

# Solar Worker

## Skills Standards



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## Purpose

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The purpose of this report is to provide the results of the effort to develop Skills Standards for Solar Workers in LIUNA. This effort included a job analysis conducted by THE PITTMAN MCLENAGAN GROUP, L.C. (PMG) on behalf of LIUNA and described in this report. The job analysis consisted of research by PMG staff on possible Solar Worker related job tasks and possible Knowledges, Skills and Abilities (KSAs). Using this research, PMG compiled tasks and KSAs lists which were subsequently used in a focus group comprised of LIUNA stakeholders. The focus group was tasked with providing expert opinion about the work necessary to be performed by LIUNA Solar Workers. PMG conducted analyses during and after the focus group. The results of those analyses are presented in this report.

This report informs relevant stakeholders of the Skills Standards for the Solar Worker and to aid the developer of a course to teach individuals to perform the tasks required of them when working as a Solar Worker. The meeting attendees were subject matter experts (SMEs) and, as such, were asked to review and adjust a list of potential work behaviors (tasks) that Solar Workers should be able to perform when hired. The list was developed from a literature review conducted by PMG and in consultation with the SMEs. The tasks to be performed by Solar Workers must be generically applicable to most regions across North America. As a result, the scope of the course arising from and/or informed by this report must be generic in nature to be useful in teaching Solar Workers to perform work that is useful across the various work sites and regions. The SMEs were also asked to review/revise/create a list of potential Knowledges, Skills and Abilities (KSAs) that would be useful to Solar Workers when performing common tasks. The user of this document should keep in mind that other and more specific tasks may be performed by Solar Workers working in specific geographic regions of North America, which require the performance of tasks not covered in this study. Those unique tasks and KSAs must be taught by instructional providers for those regions and/or specific sites.

In addition to developing the course content useful to train Solar Workers, this report also provides the information necessary for the development of a test plan for the purpose of creating assessments used to certify Solar Workers for work. In this effort, the study of the Solar Worker jobs conformed, where possible, to the 29 CFR 1607 - Uniform Guidelines for Employee Selection (1978) and related US federal law and other professional guidelines including American National Standards Institute (ANSI) 17024 accreditation program.

## Skills Standards Development

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The skills standards described in this report arose from initial research and a subsequent focus group meeting conducted by PMG. During the focus group, 6 SMEs met in Chicago on February 5, 2015, to provide expertise on the work performed by Solar Workers in various regions of North America.

During this meeting, a social scientist at PMG led the SMEs in an effort to review, revise and in some cases, create a list of potential work behaviors/tasks and KSAs needed by Solar Workers that would enable them to perform their jobs. SMEs for each step of this process are listed in the Appendix.

Using the information from the review, an adjusted list of tasks was created and distributed to the SMEs to evaluate the work behaviors/ tasks and KSAs. The SMEs were then trained on several concepts of work behavior/task performance. The SMEs used these concepts to rate the work behaviors/tasks on Importance to performance of the job. In addition, the SMEs were asked to rate each task on Necessity at Exit from Training and Certification (post certification class), Frequency of Performance and Difficulty to Perform. Next, SMEs rated the KSAs on Importance to performance of the job. The SMEs were also asked to rate each KSA on Necessity at Exit (post certification class), Consequence of Error, and Relative Contribution to Performance. All rating scales are provided in the Appendix. This analysis will be described later in this report. The PMG social scientist guided the SMEs on discussions related to their level of agreement on Task and KSA importance and necessity at exit. After the SMEs provided ratings of the tasks and KSAs, they discussed any areas of disagreement in their ratings. In order to ensure the stability of the results, PMG requires that the collected opinion of the SMEs for these concepts is substantially in agreement, i.e., to ensure a 95% confidence in the result. The tasks and KSAs had to be considered both important and necessary at exit (post certification class) by, in this case, 6 of the 6 SMEs. PMG used a modified Lawshe (1975) approach using the significance levels identified by Lawshe. Tasks and KSAs that did not meet this requirement were dropped from further consideration by the SMEs in the development of the performance standards. However, in this study SMEs opted to change or eliminate any problematic task statements prior to rating. Also, each potential functional area contained blank tasks to allow SMEs to introduce new tasks without disrupting the continuity of the task numbers. These “blank” task numbers are not included in the list of tasks dropped from further consideration. Finally, the SMEs “linked” those KSAs that were at least helpful to performance of one or more tasks in the list. Both the task and KSA lists used by the SMEs in providing their ratings are provided in the Appendix.

For the tasks, SMEs’ ratings for Difficulty and Frequency were averaged and the averages were summed to create a “consideration value.” The consideration value was used to “band” the tasks by first calculating the mean and standard deviation of the consideration value across all tasks and then by placing the tasks in ranked bands as follows: Highest – Greater than one standard deviation above

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Lawshe, C.H. (1975). A quantitative approach to content validity. *Personnel Psychology*, 28, 563-575.

the mean, Moderate – tasks that are within one standard deviation (plus or minus) of the mean, Low – more than one standard deviation below the mean. PMG subsequently wrote performance measures for tasks that were evaluated to be in the Low, Moderate, or Highest bands.

For the KSAs, PMG calculated the total tasks linked to each KSA. This total linkage is provided in the Appendix. In addition, KSAs are ordered within function, by the sum of tasks linked to that KSA for that function.

PMG used the decision rules and task ratings described above to create the performance measures using the Instructional Systems Design (ISD) approach for creation of terminal objectives. Although not necessary, PMG used the Audience, Behavior, Condition, Degree (ABCD) method when creating the performance measure statements. PMG social scientists reviewed the performance measures for applicability, readability and relatedness to the critical tasks. In addition, experts at LIUNA Training reviewed the performance measures and provided feedback. Where appropriate, SMEs reviewed the performance measures and commented.

## Definition of Terms Used to Describe and Define Skills Standards

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The definitions of the following terms are in commonly recognized job analysis literature (Gael, 1983).

**Function** – A Function is a broad subdivision of a job composed of a group of tasks that are related based on some defined common factor. Tasks are grouped into functions based on their similarity of purpose (e.g., evaluative tasks, supervisory tasks) or based on some other relevant categorization (e.g., chronology – beginning/end of shift, work activity). Generally, functions represent broad job goals. For the purposes of this report, a job is a collection of job functions performed by one employee.

**Task** – A Task is a discrete organized unit of work performed by an individual to achieve an organizationally desired outcome. The USAF *Handbook for Designers of Instructional Systems* defines a task as a group of related, manual, goal-directed activities that have a definite beginning and end; it involves interaction with equipment, other people, and/or media; and when performed, it results in a meaningful product. A task includes a mixture of decisions, perceptions, and/or physical activities required of one person.

**Performance Measure** - A Performance Measure is a statement of expectations of desired employee performance expressed in the ABCD format (Audience, Behavior, Condition, Degree). Performance measures are designed to inform curriculum and certification assessment development. They identify the critical work functions, key tasks, performance measures, and knowledges, skills, and abilities required to successfully perform in a given occupation or field.

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Gael, S. (1983). *Job Analysis – A guide to assessing work activities*.

It is understood that all of the information contained in the performance measures may or may not be included in course development or assessment development for a variety of logical and pragmatic reasons. From a logic perspective, individuals that can perform all of the performance measures as described are demonstrating 100% performance; far beyond what is required at a mastery level (the training is designed to meet the journey level). Also, from a pragmatic standpoint, not all performance measures can be addressed in training given the varied resource constraints of the different regions and training facilities.

Instructional designers use this information as the basis for the development of training objectives from which to create standards-based industry curriculum. Attainment of training objectives provides reasonable evidence that an individual has the knowledge and ability to perform the job to expectations in the field.

Certification assessment developers also use the performance measures as input into the development of certification assessments. This information is used to create assessments that, where feasible, can measure the degree to which an individual possesses the knowledges, skills and abilities to carry out key aspects of the job as measured against the performance level specified in the performance measure.

**Knowledges, Skills, and Abilities** – According to the US Office of Personnel Management, Knowledges, Skills, and Abilities (KSAs) are the attributes required to perform a job.

- Knowledge - Is a body of information applied directly to the performance of a function.
- Skill - Is an observable competence to perform a learned psychomotor act.
- Ability - Is competence to perform an observable behavior or a behavior that results in an observable product.



## Job Description

The CCL will install some or all of the components of a solar thermal or photo-voltaic system as directed specific to the job. The installations may be for residential, commercial or utility projects. The locations may be pitched roofs, flat roofs, ground array, or large solar farms. Job tasks performed by the CCL on these sites may include, but not be limited to: grubbing and clearing; excavation, trenching and backfilling; installation of pipe or conduit below or above ground; building access roads; installing site security measures; traffic control on site and off site as needed for access/egress, site preparation, forming, placement and finishing of concrete for any purpose; layout of array(s); installation of posts of all types as required by specifications; installation of racking system(s) and all components as specified; bending and installing conduit or thermal piping as specified; pulling wires as required by the job; installing and securing panels to racking system(s) as specified, including any additional components such as string converters; test or assist with testing of the system; final cleanup and landscaping of site as specified. Note that these tasks will vary by region and contractor.

## Skills Standards

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## Conduct Worker Safety and Preparation Activities Function

**CCLs participate in work site safety meetings and review the work plan, activities, goals and risks before gathering task specific tools, equipment and material to begin work. CCLs observe the project area to identify problems or safety concerns, locate safety equipment, don PPE and ensure safety procedures, e.g., fall protection, barriers, are in place.**

### Critical Tasks

*The following tasks provide a more detailed understanding of this function and are in descending order of a combination of difficulty and frequency.*

1. Ensures safety procedures are in place, e.g., fall protection, trench boxes, barriers, signage.
2. Dons and doffs appropriate protective equipment/clothing based on the needs of the project area and risk assessment.
3. Observes the project area to determine any concerns/issues that could negatively affect the project/goals, e.g., safety concerns.
4. Gathers task specific tools, equipment and materials based on the work to be performed.
5. Locates work site safety equipment, e.g., fire extinguishers, first aid kit.
6. Reviews/understands the work plan, activities and goals and associated hazards/risks.
7. Participates in/attend work site safety meeting.

### Performance Measures

*These Measures are not intended to address every critical task. Further, in some cases the Measure covers more than one task. Finally, some tasks did not meet the decision criteria for inclusion as a Performance Measure.*

1. The CCL will, given a simulated work area that requires a specific safety procedure, e.g., fall protection, trench boxes, barriers, signage, ensure the appropriate procedure is in place with 100% accuracy within a specified time frame.
2. The CCL will, given the appropriate protective equipment/clothing based on the needs of the project area and risk assessment, correctly don and doff the protective equipment/clothing with 100% accuracy within a specified time frame.
3. The CCL will, given a simulated project area or photos of same, identify any concerns/issues that could negatively affect the project/goals, e.g., safety concerns, with 100% accuracy within a specified time frame.
4. The CCL will, given a selection of tools, equipment and materials, gather task specific tools, equipment and materials based on the work to be performed with 100% accuracy within a specified timeframe.

5. The CCL will, given a simulated project area and a selection of safety equipment, locate and identify said equipment, e.g., fire extinguishers, first aid kit, with 100% accuracy within a specified time frame.
6. The CCL will participate in a review of the work plan, activities and goals and associated hazards/risks and recount the same with 100% accuracy within a specified time frame.
7. The CCL will participate in a daily work/safety briefing and restate the topics covered with 100% accuracy within a specified time frame.

## **Critical Knowledges, Skills and Abilities (KSAs)**

*The following critical KSAs are linked to the critical tasks and are provided in descending order of importance and the number of linkages to tasks listed for the “Conduct Worker Safety and Preparation Activities” function. The number in parentheses represents the sum of the number of linkages to tasks listed for “Conduct Worker Safety and Preparation Activities” function.*

1. **Knowledge of proper clothing and conduct** - Knowledge of the proper clothing and behavior necessary for a construction environment, e.g., proper clothing, conduct. (42)
2. **Properly inspects, uses and dons PPE** - Skill in the proper inspection, use and donning of PPE associated with working in a construction environments. (42)
3. **Willingness to communicate** - Ability and willingness to communicate with coworkers, supervisors, etc., sufficient to discuss work related requirements, provide information on work tasks, hazards, and/or inform of status and/or issues. (42)
4. **Willingness to learn** - Ability and willingness to learn new information and work tasks to perform activities in a construction environment. (42)
5. **Performs work individually and as a member of a team** - Ability and willingness to perform work individually and as a member of a team to achieve both quality and quantity goals. (42)
6. **Follows directions** - Ability to follow directions, instructions, rules, policies and/or procedures correctly and in order. (42)
7. **Uses one's senses** - Ability to use one's senses to include one or more of the following based on job demands: to feel heat and cold; to feel vibrations; to perceive colors; to have a sense of smell; to have visual acuity; to recognize changes in pitch or sounds; to recognize a potentially hazardous/dangerous situation. (42)
8. **Works in various types of environments and weather** - Ability to work in one or more of the following environments based on job demands: at height, below grade, enclosed space, inclement weather, polluted air, in the field and/or other types of conditions. (42)
9. **Knowledge of the threats to personal safety** - Knowledge of the threats to personal safety posed by PV systems, e.g., electrical shock, solar glare/sun damage, cuts from exposed glass edges. (40)
10. **Knowledge of the federal and state laws and regulations** - Knowledge of the applicable federal and state laws and regulations, e.g., applicable areas of the CFR, OSHA, or similar codes/laws. (36)
11. **Knowledge of PPE** - Knowledge in the proper inspection, use and donning of PPE associated with working in a construction environments. (34)
12. **Knowledge of various threats/hazards** - Knowledge of various threats/hazards posed by potential utility services within a construction environment, e.g., electrical, water/sewer, gas. (33)
13. **Reads, interprets, and uses plans, drawings and documents** - Skill in the use of basic concepts of plans and drawings, etc. sufficient to be able to read and interpret these documents for use at the work site. (33)
14. **Knowledge of safe work practices** - Knowledge of safe work practices within a construction environment in order to protect oneself and others, e.g., eliminating injuries, use of life safety measures, rules for entering and exiting the work area (including lunch breaks), etc. (32)
15. **Knowledge of techniques for preparing areas for roof installation** - Knowledge of the use of various techniques for preparing the area for roof installation, e.g., replace/reinforce roofing components, relocating services. (29)

16. **Knowledge of techniques, tools and equipment used for installing solar panels** - Knowledge of the techniques and tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations to include the use of proper materials, e.g., galvanic corrosion protection, proper caulking. (29)
17. **Reads and understands written materials** - Ability to read and/or understand written materials appropriate to the level required by the job. (29)
18. **Knowledge of various physical hazards** - Knowledge of various physical hazards within a construction environment, e.g., falls, struck by, cuts. (27)
19. **Knowledge of common tools, devices and accessories** - Knowledge of the common devices used in solar panel installations, e.g., solar water panels, solar PV panels, associated equipment/devices. (26)
20. **Plans and sets up materials on a worksite**- Skill in planning and setting up materials on a worksite and selecting them as necessary in daily/weekly work, e.g., staging materials. (26)
21. **Applies various safety procedures/processes** - Skill in the application of various safety procedures/processes in working with and around solar installations, e.g., electrical shock. (26)
22. **Knowledge of techniques for preparing areas for ground installation** - Knowledge of the use of various techniques for preparing the area for ground installation, e.g., clearing, excavating for trenches, footers/foundations. (22)
23. **Knowledge of the basic concepts of plans and drawings** - Knowledge of the basic concepts of plans and drawings, etc. sufficient to be able to read and interpret these documents for use at the work site. (20)
24. **Properly uses common devices** - Skill in the use of common devices used in solar panel installations, e.g., solar water panels, solar PV panels, associated equipment/devices. (18)
25. **Uses various measuring devices and tools** - Skill in the use of various measuring devices and tools, e.g., steel tape, electronic digital measuring devices. (18)
26. **Properly uses tools and equipment in solar panel installations** - Skill in the use of tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations. (18)
27. **Uses hand and power tools** - Skill in the use of hand and hand power tools and materials to perform construction related tasks, e.g., building/mounting frames, assembly, demolition, disassembly. (17)
28. **Knowledge in the use of hand and power tools** - Knowledge in the use of hand and hand power tools and materials to perform construction related tasks, e.g., building/mounting frames, assembly. (13)
29. **Knowledge in construction referencing systems** - Knowledge in construction referencing systems, e.g., offset stakes, slope/grade stakes. (13)
30. **Uses construction referencing systems** - Skill in the use of construction referencing systems, e.g., offset stakes, slope/grade stakes. (12)
31. **Utilizes motor skills and hand-eye coordination** - Ability to manipulate objects with one's hands; to make coordinated eye and hand movements with precision and speed; to use fine motor skills in the daily performance of work. (12)
32. **Demonstrates physical flexibility** - Ability to bend, stretch, twist, balance body, or reach out with the body, arms, or legs; to move the limbs quickly and easily; to demonstrate physical flexibility. (12)
33. **Performs basic math** - Ability to perform basic math. (10)
34. **Knowledge of the use of various measuring devices and tools** - Knowledge of the use of various measuring devices and tools, e.g., steel tape, electronic digital measuring devices. (6)
35. **Moves heavy objects** - Ability to lift, carry, push or pull heavy objects. (6)
36. **Exerts oneself physically** - Ability to exert oneself physically over a long period of time. (6)

## Conduct Work Site Preparation Activities Function

**CCLs use basic construction drawings and construction referencing systems to determine project layout and to establish line and grade and support equipment operators in making the correct cut or fill. CCLs locate existing utilities and excavate ground to specification. CCLs clear the area for ground installation, prepare the area to receive loads, unload and stage materials and install worksite protections.**

### Critical Tasks

*The following tasks provide a more detailed understanding of this function and are in descending order of a combination of difficulty and frequency.*

1. Establishes and maintains line and grade, e.g., locating footings, pads.
2. Excavates ground to specifications, e.g., hand digging, assists machine operation.
3. Checks grade to support equipment operator in making the correct cut or fill, e.g., places stakes referencing the amount of cut/fill left.
4. Uses basic construction drawings to determine project layout, e.g., diagrams, drawings.
5. Uses construction referencing systems to provide location information on stakes, e.g., witness stakes, batter boards.
6. Locates existing utilities, e.g., electric, sewer, storm water.
7. Builds/installs forms for concrete, e.g., footings, foundation for mounting systems.
8. Prepares area to receive loads, e.g., clears area, is aware of load movement and hazards.
9. Installs worksite protections, e.g., barricades, warning tape, guard rails, drop netting.
10. Unloads and stages materials related to the solar installation, e.g., panels, conduit, frames, mounting systems.
11. Clears area for ground installation, e.g., removes trees and vegetation, grubs, rakes.

## Performance Measures

*These Measures are not intended to address every critical task. Further, in some cases the Measure covers more than one task. Finally, some tasks did not meet the decision criteria for inclusion as a Performance Measure.*

1. The CCL will, given a simulated project area and plans, establish and maintain line and grade (e.g., locating footings, pads) with 100% accuracy within a specified time frame.
2. The CCL will, given a simulated project area, gather the necessary tools and equipment and excavate ground to identified specifications, e.g., hand digging and/or assisting with machine operation, with 100% accuracy within a specified time frame.
3. The CCL will, given a simulated project area, demonstrate how to check grade to support equipment operator in making the correct cut or fill (e.g., places stakes referencing the amount of cut or fill left) with 100% accuracy within a specified time frame.
4. The CCL will, given a simulated project area and relevant construction drawings, determine the project layout with 100% accuracy within a specified time frame.
5. The CCL will, given a simulated project area and relevant construction referencing systems, provide location information on stakes (e.g., witness stakes, batter boards) with 100% accuracy within a specified time frame.
6. The CCL will, given a simulated project area, locate existing utilities, e.g., electric, sewer, storm water, with 100% accuracy within a specified time frame.
7. The CCL will, given a simulated project area and the appropriate equipment, build and/or install a form for concrete (e.g., footings, foundation for mounting systems) with 100% accuracy within a specified time frame.
8. The CCL will, given a simulated project area, prepare area to receive loads (e.g., clear area, be aware of load movement and hazards) with 100% accuracy within a specified time frame.
9. The CCL will, given a simulated project area and the appropriate equipment, install worksite protections relevant to the project (e.g., barricades, warning tape, guard rails, drop netting) with 100% accuracy within a specified time frame.
10. The CCL will, given relevant materials and an identified location, unload and stage materials related to the solar installation (e.g., panels, conduit, frames, mounting systems) with 100% accuracy within a specified time frame.
11. The CCL will, given a simulated project area, clear an area for ground installation according to specified instructions (e.g., remove trees and vegetation, grub, rake) with 100% accuracy within a specified time frame.

## Critical Knowledges, Skills and Abilities (KSAs)

*The following critical KSAs are linked to the critical tasks and are provided in descending order of importance and the number of linkages to tasks listed for the “Conduct Work Site Preparation Activities” function. The number in parentheses represents the sum of the number of linkages to tasks listed for “Conduct Work Site Preparation Activities” function.*

1. **Knowledge of proper clothing and conduct** - Knowledge of the proper clothing and behavior necessary for a construction environment, e.g., proper clothing, conduct. (66)
2. **Knowledge of techniques, tools and equipment used for installing solar panels** - Knowledge of the techniques and tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations to include the use of proper materials, e.g., galvanic corrosion protection, proper caulking. (66)
3. **Properly inspects, uses and dons PPE** - Skill in the proper inspection, use and donning of PPE associated with working in a construction environments. (66)
4. **Reads, interprets, and uses plans, drawings and documents** - Skill in the use of basic concepts of plans and drawings, etc. sufficient to be able to read and interpret these documents for use at the work site. (66)
5. **Willingness to communicate** - Ability and willingness to communicate with coworkers, supervisors, etc., sufficient to discuss work related requirements, provide information on work tasks, hazards, and/or inform of status and/or issues. (66)
6. **Willingness to learn** - Ability and willingness to learn new information and work tasks to perform activities in a construction environment. (66)
7. **Performs work individually and as a member of a team** - Ability and willingness to perform work individually and as a member of a team to achieve both quality and quantity goals. (66)
8. **Follows directions** - Ability to follow directions, instructions, rules, policies and/or procedures correctly and in order. (66)
9. **Uses one's senses** - Ability to use one's senses to include one or more of the following based on job demands: to feel heat and cold; to feel vibrations; to perceive colors; to have a sense of smell; to have visual acuity; to recognize changes in pitch or sounds; to recognize a potentially hazardous/dangerous situation. (66)
10. **Works in various types of environments and weather** - Ability to work in one or more of the following environments based on job demands: at height, below grade, enclosed space, inclement weather, polluted air, in the field and/or other types of conditions. (66)
11. **Knowledge in construction referencing systems** - Knowledge in construction referencing systems, e.g., offset stakes, slope/grade stakes. (60)
12. **Uses construction referencing systems** - Skill in the use of construction referencing systems, e.g., offset stakes, slope/grade stakes. (56)
13. **Uses signaling and communication methods** - Skill in use of signaling and communication methods when communicating with others in the work zone, e.g., moving, hoisting equipment. (54)
14. **Utilizes motor skills and hand-eye coordination** - Ability to manipulate objects with one's hands; to make coordinated eye and hand movements with precision and speed; to use fine motor skills in the daily performance of work. (54)
15. **Demonstrates physical flexibility** - Ability to bend, stretch, twist, balance body, or reach out with the body, arms, or legs; to move the limbs quickly and easily; to demonstrate physical flexibility. (54)
16. **Moves heavy objects** - Ability to lift, carry, push or pull heavy objects. (54)
17. **Exerts oneself physically** - Ability to exert oneself physically over a long period of time. (54)
18. **Knowledge of PPE** - Knowledge in the proper inspection, use and donning of PPE associated with working in a construction environments. (52)
19. **Uses various measuring devices and tools** - Skill in the use of various measuring devices and tools, e.g., steel tape, electronic digital measuring devices. (51)
20. **Performs basic math** - Ability to perform basic math. (51)
21. **Uses hand and power tools** - Skill in the use of hand and hand power tools and materials to perform construction related tasks, e.g., building/mounting frames, assembly, demolition, disassembly. (50)
22. **Knowledge of the use of signaling and communication methods** - Knowledge of the use of signaling and communication methods when communicating with others in the work zone, e.g., setting ballast. (49)
23. **Reads and understands written materials** - Ability to read and/or understand written materials appropriate to the level required by the job. (49)



24. **Knowledge of the basic concepts of plans and drawings** - Knowledge of the basic concepts of plans and drawings, etc. sufficient to be able to read and interpret these documents for use at the work site. (47)
25. **Knowledge of safe work practices** - Knowledge of safe work practices within a construction environment in order to protect oneself and others, e.g., eliminating injuries, use of life safety measures, rules for entering and exiting the work area (including lunch breaks), etc. (46)
26. **Knowledge of various physical hazards** - Knowledge of various physical hazards within a construction environment, e.g., falls, struck by, cuts. (46)
27. **Knowledge of techniques for preparing areas for ground installation** - Knowledge of the use of various techniques for preparing the area for ground installation, e.g., clearing, excavating for trenches, footers/foundations. (43)
28. **Knowledge of various threats/hazards** - Knowledge of various threats/hazards posed by potential utility services within a construction environment, e.g., electrical, water/sewer, gas. (41)
29. **Knowledge of the use of various measuring devices and tools** - Knowledge of the use of various measuring devices and tools, e.g., steel tape, electronic digital measuring devices. (40)
30. **Knowledge in the use of hand and power tools** - Knowledge in the use of hand and hand power tools and materials to perform construction related tasks, e.g., building/mounting frames, assembly. (39)
31. **Knowledge of techniques for preparing areas for roof installation** - Knowledge of the use of various techniques for preparing the area for roof installation, e.g., replace/reinforce roofing components, relocating services. (39)
32. **Plans and sets up materials on a worksite** - Skill in planning and setting up materials on a worksite and selecting them as necessary in daily/weekly work, e.g., staging materials. (35)
33. **Knowledge of the threats to personal safety** - Knowledge of the threats to personal safety posed by PV systems, e.g., electrical shock, solar glare/sun damage, cuts from exposed glass edges. (33)
34. **Knowledge of the federal and state laws and regulations** - Knowledge of the applicable federal and state laws and regulations, e.g., applicable areas of the CFR, OSHA, or similar codes/laws. (20)

## Conduct Mounting System Installation Activities Function

CCLs locate mounting system parts and hardware and install the mounting system and panel supports as per manufacturers recommendation and code requirements. CCLs use fasteners to secure the mounting system to foundations or roof structural members as per plan. CCLs maintain awareness of the presence or lack of various required components, e.g., bonding, grounding components.

### Critical Tasks

*The following tasks provide a more detailed understanding of this function and are in descending order of a combination of difficulty and frequency.*

1. Installs mounting systems, frames, brackets, supports for panels as per manufacturers recommendation and/or code requirements, e.g., on flat/pitched roofs, ground.
2. Secures mounting systems/frames, e.g., using fasteners to attach to foundation, roof structural members, as per plan.
3. Locates mounting systems parts and hardware, e.g., brackets, mounts, clips, nuts, bolts.
4. Maintains awareness of the presence (or lack thereof) of various required components, e.g., bonding, grounding.

### Performance Measures

*These Measures are not intended to address every critical task. Further, in some cases the Measure covers more than one task. Finally, some tasks did not meet the decision criteria for inclusion as a Performance Measure.*

1. The CCL will, given a simulated project area, project description and the appropriate equipment, install mounting system, frames, brackets, and supports for panels as per manufacturer's recommendation and/or code requirements (e.g., on flat/pitched roofs, ground) with 100% accuracy within a specified time frame.
2. The CCL will, given a simulated project area, project description and the appropriate mounting systems/frames secure mounting systems/frames as per plan (e.g., using fasteners to attach to foundation, roof structural members) with 100% accuracy within a specified time frame.
3. The CCL will, given a simulated project area, project description and mounting systems parts and hardware (e.g., brackets, mounts, clips, nuts, bolts) or photos of supplies, locate the appropriate mounting systems parts and hardware with 100% accuracy within a specified time frame.

## Critical Knowledges, Skills and Abilities (KSAs)

*The following critical KSAs are linked to the critical tasks and are provided in descending order of importance and the number of linkages to tasks listed for the “Conduct Mounting System Installation Activities” function. The number in parentheses represents the sum of the number of linkages to tasks listed for “Conduct Mounting System Installation Activities” function.*

1. **Knowledge of proper clothing and conduct** - Knowledge of the proper clothing and behavior necessary for a construction environment, e.g., proper clothing, conduct. (24)
2. **Properly inspects, uses and dons PPE** - Skill in the proper inspection, use and donning of PPE associated with working in a construction environments. (24)
3. **Willingness to communicate** - Ability and willingness to communicate with coworkers, supervisors, etc., sufficient to discuss work related requirements, provide information on work tasks, hazards, and/or inform of status and/or issues. (24)
4. **Willingness to learn** - Ability and willingness to learn new information and work tasks to perform activities in a construction environment. (24)
5. **Performs work individually and as a member of a team** - Ability and willingness to perform work individually and as a member of a team to achieve both quality and quantity goals. (24)
6. **Follows directions** - Ability to follow directions, instructions, rules, policies and/or procedures correctly and in order. (24)
7. **Uses one's senses** - Ability to use one's senses to include one or more of the following based on job demands: to feel heat and cold; to feel vibrations; to perceive colors; to have a sense of smell; to have visual acuity; to recognize changes in pitch or sounds; to recognize a potentially hazardous/dangerous situation. (24)
8. **Works in various types of environments and weather** - Ability to work in one or more of the following environments based on job demands: at height, below grade, enclosed space, inclement weather, polluted air, in the field and/or other types of conditions. (24)
9. **Knowledge of PPE** - Knowledge in the proper inspection, use and donning of PPE associated with working in a construction environments. (23)
10. **Knowledge of safe work practices** - Knowledge of safe work practices within a construction environment in order to protect oneself and others, e.g., eliminating injuries, use of life safety measures, rules for entering and exiting the work area (including lunch breaks), etc. (23)
11. **Knowledge of common tools, devices and accessories** - Knowledge of the common devices used in solar panel installations, e.g., solar water panels, solar PV panels, associated equipment/devices. (19)
12. **Reads, interprets, and uses plans, drawings and documents** - Skill in the use of basic concepts of plans and drawings, etc. sufficient to be able to read and interpret these documents for use at the work site. (19)
13. **Knowledge of the threats to personal safety** - Knowledge of the threats to personal safety posed by PV systems, e.g., electrical shock, solar glare/sun damage, cuts from exposed glass edges. (18)
14. **Properly uses common devices** - Skill in the use of common devices used in solar panel installations, e.g., solar water panels, solar PV panels, associated equipment/devices. (18)
15. **Properly uses tools and equipment in solar panel installations** - Skill in the use of tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations. (18)
16. **Reads and understands written materials** - Ability to read and/or understand written materials appropriate to the level required by the job. (18)
17. **Utilizes motor skills and hand-eye coordination** - Ability to manipulate objects with one's hands; to make coordinated eye and hand movements with precision and speed; to use fine motor skills in the daily performance of work. (18)
18. **Demonstrates physical flexibility** - Ability to bend, stretch, twist, balance body, or reach out with the body, arms, or legs; to move the limbs quickly and easily; to demonstrate physical flexibility. (18)
19. **Moves heavy objects** - Ability to lift, carry, push or pull heavy objects. (18)

20. **Exerts oneself physically** - Ability to exert oneself physically over a long period of time. (18)
21. **Knowledge of techniques, tools and equipment used for installing solar panels** - Knowledge of the techniques and tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations to include the use of proper materials, e.g., galvanic corrosion protection, proper caulking. (17)
22. **Applies various safety procedures/processes** - Skill in the application of various safety procedures/processes in working with and around solar installations, e.g., electrical shock. (15)
23. **Knowledge of techniques for preparing areas for roof installation** - Knowledge of the use of various techniques for preparing the area for roof installation, e.g., replace/reinforce roofing components, relocating services. (12)
24. **Uses hand and power tools** - Skill in the use of hand and hand power tools and materials to perform construction related tasks, e.g., building/mounting frames, assembly, demolition, disassembly. (12)
25. **Knowledge of the use of signaling and communication methods** - Knowledge of the use of signaling and communication methods when communicating with others in the work zone, e.g., setting ballast. (11)
26. **Uses signaling and communication methods** - Skill in use of signaling and communication methods when communicating with others in the work zone, e.g., moving, hoisting equipment. (11)
27. **Uses construction referencing systems** - Skill in the use of construction referencing systems, e.g., offset stakes, slope/grade stakes. (8)
28. **Uses various measuring devices and tools** - Skill in the use of various measuring devices and tools, e.g., steel tape, electronic digital measuring devices. (6)

## Conduct Ancillary System and Component Installation Activities Function

**CCLs locate the balance (rest of) system components to include pipes, conduits, check valves, relief valves, temperature sensors, wiring, controllers, pumps, antifreeze, housing boxes, micro-inverters, system optimizers, etc. CCLs assemble or install the balance of system components as per manufacturer's recommendation and plans, seal all openings or through holes, and prepare the location to receive switch gear or inverters.**

### Critical Tasks

*The following tasks provide a more detailed understanding of this function and are in descending order of a combination of difficulty and frequency.*

1. Assembles/installs balance of system components as per manufacturer's recommendation and/or plans, e.g., runs/attaches conduit or pipe, attaches housing boxes, attaches sensors, affixes valves, mixes antifreeze solutions, installs micro-inverters and system optimizers.
2. Seals all openings/through holes, e.g., roofs, decks, walls, junctions.
3. Prepares location to receive switch gear, inverters, e.g., installs pads, frames.
4. Locates balance of system components, e.g., pipes, conduits, check valves, relief valves, temperature sensors, wiring, controllers, pumps, antifreeze, housing boxes, micro-inverters, system optimizers, etc.

### Performance Measures

*These Measures are not intended to address every critical task. Further, in some cases the Measure covers more than one task. Finally, some tasks did not meet the decision criteria for inclusion as a Performance Measure.*

1. The CCL will, given a simulated project area, project description and the appropriate equipment and tools, assemble/install a specified set of system components as per manufacturer's recommendation and/or plans (e.g., run/attach conduit or pipe, attach housing boxes, attach sensors, affix valves, mix antifreeze solutions, install micro-inverters and system optimizers) with 100% accuracy within a specified time frame.
2. The CCL will, given a simulated project area with a pre-determined set of openings and through holes, seal them per instructions, with 100% accuracy within a specified time frame.
3. The CCL will, given a simulated project area, prepare location to receive switch gear and inverters (e.g., install pads, frames) with 100% accuracy within a specified time frame.
4. The CCL will, given a simulated project area and project description, locate specified system components (e.g., pipes, conduits, check valves, relief valves, temperature sensors, wiring, controllers, pumps, antifreeze, housing boxes, micro-inverters, system optimizers, etc.) with 100% accuracy within a specified time frame.

## Critical Knowledges, Skills and Abilities (KSAs)

*The following critical KSAs are linked to the critical tasks and are provided in descending order of importance and the number of linkages to tasks listed for the “Conduct Ancillary System and Component Installation Activities” function. The number in parentheses represents the sum of the number of linkages to tasks listed for “Conduct Ancillary System and Component Installation Activities” function.*

1. **Knowledge of safe work practices** - Knowledge of safe work practices within a construction environment in order to protect oneself and others, e.g., eliminating injuries, use of life safety measures, rules for entering and exiting the work area (including lunch breaks), etc. (24)
2. **Knowledge of proper clothing and conduct** - Knowledge of the proper clothing and behavior necessary for a construction environment, e.g., proper clothing, conduct. (24)
3. **Properly inspects, uses and dons PPE** - Skill in the proper inspection, use and donning of PPE associated with working in a construction environments. (24)
4. **Uses hand and power tools** - Skill in the use of hand and hand power tools and materials to perform construction related tasks, e.g., building/mounting frames, assembly, demolition, disassembly. (24)
5. **Willingness to communicate** - Ability and willingness to communicate with coworkers, supervisors, etc., sufficient to discuss work related requirements, provide information on work tasks, hazards, and/or inform of status and/or issues. (24)
6. **Willingness to learn** - Ability and willingness to learn new information and work tasks to perform activities in a construction environment. (24)
7. **Performs work individually and as a member of a team** - Ability and willingness to perform work individually and as a member of a team to achieve both quality and quantity goals. (24)
8. **Follows directions** - Ability to follow directions, instructions, rules, policies and/or procedures correctly and in order. (24)
9. **Utilizes motor skills and hand-eye coordination** - Ability to manipulate objects with one’s hands; to make coordinated eye and hand movements with precision and speed; to use fine motor skills in the daily performance of work. (24)
10. **Demonstrates physical flexibility** - Ability to bend, stretch, twist, balance body, or reach out with the body, arms, or legs; to move the limbs quickly and easily; to demonstrate physical flexibility. (24)
11. **Moves heavy objects** - Ability to lift, carry, push or pull heavy objects. (24)
12. **Exerts oneself physically** - Ability to exert oneself physically over a long period of time. (24)
13. **Uses one's senses** - Ability to use one's senses to include one or more of the following based on job demands: to feel heat and cold; to feel vibrations; to perceive colors; to have a sense of smell; to have visual acuity; to recognize changes in pitch or sounds; to recognize a potentially hazardous/dangerous situation. (24)
14. **Works in various types of environments and weather** - Ability to work in one or more of the following environments based on job demands: at height, below grade, enclosed space, inclement weather, polluted air, in the field and/or other types of conditions. (24)
15. **Knowledge of techniques, tools and equipment used for installing solar panels** - Knowledge of the techniques and tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations to include the use of proper materials, e.g., galvanic corrosion protection, proper caulking. (23)
16. **Knowledge of PPE** - Knowledge in the proper inspection, use and donning of PPE associated with working in a construction environments. (22)
17. **Knowledge of the threats to personal safety** - Knowledge of the threats to personal safety posed by PV systems, e.g., electrical shock, solar glare/sun damage, cuts from exposed glass edges. (20)
18. **Knowledge of techniques for preparing areas for roof installation** - Knowledge of the use of various techniques for preparing the area for roof installation, e.g., replace/reinforce roofing components, relocating services. (20)

19. **Reads and understands written materials** - Ability to read and/or understand written materials appropriate to the level required by the job. (19)
20. **Reads, interprets, and uses plans, drawings and documents** - Skill in the use of basic concepts of plans and drawings, etc. sufficient to be able to read and interpret these documents for use at the work site. (18)
21. **Knowledge of various physical hazards** - Knowledge of various physical hazards within a construction environment, e.g., falls, struck by, cuts. (15)
22. **Properly uses common devices** - Skill in the use of common devices used in solar panel installations, e.g., solar water panels, solar PV panels, associated equipment/devices. (14)
23. **Properly uses tools and equipment in solar panel installations** - Skill in the use of tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations. (14)
24. **Plans and sets up materials on a worksite** - Skill in planning and setting up materials on a worksite and selecting them as necessary in daily/weekly work, e.g., staging materials. (13)
25. **Applies various safety procedures/processes** - Skill in the application of various safety procedures/processes in working with and around solar installations, e.g., electrical shock. (13)
26. **Uses signaling and communication methods** - Skill in use of signaling and communication methods when communicating with others in the work zone, e.g., moving, hoisting equipment. (12)
27. **Knowledge of the use of signaling and communication methods** - Knowledge of the use of signaling and communication methods when communicating with others in the work zone, e.g., setting ballast. (11)
28. **Knowledge in construction referencing systems** - Knowledge in construction referencing systems, e.g., offset stakes, slope/grade stakes. (10)
29. **Uses various measuring devices and tools** - Skill in the use of various measuring devices and tools, e.g., steel tape, electronic digital measuring devices. (10)
30. **Uses construction referencing systems** - Skill in the use of construction referencing systems, e.g., offset stakes, slope/grade stakes. (10)

## Conduct Solar Panel Mounting Activities Function

**CCLs place and attach solar panels on mounting systems using fasteners according to plan. CCLs install associated piping or conduit, install wiring harness, bundles, bonding, grounding on or between solar panels according to plan.**

### Critical Tasks

*The following tasks provide a more detailed understanding of this function and are in descending order of a combination of difficulty and frequency.*

1. Installs/places associated piping and/or conduit.
2. Places solar panels on mounting systems according to plan.
3. Installs/places wiring, e.g., wiring harnesses, bundles, bondings, groundings, between solar panels as per plan.
4. Attaches solar panels to mounting system, e.g., frames, brackets, using fasteners according to manufacturers' recommendation and/or code requirements.

### Performance Measures

*These Measures are not intended to address every critical task. Further, in some cases the Measure covers more than one task. Finally, some tasks did not meet the decision criteria for inclusion as a Performance Measure.*

1. The CCL will, given a simulated project area and the appropriate equipment and tools, install/place associated piping and/or conduit with 100% accuracy within a specified time frame.
2. The CCL will, given a simulated project area and solar panels or mockups of the same, place solar panels on mounting systems according to specified plan with 100% accuracy within a specified time frame.
3. The CCL will, given a simulated project area and solar panels or mockups of the same, install/place wiring (e.g., wiring harnesses, bundles, bondings, groundings) between solar panels as per specified plan with 100% accuracy within a specified time frame.
4. The CCL will, given a simulated project area and the appropriate equipment and tools, attach solar panels to mounting system (e.g., frames, brackets) using fasteners according to manufacturer's recommendation and/or code requirements with 100% accuracy within a specified time frame.



## Critical Knowledges, Skills and Abilities (KSAs)

*The following critical KSAs are linked to the critical tasks and are provided in descending order of importance and the number of linkages to tasks listed for the “Conduct Solar Panel Mounting Activities” function. The number in parentheses represents the sum of the number of linkages to tasks listed for “Conduct Solar Panel Mounting Activities” function.*

1. **Knowledge of PPE** - Knowledge in the proper inspection, use and donning of PPE associated with working in a construction environments. (24)
2. **Knowledge of safe work practices** - Knowledge of safe work practices within a construction environment in order to protect oneself and others, e.g., eliminating injuries, use of life safety measures, rules for entering and exiting the work area (including lunch breaks), etc. (24)
3. **Knowledge of proper clothing and conduct** - Knowledge of the proper clothing and behavior necessary for a construction environment, e.g., proper clothing, conduct. (24)
4. **Knowledge of the threats to personal safety** - Knowledge of the threats to personal safety posed by PV systems, e.g., electrical shock, solar glare/sun damage, cuts from exposed glass edges. (24)
5. **Knowledge of techniques for preparing areas for roof installation** - Knowledge of the use of various techniques for preparing the area for roof installation, e.g., replace/reinforce roofing components, relocating services. (24)
6. **Knowledge of techniques, tools and equipment used for installing solar panels** - Knowledge of the techniques and tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations to include the use of proper materials, e.g., galvanic corrosion protection, proper caulking. (24)
7. **Properly inspects, uses and dons PPE** - Skill in the proper inspection, use and donning of PPE associated with working in a construction environments. (24)
8. **Reads, interprets, and uses plans, drawings and documents** - Skill in the use of basic concepts of plans and drawings, etc. sufficient to be able to read and interpret these documents for use at the work site. (24)
9. **Uses hand and power tools** - Skill in the use of hand and hand power tools and materials to perform construction related tasks, e.g., building/mounting frames, assembly, demolition, disassembly. (24)
10. **Properly uses common devices** - Skill in the use of common devices used in solar panel installations, e.g., solar water panels, solar PV panels, associated equipment/devices. (24)
11. **Properly uses tools and equipment in solar panel installations** - Skill in the use of tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations. (24)
12. **Applies various safety procedures/processes** - Skill in the application of various safety procedures/processes in working with and around solar installations, e.g., electrical shock. (24)
13. **Willingness to communicate** - Ability and willingness to communicate with coworkers, supervisors, etc., sufficient to discuss work related requirements, provide information on work tasks, hazards, and/or inform of status and/or issues. (24)
14. **Willingness to learn** - Ability and willingness to learn new information and work tasks to perform activities in a construction environment. (24)
15. **Performs work individually and as a member of a team** - Ability and willingness to perform work individually and as a member of a team to achieve both quality and quantity goals. (24)
16. **Follows directions** - Ability to follow directions, instructions, rules, policies and/or procedures correctly and in order. (24)
17. **Reads and understands written materials** - Ability to read and/or understand written materials appropriate to the level required by the job. (24)
18. **Utilizes motor skills and hand-eye coordination** - Ability to manipulate objects with one’s hands; to make coordinated eye and hand movements with precision and speed; to use fine motor skills in the daily performance of work. (24)

19. **Demonstrates physical flexibility** - Ability to bend, stretch, twist, balance body, or reach out with the body, arms, or legs; to move the limbs quickly and easily; to demonstrate physical flexibility. (24)
20. **Moves heavy objects** - Ability to lift, carry, push or pull heavy objects. (24)
21. **Exerts oneself physically** - Ability to exert oneself physically over a long period of time. (24)
22. **Uses one's senses** - Ability to use one's senses to include one or more of the following based on job demands: to feel heat and cold; to feel vibrations; to perceive colors; to have a sense of smell; to have visual acuity; to recognize changes in pitch or sounds; to recognize a potentially hazardous/dangerous situation. (24)
23. **Works in various types of environments and weather** - Ability to work in one or more of the following environments based on job demands: at height, below grade, enclosed space, inclement weather, polluted air, in the field and/or other types of conditions. (24)
24. **Knowledge of various physical hazards** - Knowledge of various physical hazards within a construction environment, e.g., falls, struck by, cuts. (22)
25. **Uses signaling and communication methods** - Skill in use of signaling and communication methods when communicating with others in the work zone, e.g., moving, hoisting equipment. (20)
26. **Knowledge of the use of signaling and communication methods** - Knowledge of the use of signaling and communication methods when communicating with others in the work zone, e.g., setting ballast. (8)

## Conduct Site Clean Up and Load Out Activities Function

**CCLs remove packing material and debris from installation area, store equipment and load equipment onto trucks or trailers for transport. CCLS restore the site by filling excavations, installing top soil, seeding or installing sod. CCLs deconstruct existing solar installations and maintain existing solar installations by replacing or repairing non-functioning components and performing system upkeep.**

### Critical Tasks

*The following tasks provide a more detailed understanding of this function and are in descending order of a combination of difficulty and frequency.*

1. Stores equipment properly, e.g., tools, ladders, safety equipment.
2. Removes packing material, cleans/sweeps/vacuums debris from installation activities
3. Restores site, e.g., fills excavations, compacts earth, installs top soil, seeds, installs sod.
4. Loads/secures equipment onto trucks, trailers, into containers for transport.
5. Maintains existing solar installations, e.g., replaces/repairs non-functioning components, performs upkeep.
6. De-constructs/demolishes existing solar installations, e.g., disassembles, sorts materials, stores materials, loads for transport.

### Performance Measures

*These Measures are not intended to address every critical task. Further, in some cases the Measure covers more than one task. Finally, some tasks did not meet the decision criteria for inclusion as a Performance Measure.*

1. The CCL will, given a simulated project area and various equipment (e.g., tools, ladders, safety equipment), store equipment according to the specified procedures with 100% accuracy within a specified time frame.
2. The CCL will, given a simulated project area and the appropriate equipment, remove packing material, clean, sweep or vacuum debris from installation activities with 100% accuracy within a specified time frame.
3. The CCL will, given a simulated project area and the appropriate equipment, restore site to specifications (e.g., fill excavations, compact earth, install top soil, seeds, install sod) with 100% accuracy within a specified time frame.
4. The CCL will, given a set of equipment, load and secure that equipment onto trucks, trailers and/or into containers for transport according to the specified procedures with 100% accuracy within a specified time frame.

5. The CCL will, given solar installations or mockups of the same, conduct identified maintenance tasks such as replace or repair non-functioning components, perform upkeep, with 100% accuracy within a specified time frame.
6. The CCL will, given solar installations or mockups of the same, de-construct or demolish existing solar installations according to specified procedures (e.g., disassemble, sort materials, store materials, load for transport) with 100% accuracy within a specified time frame.

## Critical Knowledges, Skills and Abilities (KSAs)

*The following critical KSAs are linked to the critical tasks and are provided in descending order of importance and the number of linkages to tasks listed for the “Conduct Site Clean Up and Load Out Activities” function. The number in parentheses represents the sum of the number of linkages to tasks listed for “Conduct Site Clean Up and Load Out Activities” function.*

1. **Knowledge of PPE** - Knowledge in the proper inspection, use and donning of PPE associated with working in a construction environments. (36)
2. **Knowledge of safe work practices** - Knowledge of safe work practices within a construction environment in order to protect oneself and others, e.g., eliminating injuries, use of life safety measures, rules for entering and exiting the work area (including lunch breaks), etc. (36)
3. **Knowledge of proper clothing and conduct** - Knowledge of the proper clothing and behavior necessary for a construction environment, e.g., proper clothing, conduct. (36)
4. **Properly inspects, uses and dons PPE** - Skill in the proper inspection, use and donning of PPE associated with working in a construction environments. (36)
5. **Uses hand and power tools** - Skill in the use of hand and hand power tools and materials to perform construction related tasks, e.g., building/mounting frames, assembly, demolition, disassembly. (36)
6. **Willingness to communicate** - Ability and willingness to communicate with coworkers, supervisors, etc., sufficient to discuss work related requirements, provide information on work tasks, hazards, and/or inform of status and/or issues. (36)
7. **Willingness to learn** - Ability and willingness to learn new information and work tasks to perform activities in a construction environment. (36)
8. **Performs work individually and as a member of a team** - Ability and willingness to perform work individually and as a member of a team to achieve both quality and quantity goals. (36)
9. **Follows directions** - Ability to follow directions, instructions, rules, policies and/or procedures correctly and in order. (36)
10. **Utilizes motor skills and hand-eye coordination** - Ability to manipulate objects with one’s hands; to make coordinated eye and hand movements with precision and speed; to use fine motor skills in the daily performance of work. (36)
11. **Demonstrates physical flexibility** - Ability to bend, stretch, twist, balance body, or reach out with the body, arms, or legs; to move the limbs quickly and easily; to demonstrate physical flexibility. (36)
12. **Moves heavy objects** - Ability to lift, carry, push or pull heavy objects. (36)
13. **Exerts oneself physically** - Ability to exert oneself physically over a long period of time. (36)
14. **Uses one's senses** - Ability to use one's senses to include one or more of the following based on job demands: to feel heat and cold; to feel vibrations; to perceive colors; to have a sense of smell; to have visual acuity; to recognize changes in pitch or sounds; to recognize a potentially hazardous/dangerous situation. (36)
15. **Works in various types of environments and weather** - Ability to work in one or more of the following environments based on job demands: at height, below grade, enclosed space, inclement weather, polluted air, in the field and/or other types of conditions. (36)

16. **Knowledge in the use of hand and power tools** - Knowledge in the use of hand and hand power tools and materials to perform construction related tasks, e.g., building/mounting frames, assembly. (30)
17. **Knowledge of various physical hazards** - Knowledge of various physical hazards within a construction environment, e.g., falls, struck by, cuts. (29)
18. **Uses signaling and communication methods** - Skill in use of signaling and communication methods when communicating with others in the work zone, e.g., moving, hoisting equipment. (26)
19. **Knowledge of the threats to personal safety** - Knowledge of the threats to personal safety posed by PV systems, e.g., electrical shock, solar glare/sun damage, cuts from exposed glass edges. (25)
20. **Reads and understands written materials** - Ability to read and/or understand written materials appropriate to the level required by the job. (25)
21. **Knowledge of the use of signaling and communication methods** - Knowledge of the use of signaling and communication methods when communicating with others in the work zone, e.g., setting ballast. (24)
22. **Knowledge of techniques for preparing areas for roof installation** - Knowledge of the use of various techniques for preparing the area for roof installation, e.g., replace/reinforce roofing components, relocating services. (21)
23. **Plans and sets up materials on a worksite** - Skill in planning and setting up materials on a worksite and selecting them as necessary in daily/weekly work, e.g., staging materials. (20)
24. **Applies various safety procedures/processes** - Skill in the application of various safety procedures/processes in working with and around solar installations, e.g., electrical shock. (18)
25. **Reads, interprets, and uses plans, drawings and documents** - Skill in the use of basic concepts of plans and drawings, etc. sufficient to be able to read and interpret these documents for use at the work site. (15)
26. **Knowledge of techniques, tools and equipment used for installing solar panels** - Knowledge of the techniques and tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations to include the use of proper materials, e.g., galvanic corrosion protection, proper caulking. (12)
27. **Properly uses common devices** - Skill in the use of common devices used in solar panel installations, e.g., solar water panels, solar PV panels, associated equipment/devices. (10)
28. **Properly uses tools and equipment in solar panel installations** - Skill in the use of tools/equipment used for affixing/attaching solar panels and related equipment used in ground installations, roof installations, and awning installations. (10)
29. **Uses construction referencing systems** - Skill in the use of construction referencing systems, e.g., offset stakes, slope/grade stakes. (9)
30. **Knowledge in construction referencing systems** - Knowledge in construction referencing systems, e.g., offset stakes, slope/grade stakes. (6)