Test 2 Maintenance and Operations

1. When a person arrives at the jobsite, a site assessment to the physical surroundings is observed. What are some of the site physical hazards?
   1. Clutter, garbage, or other material.
   2. Working from heights.
   3. Machinery
   4. Hot surfaces
   5. Animals
2. When a person arrives at the jobsite, a site assessment of the physical surroundings is observed. What are some of the site’s energy hazards?
   1. Battery / chemical.
   2. Sufficient current to burn or arc.
   3. Voltage sources to electrocute or arc flash.
   4. Rotational machinery.
   5. Wind, solar, hydro or pressures stored in a device.
3. Define safe work practices.
   1. Written methods outlining how to perform a task with minimum risk to people, equipment, materials, environment, and processes.
4. Define safe work procedures.
   1. A series of specific steps that guide a worker through a task from start to finish in chronological order.
5. Before deploying to the site personnel responsible for system maintenance should always do what?
   1. Review the system manuals prior to deploying to the site if possible.
   2. They should ensure that all maintenance parts and required tools are available for any on-site visits.
   3. Various spare parts should be on hand.
6. Upon arrival conduct a general inspection of the PV installation site. Name 7 conditions that would be looked for (bonus points for each addition answer up to 7 more).
   1. Is working from heights a consideration?
   2. If previous knowledge of site required scaffolding and ladders, they should be either on site or arranged to be there.
   3. Identify if Fall arrest PPE needs to be used.
   4. Check the tilt and orientation of the array.
   5. Is it part of the maintenance procedure?
   6. Has the tilt or orientation changed?
   7. Check to ensure roof penetrations are watertight, if applicable.
   8. Check and ensure roof drainage.
   9. Are the roof drains clogged?
   10. Check for signs of water pooling in the vicinity of the array.
   11. Check for vegetation growth or other shade items that will affect the performance of the array.
   12. Is ground erosion near the base / footings of a ground mount array evident.
   13. Are there signs of animal / bird infestation under or on the array.
   14. Check for debris from under or around the array, can it be removed?
7. When starting to do array maintenance, what assumption do you not make?
   1. The metal of electrical equipment is not grounded properly.
8. What visual checks are made when starting to do array maintenance? (10 listed, identify 5)
   1. Is the array (can be just one panel) in a readily accessible location?
   2. Working from heights consideration?
   3. Disconnection means accessible?
   4. Racking issues that are visible?
   5. Does the racking need to be repaired when first looked at?
   6. Take notes on accessibility, and any physical damage that is visible.
   7. Ladder or scaffolding required?
   8. Is the mounting structure safe to access?
   9. If the racking is easy to visually inspect check for corrosion or other defects.
   10. Loose racking components / brackets.
9. Identify what are the steps to checking if the equipment grounding conductor is working? (9 listed)
   1. Remove any load from the array.
   2. Isolate array.
   3. Test for bonding and equipment grounding.
   4. Visual check first.
   5. Lockout tagout, as necessary.
   6. Before touching any of the metal parts including the modules, look for the equipment grounding conductor.
   7. Is it securely fastened to the racking?
   8. Can you follow it back to where it is grounded?
   9. With a voltmeter check the voltage of the module frame and the grounding conductor, use both dc and ac scales.
10. The safe limit voltage to work on a system is?
    1. 30 volts.
11. Before any repairs are made the disconnecting means needs to be opened.
    1. True or False
12. With a voltmeter check the voltage of the module frame and the grounding conductor, use both dc and ac scales. If there is voltage the next step is to find where the voltage is coming from. What are these steps?
    1. All sources of voltage need to be isolated from each other.
    2. Then the source that is at fault can be repaired or if ungrounded, an equipment ground wire is required.
13. What is the best way to check if current is flowing in a wire?
    1. Use a clamp-on dc current meter to confirm that the load / wire does not have any current passing through it.
14. Name two ways to stop the current from an array without a load break disconnecting means?
    1. Placing an opaque covering over the array.
    2. Waiting until dark is another option.
15. It is important to verify that the equipment ground is properly installed on all exposed non-current carrying metal parts. To verify name the steps required to be done?(5 listed)
    1. Set ohmmeter to the continuity setting.
    2. Touch one lead to a metal surface or ground wire.
    3. Touch the other lead to a nearby metal surface or ground wire.
    4. To Confirm continuity between the two surfaces by listening for the beep when the leads touch the surfaces at the same time.
    5. Repeat this process randomly throughout the array and at every combiner box, disconnect, and inverter.
16. Re-torquing of the bolts to manufacturer specs is a maintenance item. What are the steps required to do this? (5 Listed)
    1. Make up a diagram of the array with each bolt identified on the diagram.
    2. Each bolt will need to be identified for the racking system.
    3. A torque value assigned for each bolt.
    4. An initial placed by each bolt on the sheet indicating it was torqued.
    5. A permanent marker line drawn on the bolt head and the mating surface indicating where the bolt head position is after being retorqued.
17. Another maintenance activity is cleaning debris from the surface of the panels. What is required to clean the panels?
    1. A cloth or soft bristled brush are the only tools that should touch the surface of the panels.
    2. If clean fresh water is available, it can be sprayed at low pressure onto the surface with a hose.
18. What should not be used when cleaning panels?
    1. Pressurized power washers should never be used directly on the surface.
    2. Never spray broken modules with water.
    3. Do not spray water directly on any junction box or wires.
    4. Abrasive soaps or solvents should never be used.
19. What usually keeps the panels clean?
    1. Rain
20. Once the visual inspection and cleaning maintenance has been completed a performance test is performed. What is the performance test?
    1. A performance test is a measure of the Voc and Isc at a given irradiance.
21. Readings for irradiance shall be taken and the minimum irradiance used is what value?
    1. 200w/m2 as this is the low end where the Voc will be close to maximum values.