Solar Installation Curriculum Document

Introduction

- This guide is designed to provide a very high-level summary of the process followed by a team of solar installers for the installation of a residential solar system. It is not meant to be comprehensive and does not cover the electrical work required to install the system. Do not try to install an actual solar system without proper equipment, licenses, permits, and full training.
- Help in preparing the guide was provided by Lumina Solar, Inc., the largest residential solar installer in the Mid-Atlantic region. To learn more about Lumina Solar, please go to www.luminasolar.com.
- Each numbered item below is considered a main concept.

MAIN CONCEPTS (You MUST cover at least five of these in your game)

Morning Warehouse Preparation

1. Each team member must arrive at the office by 6:30 am, wearing the appropriate uniform (branded gear and khaki pants as shown in the pictures below) and sign into the office time tracking system. Without signing in, a team member can't be properly paid for their work. No work can be performed without the proper uniform. Each team consists of at least 3 installers. One of the installers is called the team lead and that person manages the entire team of installers.

2. The team lead checks the daily installation schedule for the job assigned to their team for that day. The team lead reports to the office manager to receive any special instructions for that day's project. The team leads then finds the installation materials pulled for that job assigned to their crew. While reviewing the material sheet for the job that day, the team lead makes sure crew installers are cleaning out the vehicle from the prior day's work, and prepping to load material for that day's installation. Each team lead is responsible for their team from the moment they enter the warehouse until the end of the workday. Any changes to the schedule or other assignments for the team should be issued by the team lead or at the direction of the team lead.

3. The team should load up all required job material into the vehicle and make sure they leave the warehouse on time so that they can reach the job site by the set time. The team lead must ensure that before leaving the warehouse, the team has all of the required equipment for the job. Since some jobs require special parts, the team lead should check that the team has all required special parts for the project. If parts are missing, the team lead must develop a plan to get them in a timely manner and notify the office manager. When ready, the team will drive out of the warehouse in the vehicle. The team lead should call the customer when they are 20 minutes away from the job site. If the team is going to be late to the customer's house, the team lead must notify the customer immediately, apologize, and

provide a new estimated time of arrival. While driving, all traffic rules must be strictly followed. No speeding or aggressive driving.

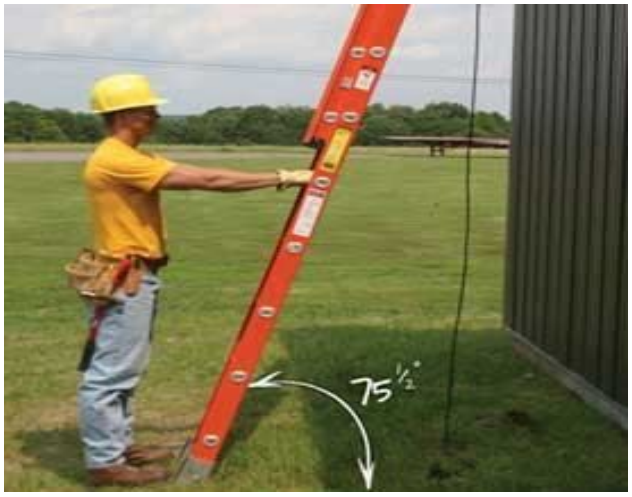
Job Site and Pre-Construction

1. Once the team arrives at the job site, the team should park the vehicle and mark its position with orange safety cones. The team lead is then responsible for: 1) introducing himself/herself to the customer, 2) reviewing the installation design with the customer and getting the customer's final sign off, 3) verifying that the proposed plan works based on site conditions, and 4) reviewing safety rules. If any changes to the system design are required, the team lead should make the necessary changes, discuss the changes with the customer, explain the purpose of the changes, and request approval. The reason for the changes should be noted so that future project planning can be improved. Then the team lead creates the game plan for the day with the team.

2. The next step is the pre-construction walkthrough. While the team lead is talking to the customer, the rest of the installation team should be preparing safety measures, setting up the ladder and preparing materials to start the project. The ladder is set at a 4-1 pitch with 3' above gutter line as shown in the pictures below. A ladder stabilizer and/or gutter guards should be used to prevent any damages to the home's gutters. Make sure the ladder is set up safely and secured by anchoring it to the roof.

3. The team should then prepare the work site by having cars and other items near the roofline moved to a safe distance away from the roofline and flagging the areas under the solar install to keep the area safe. If items fall off the roof by accident, everything should be cleared from the ground for safety reasons. The team lead should then have a quick meeting with the entire team about safety plans and roof layout. The main goal is to come up with a plan to get the job done in the safest and most efficient manner.

4. When working on the roof, each team member must be harnessed into the roof. The harnesses attach to the roof using Safety D rings that are installed on the roof. The team lead sets up Safety D rings within fifteen (15) minutes of getting on the roof. All roof workers must be properly hooked into the Safety D rings while on the roof. Once all safety measures are in place, the team starts measuring and marking the roof to make sure the proposed design will work.



Construction/Installation of System

1. The first step is to install the racking that the solar panels will sit on. The racking is installed using penetrations into the rafters of the roof. The

installers should use a hammer to locate rafters by lightly tapping on the roof. With the rafters located, the installers should begin to make initial penetrations for solar racking using power drill as shown in the diagram below. The racking attaches to the penetrations. If the racking isn't installed on the rafters, it may come loose, leading to the system flying off the roof under windy conditions or the roof leaking.

2. With the initial racking penetrations made, each penetration should be properly sealed using sealant to prevent leaking. Then, the installers will begin to install the rail using power drills and the appropriate screws. When the rail is installed, the installers will begin laying out micro inverters or optimizers on each array. The microinverters convert the power from the sun which is DC into AC which is used to power the house. Each panel gets its own microinverter. When laying out inverters, installers start from the panel line mark on the roof, measure over 20'' and start the first microinverter. Use a torque wrench, and tighten micro t-bolt to 10 ft-lbs. The next mark will be 39'' (for portrait) or 65" (for landscape). Installers continue until reaching the end of the row of panels.

3. While the roof racking and inverters are being installed, a team member should begin to unload panels from the vehicle and stage them as close as possible to the ladder. The team lead makes sure everyone is mindful of all trash associated with panels. Best practice is to set up a trash bag and dispose of trash as the team prepares panels to go up on the roof. The rest of the team then begins to bring the panels to the roof and begins installing

them on the racking one at a time. The roof lead will align the first panel using the shingle line as a guide to assure the panels will be straight. The team will continue until all panels are installed.

Energizing System/End of Job Tasks

1. When all of the panels are installed, the installers tie the inverter wiring from the roof into the electrical wiring performed by the electrical crew. This connects the solar system into the home's electrical panel box. The team lead switches the system disconnect off and tests to see if the system is operating and all panels are reporting. If issues are detected, the team lead will diagnose and troubleshoot. The system is now energized and can help power the home!

2. Once the system is energized, the team will begin cleaning up the job site and packing up. They will never leave tools or ladders. The team lead should have a final walk through with the customer to ensure satisfaction before leaving the site. The job site should be left just as clean as when the team arrived. The team will return the vehicle to the warehouse and fill out timesheets, filling up vehicles with fuel on the way back to shop. Once at the shop, the team will clean out extra materials and trash from the day from the vehicle and recycle materials as appropriate.