.

**EQUIPMENT.** There are many equipment packages available on the market, and they each have advantages and disadvantages. Some equipment may take less time to install but operates less efficiently or has a reputation for callbacks. I prefer the drainback systems from AET, which offers many different package options that enable the system designer to pick the best system for the job. In terms of installation time and labor savings, an installation team that is very familiar with the equipment it is installing is the most critical factor.

**TOOLS.** Nothing beats a good torch and solder. I have yet to see a tool that can make a connection I can trust as much as a soldered joint.

**TECHNIQUES.** Prepping tanks and other components ahead of time in the shop is an excellent technique for saving time on the installation. It is also a great way to train new installers. There are limits to what can be done in the shop, because jobs have a tendency to be unique, but many components will always go together the same way. ●

compression fittings rather than soldering is definitely safer, especially in attics and crawl spaces.

**Headlamps.** The droplight tagged along with an extension cord for decades in the construction trades, and this is another tool that is destined for the museum. Unless the attic work is going to take more than an hour, leave the droplight and extension cord in the truck. Individual headlamps can light the way.

### VEHICLES

A well-organized truck facilitates streamlined installations. Vans, pickups and step vans all have pros and cons. Vans and step vans are ideal for securely holding hundreds of small parts and tools. Pickup trucks have less secure space for parts but are easy to work from when equipped with bed and side boxes. Many plumbers prefer step vans because of their readily accessible storage, but the roof can be a drawback for a solar installer—the roofs of most step vans cannot be walked on. Many installers prefer a full-sized van with a ladder rack, pipe enclosures and a rack for collectors. Whatever your choice, a well-organized vehicle makes the job go quicker.

Obviously, if you do not have or cannot easily find the parts you need, you will waste time, job after job. A full set of racks inside the truck with small bins for every type of part is required. Good racks and bins are expensive but well worth the money spent. Keeping the truck organized and stocked is typically the crew chief's responsibility. This means all tools, parts, fluids, consumables and paperwork are in their proper places. Inventory control

**Flashed penetrations** Nothing wastes more time or cuts into a project's profits more than callbacks. Good materials and workmanship, such as flashing all roof attachment points and penetrations for pipe runs, go a long way toward eliminating a return trip to the jobsite.



Courtesy Solar Collection

starts before the truck leaves the shop and is part of the planning process.

## TECHNIQUES AND TRICKS

As installation teams gain experience, they develop techniques that enable faster, higher-quality installations. Some of these processes take place in the installer's head; others relate to construction approaches; and still others are just plain common sense.

**Know the code.** Being familiar with the code and regulations required by the AHJ in your marketplace is crucial. A good working relationship with local inspectors is very helpful and can preempt any misunderstandings that may arise. A lot of code has changed in the past few years, mostly having to do with structural requirements. For example, some jurisdictions now require the collector load to be spread over several point loads in a fashion that results in six or more standoffs for two 4-by-8-foot collectors.

**Find the rafters or trusses.** A sure way to locate rafters or trusses on the roof is to go into the attic and drill an eighth-inch guide hole alongside the rafter or truss. A second installer can mark the pilot hole on the roof. This will precisely define the edge of the structural member you plan to lag into. Another approach is to approximate the rafter location by looking at rafter tails and measuring off the gable, or skip hammering on the roof to find the rafter by feel. Neither of these approaches is precise, but they can typically get you within a few inches; then drill multiple holes one-quarter inch apart in a row to locate and mark each rafter. This method should be used only if the roof penetration will be flashed with an approximate 1-square-foot base that will adequately cover the row of drill holes. It is a good idea to caulk the test holes as a precaution against driving rain or hurricane-force winds blowing water sideways under the flashing.

**Lift from the truck rack.** Using the truck rack to your advantage with collector lifting is a smart time-and-labor saving

idea. When a collector arrives on the job atop a pipe rack, the starting height of the collector is close to the height of a single-story roof. If the vehicle can be backed up close to the eave, two or more installers can lift the collector from the rack directly to the roof.

**Attic work.** If you have worked in enough attics, you probably have a story about slipping off a truss or joist and damaging the ceiling below. More than one solar installer has taken the express elevator through the lid and down a story.

## RICH LOUIS, PE, PARTNER AND VICE PRESIDENT, SUNNYSIDE SOLAR ENERGY

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**PLANNING.** We always make sure customers are clear on what they are getting and what the project will look like when completed. This way rework is minimized and customer satisfaction is increased. This may sound like a simple concept, but extra communication amongst all members of the team (sales, design and installation crews) must be accurate and thorough to achieve that goal and meet the client's expectations. We also make sure that project planning accounts for any site-specific issues prior to the crew showing up. An important preplanning check is to verify that the tank can be delivered to its final location. This is not a problem for smaller-sized tanks, but is a critical check when a large tank is specified in the design. Finally, we stock all basic parts so projects can proceed quickly and stay on track regardless of any last-minute on-site surprises that can occur.

**EQUIPMENT.** Our systems are chosen for simplicity of operation, durability and maximum efficiency rather than installation speed. Specifying high-quality equipment results in fewer warranty callbacks for the installer and increases customer satisfaction. I have reviewed systems designed to be quick to install, with flexible line sets and threaded or gasketed fittings, for example, but I have concerns about durability, maintenance and future parts availability. Some of these products are metric sized or include parts that are available only via special order from Europe. System quality and performance should always be the priority.

**TOOLS.** ProPress fittings speed the installation along nicely. We do continue to solder all connections above the roofline, rather than rely on gasket-type fittings, due to the high temperatures at that location. Milwaukee's lithium-ion battery-powered copper tubing cutter is quite handy, especially for tight spaces. I have been looking to try a tool by Bosch, the D-Tect 100, designed for locating trusses under roofing materials. However, it is not yet available in the US. Milwaukee makes a similar tool, but it did not work well on shingled surfaces.

**TECHNIQUES.** A company that provides training and makes its well-trained crews feel valued will have better staff retention and skilled installers, both of which ultimately lead to faster, higher-quality installations. Each project site offers its own unique challenges. Skilled, motivated installers can assess those challenges and provide quick, creative solutions. ●

**Safety** Uncalculated time is lost every year due to accidents on the jobsite. Appropriate safety equipment and crew training is critical and should be prioritized and enforced by company owners, managers and lead installers.



shawnschreiner.com

Careful movements while in the attic will prevent injuries and costs associated with repair work.

**Soldering safety.** To minimize fire potential, soldering pipe in attics deserves the utmost of care. It should be avoided whenever possible. On many jobs, with careful measurements, the tubing can be soldered on the roof or the ground and then fitted in the attic. If this is not possible, make sure that you bring a fire extinguisher into the attic. A small piece of flashing about a foot square can be used to protect both exposed framing and finished walls when you are soldering close to them.

**The bread trick.** Even a pipe that is barely dripping cannot be soldered because the water vaporization takes the temperature of the tubing below the melting point of the solder. When soldering a fitting or a valve on a water line that is leaking slightly due to a faulty valve, temporarily plug the pipe with a piece of bread. After the joint is prepared and fluxed, push the bread into the existing tubing. It will soak up small amounts of water like a sponge and give you enough time to get the joint soldered. This is no time for health food: cheap white bread works best and dissolves quickly. Do not use multigrain bread, because seeds may clog faucet aerators.

**Control test.** If the installed system has a differential control, every crew member should know that the last thing to do on the roof is finish the insulation on the collector sensor and to do so only after the controls have been cycled. This can be done quickly, even on cloudy days with fire and ice—a lighter and an ice cube. On the roof, heat the collector sensor with the lighter and the pump should turn on; cool it with

the ice cube and it should turn off. This test is simple, quick and verifies continuity of the sensor wiring.

**Count your tools.** Tools are often left behind on jobsites or lost for good in attics. It is a good idea to count them before and after the installation. This can prevent the time lost looking in vain for a missing tool later. Using buckets with tool sleeves helps keep tools organized and easily accessible.

**Watch your feet.** A good policy is to take off footwear prior to entering a home, or to lay down protective plastic or paper barriers. Homeowners appreciate this level of attention to detail and respect for their space.

**Safety.** Uncalculated time is lost every year due to accidents on the jobsite caused by unsafe practices, and the time lost is your least worry. Roofs are dangerous places, and solar water heating system installers spend a lot of time on them. Flat plate collectors are heavy and can be awkward to move on steep roof pitches. Proper fall protection starts with quality equipment, including ladders, harnesses and rigging. But the protection they provide is only as good as the training needed to ensure proper use. Appropriate safety training for the installation team is an absolute must. ⊕

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