

# BUILDING ELECTRICAL



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Competency Standards  
National Vocational Certificate Level 2

Version 1 - December 2014



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## Competency Standards: Building Electrician cum PV Cell Installer (Assistant) - Level 2

### Competency Standard A: Maintain workplace safety

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Follow safe work procedures; apply tools and equipment safety measures; and follow workplace emergency procedures.

| Competency Unit                                       | Performance Criteria   | Knowledge and Understanding   |
|---|--|---|
| <b>A1:</b><br>Follow safe work procedures             | <p><b>P1-</b> Organise and arrange duties, tools, equipment materials and work area</p> <p><b>P2-</b> Use and store PPE</p> <p><b>P3-</b> Perform tasks in a safe manner</p> | <p><b>K1-</b> Company safety SOP/policy; Housekeeping practices; Factors that may influence safety at the workplace, such as anger and stress</p> <p><b>K2-</b> Types of personal protective equipment</p> <p><b>K3-</b> Safety signs and symbols; Isolation and lockout procedures</p> |
| <b>A2:</b><br>Apply tools & equipment safety measures | <p><b>P1-</b> Check earthing for safety of equipment</p> <p><b>P2-</b> Store tooling and equipment securely</p>  | <p><b>K1-</b> Method of earthing and its effects on safety</p> <p><b>K2-</b> Storage and stacking methods of tools &amp; equipment</p>  |
| <b>A3:</b><br>Follow workplace emergency procedures   | <p><b>P1-</b> Follow safe workplace procedures for dealing with accidents, fires and emergencies within scope of responsibility</p>  | <p><b>K-</b> Scope of responsibility; First aid procedures; Fire safety and fire fighting procedures; Risk control measures</p>   |

**Competency Standard B: Apply continuing professional development**

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Identify professional development needs; develop professional knowledge, skills and attitudes, and maintain professional proficiency.

| Competency Unit   | Performance Criteria   | Knowledge and Understanding   |
|---|--|---|
| <b>B1:</b><br><b>Identify professional development needs</b>              | <b>P1-</b> Discuss professional development needs<br><b>P2-</b> Identify professional development programmes | <b>K1-</b> Reasons for professional development<br><b>K2-</b> Access to programmes; Career guidance |
| <b>B2-</b><br><b>Develop professional knowledge, skills and attitudes</b> | <b>P1-</b> Participate in training programmes<br><b>P2-</b> Document training outcome                        | <b>K1-</b> Outcomes and relevance of training<br><b>K2-</b> Report and portfolio writing            |
| <b>B3-</b><br><b>Maintain professional proficiency</b>                    | <b>P1-</b> Identify and use self-study sources<br><b>P2-</b> Implement self-study plan                       | <b>K1-</b> Research methods; Access to sources<br><b>K2-</b> Planning your career                   |

**Competency Standard C: Perform preventive maintenance as part of electrical operations**

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for preventive maintenance; perform routine inspections; carry out preventive maintenance; and complete work.

| Competency Unit  | Performance Criteria  | Knowledge and Understanding   |
|--|---|---|
| <p><b>C1:</b><br/><b>Plan and prepare for preventive maintenance</b></p> | <p><b>P1-</b> Identify and obtain safety and other regulatory requirements for maintenance<br/><b>P2-</b> Interpret circuit diagrams<br/><b>P3-</b> Identify and select tools and equipment</p> | <p><b>K1-</b> Safety requirements; Specifications; Hazard identification<br/><b>K2-</b> Drawings and symbols specifications<br/><b>K3-</b> Tools and equipment and calibration thereof</p>  |
| <p><b>C2:</b><br/><b>Perform routine Inspection</b></p>                  | <p><b>P1-</b> Check for safety hazards<br/><b>P2-</b> Carry out procedures for routine checks<br/><b>P3-</b> Document results</p>   | <p><b>K1-</b> Inspection requirements<br/><b>K2-</b> Maintenance of electrical instruments and equipment<br/><b>K3-</b> Types of common faults of wiring; Load balance; Safety precautions<br/><b>K4-</b> Test and preventive reports</p> |
| <p><b>C3:</b><br/><b>Carry out preventive maintenance</b></p>            | <p><b>P1-</b> Perform basic measurements tests<br/><b>P2-</b> Perform minor adjustments and calibrations<br/><b>P3-</b> Replace the likely to be worn out or damaged parts</p>                  | <p><b>K1-</b> Measurement and calculation of electrical parameters<br/><b>K2-</b> Basic operation of appliance and settings to adjust performance<br/><b>K3- Proper</b> communicate the preventive maintenance procedure skills</p>       |
| <p><b>C4:</b><br/><b>Complete work</b></p>                               | <p><b>P1-</b> Complete work related documents and procedures<br/><b>P2-</b> Perform final quality inspection<br/><b>P3-</b> Clean up and store tools, equipment and materials</p>               | <p><b>K1-</b> Importance of documentation; Customer care procedures and techniques<br/><b>K2-</b> Importance of quality; handing over to client<br/><b>K3-</b> Waste disposal procedures; Care of tools and equipment</p>                 |

**Competency Standard D: Perform corrective maintenance as part of electrical operations**

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for corrective maintenance; perform troubleshooting; carry out corrective maintenance procedures; and complete work.

| Competency Unit  | Performance Criteria   | Knowledge and Understanding  |
|--|--|--|
| <b>D1:</b><br><b>Plan and prepare for corrective maintenance</b> | <b>P1-</b> Identify and obtain safety and other regulatory requirements for maintenance<br><b>P2-</b> Interpret circuit diagrams<br><b>P3-</b> Identify and select tools and equipment | <b>K1-</b> Safety requirements; Specifications; Hazard identification<br><b>K2-</b> Drawings and symbols specifications<br><b>K3-</b> Tools and equipment and calibration thereof  |
| <b>D2:</b><br><b>Perform troubleshooting</b>                     | <b>P1-</b> Check for safety hazards<br><b>P2-</b> Carry out diagnostic procedures<br><b>P3-</b> Identify faulty parts and/or equipment<br><b>P4-</b> Analyse system fault              | <b>K1-</b> Troubleshooting requirements<br><b>K2-</b> Identification of electrical faults by checking shape, size and colour of components and parts; Measurement of electrical parameters; Safety precautions<br><b>K3-</b> Methods of fault identification in electrical components<br><b>K4-</b> System operations in an electrical environment |
| <b>D3:</b><br><b>Carry out corrective maintenance procedures</b> | <b>P1-</b> Dismantle faulty parts or components<br><b>P2-</b> Replace or repair faulty parts or components<br><b>P3-</b> Perform commissioning   | <b>K1-</b> Dismantling procedures<br><b>K2-</b> Replacing and repairing procedures<br><b>K3-</b> Electrical load management; commissioning before & after correction procedures  |
| <b>D4:</b><br><b>Complete work</b>                               | <b>P1-</b> Complete work related documents and procedures<br><b>P2-</b> Perform final quality inspection<br><b>P3-</b> Clean up and store tools, equipment and materials               | <b>K1-</b> Importance of documentation; Customer care procedures and techniques<br><b>K2-</b> Importance of quality; handing over to client<br><b>K3-</b> Waste disposal procedures; Care of tools and equipment   |



**Competency Standard E: Test electrical and electronic parameters**

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Perform testing; diagnose faults; and remove faults.

| Competency Unit                      | Performance Criteria  | Knowledge and Understanding  |
|--------------------------------------|---|--|
| <b>E1:</b><br><b>Perform Testing</b> | <b>P1-</b> Conduct visual inspection<br><b>P2-</b> Implement testing procedures                         | <b>K1-</b> Damage identification in terms of cracks, disorder in shape and structure, broken parts<br><b>K2-</b> Process of different tests; Electrical parameters |
| <b>E2:</b><br><b>Diagnose fault</b>  | <b>P1-</b> Interpret test results<br><b>P2-</b> Implement troubleshooting procedures and identify fault | <b>K1-</b> Interpretation of drawings and circuit diagrams<br><b>K2-</b> Troubleshooting procedures; Electrical and electronic parameters                          |
| <b>E3:</b><br><b>Remove faults</b>   | <b>P1-</b> Repair or replace component parts<br><b>P2-</b> Carry out operational testing                | <b>K1-</b> Interpretation of drawings and circuit diagrams; product knowledge<br><b>K2-</b> Product knowledge; Testing procedures and equipment                    |

**Competency Standard F: Install solar panel**

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for installation; install solar photovoltaic array; carry out operational checks; and complete work

| Competency Unit  | Performance Criteria  | Knowledge and Understanding  |
|--|---|--|
| <p><b>F1:</b><br/><b>Plan and prepare for installation</b></p> | <p><b>P1-</b> Identify and obtain safety and other regulatory requirements for installation<br/><b>P2-</b> Determine location<br/><b>P3-</b> Set PV angles</p>                                    | <p><b>K1-</b> Safety requirements; Specifications; Hazard identification (Proper space requirement, load requirement)<br/><b>K2-</b> Factors influencing the efficiency of solar panels; Physical structure, shading effects<br/><b>K3-</b> Summer and winter requirements<br/><b>K4-</b> Load analysis<br/><b>K5-</b> Existing combined distribution BUTU (Average &amp; Maximum Angle)</p> |
| <p><b>F2:</b><br/><b>Install solar photovoltaic array</b></p>  | <p><b>P1-</b> Interpret and confirm installation<br/><b>P2-</b> Connect PV panels and electrical components<br/><b>P3-</b> Arrange earthing<br/><b>P4-</b> Confirm installation</p>               | <p><b>K1-</b> Installation requirements<br/><b>K2-</b> Series and parallel circuit setup; Cable sizing; Forward and reverse diodes<br/><b>K3-</b> Requirements for properly bonded earthing<br/><b>K4-</b> Supervisor and/or client communication</p>  |
| <p><b>F3:</b><br/><b>Carry out operational checks</b></p>      | <p><b>P1-</b> Test and adjust component and/or parts<br/><b>P2-</b> Confirm operation of electrical product or appliance<br/><b>P3-</b> Explain operation of product or appliance to customer</p> | <p><b>K1-</b> Functional tests and adjustments; Basic knowledge and calculation of open circuit voltage, on load voltage, short circuit current, maximum current load; Basic function of relay change over<br/><b>K2-</b> Basic operation of appliance and settings to adjust performance<br/><b>K3-</b> Communication skills (communicate with seniors or client after check up)</p>        |
| <p><b>F4:</b></p>  | <p><b>P1-</b> Complete work related documents and procedures</p>  | <p><b>K1-</b> Importance of documentation; Customer care procedures and techniques</p>   |

|                        |  |   |
|------------------------|--|---|
| <b>Complete work</b>   | <b>P2-</b> Perform final quality inspection                  | <b>K2-</b> Importance of quality; handing over to client          |
| <b>Work Completion</b> | <b>P3-</b> Clean up and store tools, equipment and materials | <b>K3-</b> Waste disposal procedures; Care of tools and equipment |

### Competency Standard G: Assemble electrical appliances

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for assembling; assemble appliances; and complete work.

| Competency Unit   | Performance Criteria   | Knowledge and Understanding   |
|---|--|---|
| <b>G1:</b><br><b>Plan and prepare for assembling</b>          | <b>P1-</b> Identify and obtain safety and other regulatory requirements for assembling<br><b>P2-</b> Prepare tools and equipment   | <b>K1-</b> Safety requirements; Specifications; hazard identification<br><b>K2-</b> Types of tools, equipment and material  |
| <b>G2:</b><br><b>Assemble machine / Electrical Equipments</b> | <b>P1-</b> Confirm assembling specifications<br><b>P2-</b> Assemble and connect electrical circuit with ports<br><b>P3-</b> Join cables and connections<br><b>P4-</b> Confirm assembling / confirmation report | <b>K1-</b> Assembling requirements<br><b>K2-</b> Concept of neutral, phase and earth; Input and Output Safety precautions<br><b>K3-</b> Types and application of different methods of joints<br>- tin (solder), crimped terminals<br>- ferrules and shrinking nut<br>- bolt & screw terminal<br><b>K4-</b> Supervisor and/or client communication |
| <b>G3:</b><br><b>Complete work</b>                            | <b>P1-</b> Complete work related documents and procedures<br><b>P2-</b> Perform final quality inspection<br><b>P3-</b> Clean up and store tools, equipment and materials                                       | <b>K1-</b> Importance of documentation; customer care procedures and techniques<br><b>K2-</b> Importance of quality; handing over to client(Q&C)<br><b>K3-</b> Waste disposal procedures; care of tools and equipment   |



**Competency Standard H: Perform installation of electrical products and appliances**

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for installation; install electrical products and appliances; carry out operational checks; and complete work.

| Competency Unit   | Performance Criteria   | Knowledge and Understanding   |
|---|--|---|
| <p><b>H1:</b><br/><b>Plan and prepare for installation</b></p>          | <p><b>P1-</b> Identify and obtain safety and other regulatory requirements for installation<br/> <b>P2-</b> Interpret circuit diagram<br/> <b>P3-</b> Selecton and termination of electrical cables<br/> <b>P4-</b> Arrange earthing</p> | <p><b>K1-</b> Safety requirements; Specifications; hazard identification<br/> <b>K2-</b> Drawing and symbol specifications<br/> <b>K3-</b> Types and size of cables; mounting of cables; tools for cable works<br/> <b>K4-</b> Earthing requirements (Methods, conductor specification)</p>   |
| <p><b>H2:</b><br/><b>Install electrical products and appliances</b></p> | <p><b>P1-</b> Confirm installation specification<br/> <b>P2-</b> Position and configure product or appliance<br/> <b>P3-</b> Join cables and connections<br/> <b>P4-</b> Confirm installation</p>  | <p><b>K1-</b> Installation requirements<br/> <b>K2-</b> Importance of correct position and location; Safety precautions<br/> <b>K3-</b> Types and application of different jointing methods<br/> - tin, crimped terminals<br/> - ferrules and shrinking nut<br/> - bolt &amp; screw terminal<br/> <b>K4-</b> Supervisor and/or client communication</p> |
| <p><b>H3:</b><br/><b>Carry out operational checks</b></p>               | <p><b>P1-</b> Test and adjust component and/or parts<br/> <b>P2-</b> Confirm operation of electrical product or appliance<br/> <b>P3-</b> Explain operation of product or appliance to customer</p>                                      | <p><b>K1-</b> Functional tests and adjustments<br/> <b>K2-</b> Machine features<br/> <b>K3-</b> Communication skills</p>  |
| <p><b>H4:</b><br/><b>Complete work</b></p>                              | <p><b>P1-</b> Complete work related documents and procedures<br/> <b>P2-</b> Perform final quality inspection<br/> <b>P3-</b> Clean up and store tools, equipment and materials</p>  | <p><b>K1-</b> Importance of documentation; customer care procedures and techniques<br/> <b>K2-</b> Importance of quality; handing over to client (Q&amp;C)<br/> <b>K3-</b> Waste disposal procedures; care of tools and equipment</p>   |

**Competency Standard I: Install domestic wiring**

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan wiring layout; lay cable; perform wiring test; install electrical appliances; and complete work.

| Competency Unit                          | Performance Criteria  | Knowledge and Understanding   |
|--|---|---|
| <b>I1:</b><br><b>Plan wiring layout</b>  | <b>P1-</b> Draw wiring layout<br><b>P2-</b> Measure distance to connection points<br><b>P3-</b> Estimate material<br><b>P4-</b> Prepare tools, equipment and materials  | <b>K1-</b> Interpretation of drawings, symbols, cable number according to load, and colour coding<br><b>K2-</b> Measuring of units and conversion<br><b>K3-</b> Quality of different conductor and insulator types<br><b>K4-</b> Application of tools, equipment and materials    |
| <b>I2:</b><br><b>Lay cables</b>          | <b>P1-</b> Prepare installation of cable<br><b>P2-</b> Install conduit, <b>GI</b> pipes, <b>PVC</b> pipes and/or ducts<br><b>P3-</b> Pull-in cables<br><b>P4-</b> Connect cables<br><b>P5-</b> Connect fixtures | <b>K1-</b> Chiselling, ducting, <b>PVC</b> and <b>GI</b> pipe wiring procedures<br><b>K2-</b> Properties of materials<br><b>K3-</b> Application of cables and tools<br><b>K4-</b> Types of joints<br><b>K5-</b> Types and purpose of fixtures                                     |
| <b>I3:</b><br><b>Perform wiring test</b> | <b>P1-</b> Inspect wiring and distribution board<br><b>P2-</b> Conduct tests<br><b>P3-</b> Document test results  | <b>K1-</b> Importance of continuity and factors of loose fittings<br><b>K2-</b> Application of equipment and tools used for testing; Importance of earthing<br><b>K3-</b> Importance of documenting compliance and noncompliance of test results and subsequent steps to be taken |

|  |   |   |
|--|---|---|
| <p><b>I4:</b><br/><b>Install electrical appliances</b></p> | <p><b>P1-</b> Interpret and confirm installation specifications<br/> <b>P2-</b> Install, position and secure appliances<br/> <b>P3-</b> Connect appliance and test for correct operation<br/> <b>P4-</b> Confirm completed installation</p> | <p><b>K1-</b> Interpretation of installation requirements and specifications<br/> <b>K2-</b> Importance of correct position and location; Safety precautions<br/> <b>K3-</b> Basic operation of appliance and settings to adjust performance; Requirements for good, properly bonded earth<br/> <b>K4-</b> Client communication</p> |
| <p><b>I5:</b><br/><b>Complete work</b></p>                 | <p><b>P1-</b> Complete work related documents and procedures<br/> <b>P2-</b> Perform final quality inspection<br/> <b>P3-</b> Clean up and store tools, equipment and materials</p>   | <p><b>K1-</b> Importance of documentation; Customer care procedures and techniques<br/> <b>K2-</b> Importance of quality; handing over to client<br/> <b>K3-</b> Waste disposal procedures; Care of tools and equipment</p>   |

**Competency Standard J: Use and maintain electrical tools and equipment**

**Overview:** This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Use electrical tools and equipment; maintain electrical tools, equipment and instruments; maintain batteries; and calibrate measuring equipment.

| Competency Unit   | Performance Criteria  | Knowledge and Understanding   |
|---|---|---|
| <b>J1:</b><br><b>Use electrical tools and equipment</b>                   | <b>P1-</b> Identify and select tools, equipment and instruments<br><b>P2-</b> Demonstrate safe use of tools, equipment and instruments  | <b>K1-</b> Purpose of electrical tools, equipment and instruments<br><b>K2-</b> Use of electrical tools, equipment and instruments  |
| <b>J2:</b><br><b>Maintain electrical tools, equipment and instruments</b> | <b>P1-</b> Describe preventive maintenance procedures<br><b>P2-</b> Maintain and/or replace tool insulation<br><b>P3-</b> Clean and store electrical tools, equipment and instruments | <b>K1-</b> Preventive maintenance; Types of maintenance schedules or programmes for:<br>- Tools<br>- Equipment<br>- Instruments<br>- Machinery<br>- Facilities<br><b>K2-</b> Types of insulation and reports<br><b>K3-</b> Storage requirements |
| <b>J3:</b><br><b>Maintain batteries</b>                                   | <b>P1-</b> Determine state of charge<br><b>P2-</b> Maintain electrolyte level<br><b>P3-</b> Charge batteries  | <b>K1-</b> Types of batteries<br><b>K2-</b> Role of electrolyte<br><b>K3-</b> Charging procedures   |
| <b>J4:</b><br><b>Calibrate measuring instruments</b>                      | <b>P1-</b> Check calibration of measuring instruments<br><b>P2-</b> Document and interpret calibration procedure<br><b>P3-</b> Calibrate measuring instrument                         | <b>K1-</b> Types and methods of calibration<br><b>K2-</b> Types of calibration reports<br><b>K3-</b> Types and methods of calibration   |



**Competency Standard K: Solar PV Fundamentals**

**Overview:** This competency standard is intended for those who carry out installation of off-grid solar PV system. People holding credit for this module are able to describe Solar PV basics (photovoltaic history and today’s market) and different types of solar PV cells, their characteristic and techniques (polycrystalline, monocrystalline and Thin Film)

| Competency Unit   | Performance Criteria   | Knowledge and Understanding  |
|---|--|--|
| <p><b>A1:</b><br/> <b>Basic concepts of solar PV system(History and today market)</b></p> | <p><b>P1-</b> Define the basic photovoltaic terms<br/> <b>P2-</b> Importance of renewable energy<br/> <b>P3-</b> Identify today’s needs of solar technology</p>  | <p><b>K1-</b> Semiconductor, diodes and their functions<br/> <b>K2-</b> Energy, kind of energy and sources of energy<br/> <b>K3-</b> Load demand, loads heeding and solar technology</p>   |
| <p><b>A2:</b><br/> <b>Types and characteristics of solar PV system</b></p>                | <p><b>P1:</b> Identify and select solar cell<br/> <b>P2:</b> Plan and prepare for solar panel installation techniques<br/> <b>P3-</b> Identify the types of photovoltaic cells<br/> <b>P4-</b> Measure the distance for solar array<br/> <b>P5 -</b> Estimate the solar power demand</p> | <p><b>K1-</b> Identify the characteristics of different solar cells<br/> <b>k2-</b> Methods of solar cells manufacturing, materials and properties of materials<br/> <b>K3-</b> Mono technology, ploy technology and amphibious technology<br/> <b>K4-</b> Interpretation of drawing scale, basic measuring units and conversion of units<br/> <b>K5-</b> Calculation for energy and load demand</p> |

## Competency Standard L: Off-grid Solar PV Systems with battery storage

**Overview:** This competency standard is intended for those who carry out installation of off-grid solar PV system. People holding credit for this module are able to describe, Off-grid Solar PV Systems, Backup (UPS) systems, Batteries (Characteristics, handling, maintenance, safety, life time, autonomy, recycling) and Charge controllers

| Competency Unit   | Performance Criteria   | Knowledge and Understanding   |
|---|--|---|
| <b>B1:<br/>Off grid solar PV system</b>                   | <p><b>P1-</b> Follow safety and other regulatory requirements for off-grid solar PV system.</p> <p><b>P2-</b> Interpret circuit diagram</p> <p><b>P3-</b> Identify and select tools and equipment for off- grid PV system</p> <p><b>P4-</b> Perform connection of PV panels and electrical components.</p>                         | <p><b>K1-</b> Safety requirements and hazards identification</p> <p><b>K2-</b> Interpretation of drawings and specifications</p> <p><b>K3-</b> Tools and equipment for installation</p> <p><b>K4-</b> Jointing techniques ,specifications and safety requirements</p>                 |
| <b>B2:<br/>Plan and prepare for backup system</b>         | <p><b>P1-</b> Follow safety and other regulatory requirements for backup system</p> <p><b>P2-</b> Plan and prepare electrical tools and equipment for backup system</p> <p><b>P3-</b> Performs connections for backup system</p> <p><b>P4-</b> Monitor load specifications for backup system</p>                                   | <p><b>K1-</b> Safety requirements and hazards identification</p> <p><b>K2-</b> Tools and equipment for backup system</p> <p><b>K3-</b> Methods and techniques of connections</p> <p><b>K4-</b> Calculation of load, method of electrical measuring parameters and load management</p> |
| <b>B3:<br/>Maintain batteries</b>                         | <p><b>P1-</b> Identify the characteristics of different types of batteries</p> <p><b>P2-</b> Perform battery connections</p> <p><b>P2:</b> Plan and prepare for charging of batteries</p> <p><b>P3-</b> Maintain electrolyte level</p> <p><b>P4-</b> Testing procedures for batteries</p> <p><b>P-5</b> Recycling of batteries</p> | <p><b>K1-</b> Types of batteries</p> <p><b>K2-</b> Connection techniques and requirements</p> <p><b>K3-</b> Battery charging techniques</p> <p><b>K4-</b> Role of electrolyte</p> <p><b>K5-</b> Recycling and repairing procedures</p>  |
| <b>B4:<br/>Use electrical tools and charge controller</b> | <p><b>P1-</b> Follow safety and other regulatory requirements for use of electrical tools.</p> <p><b>P2-</b> Interpret circuit diagram</p>   | <p><b>K1-</b> Safety requirements and hazards identification</p> <p><b>K2-</b> Interpretation of drawings and specifications</p>  |

|  |  |  |
|--|--|--|
|  | <b>P3-</b> Identify and select tools and equipment for charge controller<br><b>P4-</b> make connections of charge controller with components | <b>K3-</b> Tools and equipment for charge controller system<br><b>K4-</b> Methods of connection and specifications |
|--|--|--|

## Competency Standard M: Operation and maintenance of off-grid solar PV systems

**Overview:** This competency standard is intended for those who carry out Installation of off-grid solar PV system. People holding credit for this module are able to describe Commissioning procedures and Operation and maintenance of off-grid solar PV systems

| Competency Unit  | Performance Criteria  | Knowledge and Understanding  |
|--|---|--|
| <b>C1:</b><br><b>Commissioning procedures</b>                                      | <b>P1-</b> Follow safety and other regulatory requirements for commissioning.<br><b>P2-</b> Interpret circuit diagram.<br><b>P3-</b> Plan and prepare electrical tools and equipment for commissioning.<br><b>P4-</b> Performs connections for commissioning.<br><b>P5-</b> Perform commissioning | <b>K1-</b> Safety requirements and hazards identification<br><b>K2-</b> Interpretation of drawing and specifications<br><b>K3-</b> Tools and equipment for commissioning procedures<br><b>K4-</b> Connection techniques, and requirements for commissioning<br><b>K5-</b> Dismantling, replacing and commissioning procedures  |
| <b>C2:</b><br><b>Monitor operation And maintainers of Off-Grid Solar PV System</b> | <b>P1-</b> Monitor electrical loads<br><b>P2-</b> Analyze system faults<br><b>P3-</b> Check out electrical parameters<br><b>P4-</b> Carryout preventive maintenance<br><b>P5-</b> Replace and repair faulty parts or components   | <b>K1-</b> Methods of calculation of load ,measuring techniques of current and voltage<br><b>K2-</b> Identification of faults and measurement of electrical parameters<br><b>K3-</b> Methods of fault identification and troubleshooting<br><b>K4-</b> Inspection requirement, safety requirements and hazards identification<br><b>K5-</b> Dismantling and replacing procedures |
| <b>C4:</b><br><b>Complete work</b>   | <b>P1-</b> Complete work related documents and procedures<br><b>P2-</b> Perform final quality inspection<br><b>P3-</b> Clean up and store tools, equipment and materials  | <b>K1-</b> Importance of documentation; Customer care procedures and techniques<br><b>K2-</b> Importance of quality<br><b>K3-</b> Handing over procedure to client<br><b>K4-</b> Waste disposal procedures<br><b>K5-</b> Care of tools and equipment   |



### Documents, policies, guidelines:

- International Labour Organisation (ILO) Standards on Occupational Health and Safety
- Pakistan Electricity Act, 1910 and subsequent amendments
- Institute of Electrical and Electronics Engineers Standards Association (IEEE-SA)
- Industry code of practice



Should comply to the  
standrds used in Pakistan

### Tools and Equipment:

| No. | Description                   | Quantity                  |
|-----|-------------------------------|---------------------------|
| 1   | Personal protective equipment | Industry code of practice |
| 2   | Fire extinguishers            |                           |
| 3   | First aid box                 |                           |
| 4   | Adjustable wrench             |                           |
| 5   | Amp meter                     |                           |
| 6   | AVO meter                     |                           |
| 7   | Batteries                     |                           |
| 8   | Battery charger               |                           |
| 9   | Bench vice                    |                           |
| 10  | Ceiling hole cutter           |                           |

|           |                    |  |
|-----------|--------------------|--|
| <b>11</b> | Charge controller  |  |
| <b>12</b> | Chisel             |  |
| <b>13</b> | Clamp on meter     |  |
| <b>14</b> | Compass            |  |
| <b>15</b> | Cutter             |  |
| <b>16</b> | Drill machine      |  |
| <b>17</b> | Earth tester meter |  |
| <b>18</b> | Extension board    |  |
| <b>19</b> | File set           |  |
| <b>20</b> | First Aid box      |  |
| <b>21</b> | Gloves             |  |
| <b>22</b> | Goggles            |  |
| <b>23</b> | Grinder            |  |
| <b>24</b> | Hammer             |  |
| <b>25</b> | Hand drill machine |  |
| <b>26</b> | Helmet             |  |
| <b>27</b> | Hertz meter        |  |
| <b>28</b> | Hacksaw            |  |
| <b>29</b> | Knife (cable)      |  |
| <b>30</b> | Level              |  |

|           |                                       |  |
|-----------|---------------------------------------|--|
| <b>31</b> | L-key set                             |  |
| <b>32</b> | Lock plier                            |  |
| <b>33</b> | Measuring tape                        |  |
| <b>34</b> | Mega meter (Analog & Digital)         |  |
| <b>35</b> | Micrometer                            |  |
| <b>36</b> | Multimeter                            |  |
| <b>37</b> | Number punch                          |  |
| <b>38</b> | Phase sequence meter                  |  |
| <b>39</b> | Pipe cutter                           |  |
| <b>40</b> | Pipe vice                             |  |
| <b>41</b> | Pipe wrench                           |  |
| <b>42</b> | Plier set                             |  |
| <b>43</b> | Punching tool (Networking /Telephone) |  |
| <b>44</b> | Ratchet set                           |  |
| <b>45</b> | Safety boots                          |  |
| <b>46</b> | Scissor                               |  |
| <b>47</b> | Screw driver set                      |  |
| <b>48</b> | Soldering iron                        |  |
| <b>49</b> | Spanner set                           |  |
| <b>50</b> | Steel scale                           |  |



|           |                                    |  |
|-----------|------------------------------------|--|
| <b>51</b> | Steel wire                         |  |
| <b>52</b> | synchronizing meter                |  |
| <b>53</b> | Tachometer                         |  |
| <b>54</b> | Tester                             |  |
| <b>55</b> | Thimble press                      |  |
| <b>56</b> | Tong tester (clamp-on meter) AC/DC |  |
| <b>57</b> | Torch                              |  |
| <b>58</b> | Vernier caliper                    |  |
| <b>59</b> | Volt meter                         |  |
| <b>60</b> | Wire gauge                         |  |
| <b>61</b> | Wood saw                           |  |

**Consumables:**

| No. | Description             | Quantity    |
|-----|-------------------------|-------------|
| 1   | Cable 3 / .029"         | As Required |
| 2   | Cable 7 / .029"         | As Required |
| 3   | Cable 1 / .036"         | As Required |
| 4   | Cable 23 / .0076"       | As Required |
| 5   | Cable 40 / .0076"       | As Required |
| 6   | Switch Single Way       | As Required |
| 7   | Switch Two Way          | As Required |
| 8   | Push Button             | As Required |
| 9   | Bulb Holder Piano Type  | As Required |
| 10  | Bulb Holder Button Type | As Required |
| 11  | Ceiling Rose            | As Required |
| 12  | Fan Dimmer              | As Required |
| 13  | Socket Two Pin          | As Required |
| 14  | Socket Three Pin        | As Required |
| 15  | Light Plug              | As Required |
| 16  | Power Plug              | As Required |
| 17  | PVC Pipe                | As Required |
| 18  | PVC Elbow               | As Required |
| 19  | PVC Band                | As Required |

|           |                     |             |
|-----------|---------------------|-------------|
| <b>20</b> | Junction Box        | As Required |
| <b>21</b> | Fan Box             | As Required |
| <b>22</b> | Raval Plug          | As Required |
| <b>23</b> | Pipe Shaddle        | As Required |
| <b>24</b> | Cable Shaddle       | As Required |
| <b>25</b> | Board 4 x 4         | As Required |
| <b>26</b> | Board 7 x 4         | As Required |
| <b>27</b> | Board 8 x 10        | As Required |
| <b>28</b> | TV Pin              | As Required |
| <b>29</b> | Telephone Pin       | As Required |
| <b>30</b> | Insolation Tape     | As Required |
| <b>31</b> | PVC Duct Plain 3/4" | As Required |
| <b>32</b> | PVC Duct Slotted 1" | As Required |
| <b>33</b> | PVC Duct Plain 3/4" | As Required |
| <b>34</b> | PVC Duct Slotted 1" | As Required |
| <b>35</b> | Fuse Piano Type     | As Required |
| <b>36</b> | Main Switch         | As Required |
| <b>37</b> | Breaker Single Poll | As Required |
| <b>38</b> | Breaker Double Poll | As Required |
| <b>39</b> | Volt meter Panel    | As Required |
| <b>40</b> | Ampere Meter Panel  | As Required |

|           |                             |             |
|-----------|-----------------------------|-------------|
| <b>41</b> | DB Box                      | As Required |
| <b>42</b> | DB Switch                   | As Required |
| <b>43</b> | PG Connector                | As Required |
| <b>44</b> | Neutral Terminal            | As Required |
| <b>45</b> | Screw Different Size        | As Required |
| <b>46</b> | Steel Nail Different Size   | As Required |
| <b>47</b> | Bulb 100 Watt               | As Required |
| <b>48</b> | Bulb 200 Watt               | As Required |
| <b>49</b> | Nut Bolt Different Size     | As Required |
| <b>50</b> | Electric Bell               | As Required |
| <b>51</b> | Two Pin Shoe                | As Required |
| <b>52</b> | Three Pin Shoe              | As Required |
| <b>53</b> | Cable Tube Connection       | As Required |
| <b>54</b> | Tube Rod                    | As Required |
| <b>55</b> | Choke 20w, 40w              | As Required |
| <b>56</b> | Tube Starter                | As Required |
| <b>57</b> | Choke Patti Fitting         | As Required |
| <b>58</b> | Winding Wire Different Size | As Required |
| <b>59</b> | Slat Paper Different Size   | As Required |
| <b>60</b> | Cotton Tape                 | As Required |

|           |                                 |             |
|-----------|---------------------------------|-------------|
| <b>61</b> | Sleeve Different Size           | As Required |
| <b>62</b> | Varnish                         | As Required |
| <b>63</b> | Cable Three Core 40/ .0076      | As Required |
| <b>64</b> | Cable Four Core 7/ .036         | As Required |
| <b>65</b> | Cable Three Core 7/ .029        | As Required |
| <b>66</b> | Connection Plate                | As Required |
| <b>67</b> | Clutch Plate                    | As Required |
| <b>68</b> | Breaker Fitting Patti (Din Ray) | As Required |
| <b>69</b> | Relay 12V, 5A                   | As Required |
| <b>70</b> | Resistor Different Types        | As Required |
| <b>71</b> | Transistor Different Types      | As Required |
| <b>72</b> | LED                             | As Required |
| <b>73</b> | Diode                           | As Required |
| <b>74</b> | Rectifier Bridge                | As Required |
| <b>75</b> | Carbon Brush                    | As Required |
| <b>76</b> | Battery 6v                      | As Required |
| <b>77</b> | Breaker Stripe                  | As Required |
| <b>78</b> | Flout Switch                    | As Required |
| <b>79</b> | Magnetic Connector              | As Required |
| <b>80</b> | Cut Out                         | As Required |

|            |   |             |
|------------|---|-------------|
| <b>81</b>  | Breaker Cartridge Fuse                    | As Required |
| <b>82</b>  | ON / OFF Push Button                      | As Required |
| <b>83</b>  | Timer                                     | As Required |
| <b>84</b>  | Relay AC – 220V                           | As Required |
| <b>85</b>  | Relay DC- 12V                             | As Required |
| <b>86</b>  | Selector Switch Volt Meter                | As Required |
| <b>87</b>  | Selector Switch Ampere Meter              | As Required |
| <b>88</b>  | Emergency Switch                          | As Required |
| <b>89</b>  | Soldering Wire                            | As Required |
| <b>90</b>  | Paste                                     | As Required |
| <b>91</b>  | Light Indicator                           | As Required |
| <b>92</b>  | Limit Switch (MEM Inter Locking)          | As Required |
| <b>93</b>  | Motor Driven Selector Switch (Water Tank) | As Required |
| <b>94</b>  | Speaker                                   | As Required |
| <b>95</b>  | Acid                                      | As Required |
| <b>96</b>  | Hydro Metter                              | As Required |
| <b>97</b>  | Multi Metter (Analogue / Digital)         | As Required |
| <b>98</b>  | Cam Starter (single phase & three phase)  | As Required |
| <b>99</b>  | Generator Switch                          | As Required |
| <b>100</b> | Star Delta Manual                         | As Required |

|            |  |             |
|------------|--|-------------|
| <b>101</b> | Capacitor Different Size                 | As Required |
| <b>102</b> | Intercom Bell                            | As Required |
| <b>103</b> | Over Load Relay                          | As Required |
| <b>104</b> | Forward Reverse Switch                   | As Required |
| <b>105</b> | Tai Different Size                       | As Required |
| <b>106</b> | Magnetic Connector                       | As Required |
| <b>107</b> | Current Transformer                      | As Required |
| <b>108</b> | 8 Pin type & 11 Pin type relay with base | As Required |
| <b>109</b> | Timer Circuit                            | As Required |
| <b>110</b> | Relay Circuit                            | As Required |
| <b>111</b> | Boben Transformer                        | As Required |
| <b>112</b> | Core Transformer                         | As Required |
| <b>113</b> | Coal                                     | As Required |
| <b>114</b> | Calcium Carbonate                        | As Required |
| <b>115</b> | Petrol                                   | As Required |
| <b>116</b> | Heat Sleeve Tube                         | As Required |
| <b>117</b> | Changer Over Switch                      | As Required |
| <b>118</b> | Timer 0-60 second                        | As Required |
| <b>119</b> | Time 1-6 minute                          | As Required |
| <b>120</b> | Babon 1 ¼", 1 ½", 2", 2x3"               | As Required |
| <b>121</b> | UPS Card                                 | As Required |

