**Solar Electric Technician Training**

**Module 7: Maintenance and troubleshooting**

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| **Objectives:** By the end of this session, learners will be able to:   * Maintain solar modules and mounting structures using the provided templates and guidelines. * Maintain and troubleshoot various types of systems and their components as outlined in technical manual. This includes, but not limited to: * PV modules * Mounting structures * Battery banks * Charge controllers * On-grid/off-grid inverters * Pump controllers * Water pumps * Fuses, earthing, lightning arrestors and other protective devices * Switchgear * Cables and wiring * Repair and maintain single-phase and three-phase wiring systems. | **Instructor:** *[Name]* |
| **Session Duration:**   * 5 hours (Theory) * 29 hours (Practical) |

| **Trainers' activities** | **Learners’ activities** | **Teaching aids** | **Time** |
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| **Maintain solar modules and mounting structures using the templates and guidelines.** | | | **240’** |
| **Introduction**   * Review session objectives and emphasize the importance of maintenance and troubleshooting. * Briefly recap installation, testing and commissioning of systems. | * Listen, take notes, and ask questions for clarification. * Participate in discussion. | * Whiteboard and Markers. | 15’ |
| **Illustrative talk**   * Discuss the steps of maintenance: * Visual inspection of each component. * Follow safety measures. * How to prepare the maintenance schedule of each component. | * Listen, take notes, and ask questions for clarification. * Participate in discussion. | * Presentation slides to be prepared by trainer | 30’ |
| **Demonstration**   * Demonstrate the maintenance process on an installed Solar Photovoltaics (SPV) module and mounting structure, using templates and guidelines: * Wire interconnection. * Dust/soiling on. surface of PV modules. * Panel junction box. * Rust on the structures. * Verify for any damage on structure. * Provide opportunities to perform the maintenance process on an installed SPV module and mounting structure in small groups, with supervision and feedback. | * Observe demonstration, ask questions, and take notes. * Execute the maintenance tasks refereeing to the templates and guidelines. | * SPV system workstations * Faulty samples * Inspection tools * Technical manuals * Assignment | 180’ |
| **Review**   * Summarize key points from the session and facilitate a discussion on challenges faced during the exercises. | * Participate in discussion, share insights |  | 15’ |
| **Maintain and troubleshoot different types of systems and their components including but not limited to the following components using the technical manual** | | | **1560’** |
| Illustrated talk, demonstrate and give opportunity to perform the maintenance and troubleshoot of different systems.   * PV module * Mounting structure * Battery bank * Charge controller * On-grid/off-grid inverter * Pump controller * Water pump * Fuses, earthing, lightning arrestors and other protective devices * Switchgear * Cables and wiring | * Listen, take notes, and ask questions for clarification. * Participate in discussion, ask questions, and share experiences with maintenance and troubleshoot. * Inspect provided samples, identify faults, and discuss findings with peers. | * Whiteboard, markers, presentation slides * Faulty samples * Inspection tools * Technical manuals * Assignment | 150’ for each component |
| **Review**   * Summarize key points from the session and facilitate a discussion on challenges faced during the exercises. | * Participate in discussion, share insights |  | 60’ |
| **Repair and maintain single-phase and three-phase wiring systems** | | | **240’** |
| * Demonstrate ways to isolate the wiring system from the whole facility. * Demonstrate to verify system isolation. | * Participate, practice and measure. | * Three-phase system including main distribution board, wirings, switchgears, etc. * Assignment | 60’ |
| Demonstrate and perform visual inspection of the following: -   * Cables and connections * Loose connections * Signs of corrosion or moisture | * Participate, practice and measure. | * Main or Sub-distribution boards * Cables and wirings * Assignment | 30’ |
| Demonstrate and monitor phase balance and voltage levels for the following:   * Load distribution. * Voltage and current imbalance. * Phase and neutral voltage levels. | * Participate, practice and measure. | * Main or Sub- distribution boards * Testing equipment * Assignment | 90’ |
| Demonstrate and perform tests on the following:   * Circuit breakers and fuses. * Grounding and bonding. * Cable continuity. * Replacement of faulty components. | * Participate and practice | * Testing equipment * Installation tools * Earth tester and megger * Assignment | 60’ |
| **Total time** | | | **2160’** |