**Solar Electric Technician (Level 2)**

**Module 6: Testing and commissioning**

**E1: Assignment - Use of testing equipment and three-phase wiring checks**

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| **E1: ASSIGNMENT MEMO** | |
| **Date** | …. |
| **To** | Participants |
| **From** | Trainers |
| **Subject** | Use of testing equipment and three-phase wiring checks |
| **What** | Participants will use study demo system equipment’s to verify wiring integrity in small groups. |
| **Why** | This exercise aims train participants in using tools and equipment to test, commission, and verify the wiring integrity of a three-phase solar photovoltaic (PV) system. By the end of the session, trainees will be able to inspect wiring, perform electrical tests, and verify the system's functionality. |
| **How** | 1. Work in group of 2 or 4. 2. Gather the required tools and equipment. 3. Read and carefully follow the instructions for the assigned task. 4. Study the demo system and perform the checks specified using testing equipment. 5. Review and discuss the results with the trainer. |
| **Time** | 135’ |

**Required tools/equipment**

* Three-phase solar PV system setup (including solar panels, inverter, DC and AC disconnects, wiring, and mounting).
* Multimeter (for voltage, current, and continuity testing).
* Clamp meter (for measuring current in live circuits).
* Wire strippers, crimping tools, screwdrivers, and torque wrench.
* Personal protective equipment (PPE): gloves, safety goggles, and insulated boots.
* Wiring diagrams and specifications for the system.
* Notepad and pen for documenting results.

**Expected outcomes**

* **Safety adherence:** Learners will consistently follow proper safety protocols while conducting tests and inspections.
* **Tool proficiency:** Learners will demonstrate competency in using essential tools, including multimeters and clamp meters.
* **Wiring integrity:** Learners will successfully inspect and test wiring for faults or irregularities, ensuring system reliability.
* **Testing accuracy:** Learners will accurately measure voltage, current, continuity, and phase balance in the system.
* **System understanding:** Learners will gain a solid understanding of the electrical principles and mechanics underlying the operation of a three-phase solar PV system.

**Safety briefing and equipment overview (20 minutes)**

**Task 1:** Understand the safety procedures and become familiar with the tools you will use.

**Safety first**

* Always wear your PPE (gloves, safety goggles, and insulated boots).
* De-energize the system before handling electrical components, and follow lockout/tagout procedures.
* Be aware of the risk of high voltage on both the DC and AC sides of the PV system.

**Tool overview: Learn how to use the following equipment.**

* Multimeter for measuring voltage, current, and continuity.
* Clamp meter to measure current without breaking the circuit.
* Torque wrench for checking the tightness of electrical connections.

**System overview and wiring inspection (25 minutes)**

**Task 2:** Visually inspect the three-phase PV system’s wiring for correctness, security, and damage.

**Follow the wiring diagram provided to verify the following and write in remarks**

|  |  |
| --- | --- |
| Correct colour coding of wires (live, neutral, ground, DC) |  |
| Proper cable routing with no loose, exposed, or damaged wires. |  |
| All cables are properly labelled and identified. |  |

**Check the integrity of connections at**

|  |  |
| --- | --- |
| Solar panels (DC side) |  |
| Inverter |  |
| AC distribution panel |  |
| Grounding points |  |

**Document any issues you observe, such as**

|  |  |
| --- | --- |
| Loose wires or poor cable management |  |
| Any signs of wear, heat damage, or corrosion. |  |

**Continuity and grounding test (20 minutes)**

**Task 3:** Test continuity and ensure proper grounding of the system and record your continuity test results, noting any open circuits or faulty connections in table below.

|  |  |  |
| --- | --- | --- |
| **Test** | **Instructions** | **Documentation of results/observations/remarks** |
| Continuity test | * Use a multimeter to check continuity across key wiring connections: * Verify the integrity of live, neutral, and ground wires. * Check the wiring between solar panels, inverter, and the AC distribution board. * Ensure that the grounding system is properly connected and functional |  |

**Voltage and current testing on the DC side (15 minutes)**

**Task 4:** Test the performance of the solar panels and verify DC output.

Document the test results, noting any strings with irregular voltage or current levels that could indicate shading, dirt, or damaged panels in table below.

|  |  |  |
| --- | --- | --- |
| **DC parameters** | **Instructions** | **Documentation of results/observations/remarks** |
| Open-circuit voltage (Voc) | * Use a multimeter to measure the open-circuit voltage of each string of solar panels. * Compare the measured values to the expected system specifications. |  |
| Short-circuit current (Isc) | * Using a clamp meter, measure the short-circuit current from each panel string. * Ensure that the current falls within the expected range based on the system specifications |  |

**Voltage, current, and phase balance testing on the AC side (25 minutes)**

**Task 5:** Test the AC output from the inverter and check the balance across the three phases and document your readings and ensure they are within acceptable ranges for proper system functionality.

|  |  |  |
| --- | --- | --- |
| **AC parameters** | **Instructions** | **Documentation of results answers/remarks** |
| Voltage testing | * Use the multimeter to measure the output voltage on each of the three phases (typically 230V/400V depending on the system configuration) |  |
| Current testing | * Use a clamp meter to measure the current on each phase and ensure that the system is drawing balanced current across all three phases. |  |

**Torque and connection check (15 minutes)**

**Task 6:** Verify the tightness of electrical connections to avoid loose connections that can cause arcing or overheating.

|  |  |
| --- | --- |
| **Use a torque wrench to check the tightness of key connections at:** | **Remarks/Answers** |
| DC combiner boxes |  |
| Inverter |  |
| AC distribution panel |  |
| Grounding points |  |

*Note: Ensure connections are tight but not over-tightened according to manufacturer specifications.*

**Review and debrief (15 minutes)**

**Task 7:** Discuss the results and lessons learned from the practical exercise.

**Group review:** Share your observations, test results, and any issues identified during the exercise.

Debrief with the trainer:

* Discuss any challenges encountered and areas where more focus is needed.
* Trainer provides feedback on performance and answers any questions.