THE NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

OCCUPATIONAL STANDARDS

OCCUPATION: RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)

LEVEL: NTA LEVEL 6

FEBRUARY 2024

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ABBREVIATIONS

6S	Standardized Management Mode for the Production Operation Site: Security, Seiketsu, Seiri, Seiso, Seiton and Shitsuke
AC	Alternating Current
APP	Application Program
BMS	Battery Management System
CAD	Computer Aided Design
CBET	Competency Based Education and Training
DC	Direct Current
MC4	Multi-Contact-4mm Photovoltaic Pin Connector
MPPT	Maximum Power Point Tracking
NACTVET	National Council for Technical and Vocational Education and Training of Tanzania
NOS	National Occupational Standards
OS	Occupational Standards
PF	Power Factor
PLC	Programmable Logic Controller
PV	Photovoltaic Power Generation
SVG	Static Var Generator
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training

GLOSSARY OF TERMS

Circumstantial knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross-cutting issues.
Competence:	The ability to use knowledge, understanding, practical and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/training programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks - essentially the same tasks are performed by all employees having the same title.
Occupational area:	This is a broad grouping of related jobs. (Example: catering service)
Occupational standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as performance tools of assessment of the prescribed outcomes.
Performance criteria:	Indicate the expected end results or outcome in form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skills are conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor activities.
Standards:	A set of statements, which, if proved true under working conditions, means that an individual is meeting an expected level and type of performance.
Task analysis:	The process of analyzing each task to determine the steps, circumstantial knowledge, attitudes, performance criteria, tools and materials needed, and safety concerns required of employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, consists of two or more definite steps, and leads to a product, service, or decision.

UNDERPINNING KNOWLEDGE	The crucial knowledge that an individual must acquire in order to perform a given task.
Verification process:	The process of experts reviewing and confirming the statements of tasks (competency) through occupational analysis. Other questions such as the degree of task learning difficulty are also frequently asked. This process is sometimes referred to as validation.
Occupational competence:	The application of knowledge and skills to perform consistently to the standards required in the working context.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status, with a high level of human development. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical and Vocational Education and Training (NACTVET) has begun the job of drafting Occupational Standards (OS) that will eventually be adopted as National Occupational Standards (NOS) for use in the delivery of TET that meets the needs of the labour market and the country's economic agenda.

Occupational Standards (OS) are performance criteria that are matched with labour market demands. Each of them describes the functions, performance standards, and understanding or knowledge underpinning a given occupation. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruitment, supervision, and appraisal, as well as TET Standards. They are also helpful for benchmarking and harmonizing job qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current, and consistent in application across all public and private institutions.

However, it must be noted that Occupational Standards are different from Training /Education Standards. Occupational standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical circuits, performs troubleshooting in electrical circuits, etc.), and are usually defined by Employers following procedures as agreed upon by all the stakeholders. On the other hand, Training and Education Standards are developed from the activities defined in the occupational standards, and they specify learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him/her to function at an agreed level in an occupation. Training and Education Standards are used to define curricula in training institutions. It is critical, however, to establish a direct link between the occupational standards and the training standards for both of them to respond collaboratively to the demands of the labour market.

For the purpose of TET delivery, Tanzania has adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the occupational standards. Occupational standards are thus the starting point for developing competency-based training (CBET) programmes. Therefore, it is quite pertinent

for TET institutions to use the relevant occupational standards as a benchmark for formulating their curricula.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training.

The document explains how the occupational standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0. OCCUPATIONAL STANDARDS DEVELOPMENT PROCESS

The process of developing these Occupational Standards involved both local and international expertise. The process began with an examination of major documents that guide Tanzanian skills development including the *10-year National Skills Development Strategy (2016-2026).* NACTVET labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a team of experts in consultation with practitioners developed draft occupational standards. The draft document was used to develop an occupational profile for each occupation (DACUM Chart), which is attached as an **Appendix** to every Occupational Standard.

The occupational standards were validated during the stakeholders' forum held on 22nd and 23rd February 2024 at Morogoro. The information from the stakeholders' forum provides insight from the workplaces, professional bodies, regulatory bodies and sector ministries regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATIONAL STANDARDS FOR RENEWABLE ENERGY ENGINEERING TECHNICIANS (SOLAR)

These standards cover a broad range of duties and tasks that can be performed by a Renewable Energy Engineering Technician (Solar). However, the occupational standards are not meant to replace individual job descriptions, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Renewable Energy Engineering Technician (Solar) may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

Renewable Energy Engineering Technicians (Solar) refer to the personnel engaged in identification and review of the assembly drawings for the PV generation system and station power load and materials, installation and debugging of PV power station modules, monitoring devices and other

related facilities and equipment, as well as inspection and maintenance of the operating status of the PV power station during the construction of the solar PV power station, and the following are the main responsibilities of a Renewable Energy Engineering Technician (Solar):

Generally, a Renewable Energy Engineering Technician (Solar) performs the following duties:

a) Perform equipment selection, material accounting, installation, operation, maintenance and hand-over of equipment for the small PV system;

b) Perfom household PV construction scheme design, installation, inspection and maintenance;

c) Determine routine use and maintenance methods for various PV generation systems;

d) Analyze and determine the failure reasons of the PV generation system and dispose common failures according to various fault phenomena.

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA 4, 5 and 6.

4.0. VALIDITY PERIOD

The Occupational Standards will be valid for 3-5 years due to the fast-changing nature of technology. The review will proceed in the same manner as the previous one, with new occupational standards being developed based on current labour market information.

5.0. OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR) - NTA LEVEL 6

<table>
<tr><td>OCCUPATION</td><td>RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>INTERPRET AND REVIEW DIAGRAMS OF SOLAR PV POWER GENERATION SYSTEMS</td><td>DUTY NO.</td><td>601</td></tr>
<tr><td>TASK TITLE</td><td>INTERPRET TOPOLOGICAL STRUCTURE DIAGRAMS OF SOLAR PV POWER GENERATION SYSTEMS</td><td>TASK NO.</td><td>6011</td></tr>
<tr><td>PERFORMANCE CRITERIA</td><td colspan="3">The person performing this task must be able to interpret the topological structure diagram of PV power generation system according to technical requirements and industry standards.</td></tr>
<tr><td>RANGE STATEMENT</td><td colspan="3">This task may be executed in PV power stations under the supervision of a Renewable Energy Engineering Engineer.
The tools and equipment to be used include:
1. Computer;
2. Topological structure diagram of PV generation system;
3. Magnifier;
4. AutoCAD software;
5. Safety gear.</td></tr>
<tr><td colspan="4">EVIDENCE REQUIREMENT</td></tr>
<tr><td colspan="2">PRACTICAL PERFORMANCE</td><td colspan="2">UNDERPINNING KNOWLEDGE</td></tr>
<tr><td colspan="2">The person performing this task must be able to do the following:
1. Open the topological structure diagram of PV power generation system with AutoCAD software;
2. Interpret the symbolic meanings of the topological structure diagram of PV power generation system;
3. Interpret the types of PV generation systems;
4. Interpret the diagram of the main equipment and parameters of PV power generation system;
5. Review the diagrams where necessary.
6. Store tools, equipment and drawings;</td><td colspan="2">Detailed knowledge about:
1.0 Methods
The person performing this task must be able to explain how to:
1.1 Strategies and procedures for interpreting the topology diagram of PV power generation system;
1.2 Interpret the symbolic meanings of the topological structure diagram of PV power generation system;
1.3 Store the topological structure diagram of PV power generation system.

2.0 Principle
The person performing this task must be able to explain the following principles:</td></tr>
</table>

7. Observe health, occupational and environmental safety rules and regulations.	2.1 Principles of photovoltaic power generation; 2.2 Design specification of PV power station; 2.3 Construction specification of PV power station; 2.4 Acceptance specification of PV power station; 2.5 Provisions for drawing storage. **3.0 Theories** The person performing this task must be able to explain: 3.1 Types of PV power generation systems; 3.2 Main equipment of PVpower generation system; 3.3 Main technical parameters of PV power generation system; **4.0 Essential skills** 4.1 Communication skills; 4.2 AutoCAD drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Innovation skills. **5.0 Mathematical skills** 5.1 Numerical computation.
DESCRIPTION OF THE END PRODUCT / SERVICE	The topological structure diagrams of a solar PV power generation systems are interpreted and reviewed in accordance with the construction instructions of PV power generation systems and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe operation of computers; 2. Occupational health and safety.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INTERPRET AND REVIEW DIAGRAMS OF SOLAR PV POWER GENERATION SYSTEMS	**DUTY NO.**	601
TASK TITLE	INTERPRET SOLAR PV MODULE ASSEMBLY DRAWINGS	**TASK NO.**	6012
PERFORMANCE CRITERIA	The person performing this task must be able to interpret the solar PV power module assembly drawings according to technical requirements and industry standards.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Computer; 2. Solar PV Module Assembly Drawing 3. Magnifier; 4. AutoCAD software; 5. Safety gear.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Open the assembly diagram of solar PV module with AutoCAD software; 2. Explain the meanings of symbols in the assembly drawing of solar PV modules; 3. Interpret Installation method of PV modules; 4. Interpret base types of solar PV modules; 5. Interpret the types and parameters of solar PV module supports; 6. Store tools, equipment and drawings; 7. Observe health, occupational and environmental safety rules and regulations.	Detailed knowledge about:

	1.0 Methods The person performing this task must be able to explain how to: 1.1 Interpret strategies and procedures for solar PV module assembly drawings; 1.2 Explain the meanings of symbols in the assembly drawing of solar PV modules; 1.3 Storage solar PV module assembly drawings. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of photovoltaic power generation; 2.2 Design specification of solar PV power station; 2.3 Construction specification of solar PV power station; 2.4 Provisions for drawing storage. **3.0 Theories** The person performing this task must be able to explain: 3.1 Types of solar PV modules; 3.2 Installation method of solar PV modules; 3.3 Base types of solar PV modules; 3.4 Support types of solar PV modules. **4.0 Essential skills** 4.1 Communication skills; 4.2 AutoCAD drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Innovation skills. **5.0 Mathematical skills** 5.1 Numerical computation.
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV power module assembly drawings are interpreted according to technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe operation of computers; 2. Occupational health and safety.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INTERPRET AND REVIEW DIAGRAMS OF SOLAR PV POWER GENERATION SYSTEMS	**DUTY NO.**	601
TASK TITLE	INTERPRET LOW VOLTAGE DISTRIBUTION DIAGRAMS OF SOLAR PV POWER SYSTEMS	**TASK NO.**	6013
PERFORMANCE CRITERIA	The person performing this task must be able to interpret the low-voltage distribution diagram of solar PV power systems according to the technical requirements and industry standards.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Computer; 2. Interpretation of low voltage distribution diagram of solar PV power station; 3. Magnifier; 4. AutoCAD software; 5. Safety gear.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Open the low-voltage assembly diagram of solar PV power station with AutoCAD software; 2. Interpret the symbolic meanings of low-voltage distribution diagram of solar PV power station; 3. Interpret the main electrical components of low-voltage distribution system of solar PV power station; 4. Interpret the wiring form of electrical components; 5. Interpret the low-voltage distribution power supply of solar PV power station and its standby situation; 6. Interpret busbar and cable laying form; 7. Interpret the layout forms of protection facilities, grounding	Detailed knowledge about: **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Interpret strategies and procedures for solar PV power station assembly drawings; 1.2 Interpret the symbolic meanings of low-voltage distribution diagram of solar PV power station; 1.3 Storage of solar PV power station low voltage distribution diagram. **2.0 Principle** The person performing this task must be able to explain the following principles:

systems and lightning protection facilities; 8. Store tools, equipment and drawings; 9. Observe health, occupational and environmental safety rules and regulations.	2.1 Principles of photovoltaic power generation; 2.2 Design specification of low-voltage distribution; 2.3 Design specification of power supply and distribution system; 2.4 Technical requirements for protection of solar PV power station against lightning; 2.5 Provisions for drawing storage. **3.0 Theories** The person performing this task must be able to explain: 3.1 Types of electrical components for low voltage distribution system of solar PV power station; 3.2 Layout form of lightning protection facilities, protection facilities and grounding system; 3.3 Busbar and cable laying form. **4.0 Essential skills** 4.1 Communication skills; 4.2 AutoCAD drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Innovation skills. **5.0 Mathematical skills** 5.1 Numerical computation.
DESCRIPTION OF THE END PRODUCT / SERVICE	The low voltage distribution diagrams of solar PV power systems are interpreted according to technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe operation of computers; 2. Occupational health and safety.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INTERPRET AND REVIEW DIAGRAMS OF SOLAR PV POWER GENERATION SYSTEMS	**DUTY NO.**	601
TASK TITLE	CALCULATE AUXILIARY POWER LOAD OF SOLAR PV POWER SYSTEMS	**TASK NO.**	6014
PERFORMANCE CRITERIA	The person performing this task must be able to calculate the auxiliary power load of solar PV power station according to technical requirements and industry standards.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Computer; 2. Calculators; 3. Office software; 4. Technical parameter documents of auxiliary equipment of solar PV power station; 5. Safety gear.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Open Office software; 2. Analyze the load types of auxiliary equipment in solar PV power station; 3. Calculate the capacity of auxiliary power equipment; 4. Query the simultaneous coefficient of auxiliary power equipment; 5. Calculate the load of a single device; 6. Calculate the load of a single power group; 7. Calculate the load of multiple power group; 8. Calculate the load on the low voltage busbar; 9. Calculate the load of the whole plant; 10. Store tools, equipment and documentation;	Detailed knowledge about: **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Calculate auxiliary power load of solar PV power stations; 1.2 Store technical parameter documents of auxiliary equipment of solar PV power station. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of photovoltaic power generation; 2.2 Principle of power supply and distribution technology; 2.3 Design specification of solar PV power station; 2.4 Provisions for documentation storage. **3.0 Theories** The person performing this task must be able to explain:

11. Observe health, occupational and environmental safety rules and regulations.	3.1 Load types of auxiliary equipment in solar PV power station; 3.2 Simultaneous coefficient of auxiliary equipment of solar PV power station; 3.3 Load of single equipment, load of single power group and load of multiple power groups. 4.0 Essential skills 4.1 Communication skills; 4.2 Operation skills of Office software; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Innovation skills. **5.0 Mathematical skills** 5.1 Numerical computation.
DESCRIPTION OF THE END PRODUCT / SERVICE	The auxiliary power load of solar PV power station is calculated, and the instructions of auxiliary power load are formulated according to technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe operation of computers; 2. Occupational health and safety.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INTERPRET AND REVIEW DIAGRAMS OF SOLAR PV POWER GENERATION SYSTEMS	**DUTY NO.**	601
TASK TITLE	ESTABLISH THE QUANTITY OF MATERIALS FOR ASSEMBLING THE SOLAR PV MODULES	**TASK NO.**	6015
PERFORMANCE CRITERIA	The person performing this task must be able to establish the quantity of materials for assembling the solar PV modules according to technical requirements and industry standards.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Computer; 2. Calculators; 3. Office software; 4. Solar PV module assembly drawing; 5. Topological structure diagram of solar PV generation systems; 6. Construction task book of solar PV power stations; 7. AutoCAD software; 8. Safety gear.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Open the assembly drawing of solar PV module and the topological structure diagram of solar PV generation system with AutoCAD software; 2. Interpret solar PV module assembly drawing; 3. Interpret topological structure diagram of solar PV generation system; 4. Open Office software; 5. Interpret support types of solar PV modules; 6. Calculate the number of columns, inclined beams, beams and purlins of solar PV module supports; 7. Calculate the number of angle adjusting devices;	Detailed knowledge about: **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Perform assembly material accounting of solar PV modules; 1.2 Storage assembly drawings of solar PV modules and topological structure diagrams of solar PV generation system. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of photovoltaic power generation; 2.2 Design specification of solar PV power station; 2.3 Construction specification of solar PV power station; 2.4 Provisions for drawing storage. **3.0 Theories**

8. Interpret base types of solar PV modules; 9. Calculate the basic number of solar PV modules; 10. Clean the tools, equipment and workplace; 11. Store tools, equipment and drawings; 12. Observe health, occupational and environmental safety rules and regulations.	The person performing this task must be able to explain: 3.1 Support types of solar PV modules; 3.2 Support structures of solar PV modules; 3.3 Base types of solar PV modules; 3.4 Devices of adjusting angles of solar PV modules. **4.0 Essential skills** 4.1 Communication skills; 4.2 Operation skills of Office software; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Innovation skills. **5.0 Mathematical skills** 5.1 Numerical computation.
DESCRIPTION OF THE END PRODUCT / SERVICE	The quantity of materials for assembling the solar PV modules is established according to the technical requirements, industry standards, and standard solar PV installation specifications.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe operation of computers; 2. Occupational health and safety.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSTALL THE SOLAR PV POWER SYSTEM	**DUTY NO.**	602
TASK TITLE	INSTALL THE SOLAR PV POWER STATION MODULES AND SUPPORTS	**TASK NO.**	6021
PERFORMANCE CRITERIA	The person performing this task must be able to install solar PV power system modules and supports in accordance with technical requirements and standard operation procedures.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Wrench, socket, plier, screwdriver and other hardware tools; 2. Wire stripper; 3. Crimpling plier; 4. Electric drill; 5. Special wrench for photovoltaic connector; 6. Angle grinder and toothless saw; 7. Level gauge; 8. Tilt angle measuring instrument; 9. Multimeter; 10. Tape; 11. Personal protective equipment, such as safety shoes, safety helmet and insulating gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the quality of the appearances of modules and supports before installation; 2. Install bottom beams for supports; 3. Install bars; 4. Roughly adjust the installation surface of solar PV modules; 5. Install solar PV modules; 6. Level solar PV modules; 7. Connect solar PV modules; 8. Install solar PV modules and check the wiring; 9. Test solar PV modules; 10. Clean the tools, equipment and workplace;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Check the appearances of modules and supports; 1.2 Stack and handle solar PV modules; 1.3 Fix and level bottom beam components; 1.4 Sort and place support bars; 1.5 Test the open circuit voltage of solar PV modules; 1.6 Fabricate photovoltaic connectors; 1.7 Install the grounding wire of solar PV modules; 1.8 Use multimeters to measure voltage, current and on-off status of solar PV modules. **2.0 Principle** The person performing this task must be able to explain the following principles:

11. Observe health, occupational and environmental safety rules and regulations.	2.1 Installation test specification for solar PV modules; 2.2 Installation process of photovoltaic supports. **3.0 Theories** The person performing this task must be able to explain: 3.1 Criteria for installing and testing supports; 3.2 Criteria for installing and testing modules; 3.3 Precautions of installing supports and modules. **4.0 Essential skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Cable connection; 4.4 Safe and civilized construction skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV power station modules and supports are installed in accordance with technical requirements and standard operation procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Electrician safety basics; 2. Occupational health and safety; 3. Engineering management.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSTALL THE SOLAR PV POWER SYSTEM	**DUTY NO.**	602
TASK TITLE	INSTALL THE SOLAR PV POWER STATION MONITORING EQUIPMENT	**TASK NO.**	6022
PERFORMANCE CRITERIA	The person performing this task must be able to install the solar PV power system monitoring equipment in accordance with technical requirements and standard operation procedures.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Wrench, socket, plier, screwdriver and other hardware tools; 2. Wire stripper; 3. Crimpling plier; 4. Multimeter; 5. Portable computer; 6. Personal protective equipment, such as safety shoes, safety helmet and insulating gloves.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Complete RS485 communication wiring of such communication acquisition modules as inverters, combiner boxes and electric meters; 2. Arrange communication cables; 3. Complete the wiring of inverters, combiner boxes, electric meters and communication management machines; 4. Debug the communication of inverters, combiner boxes, electric meters and other equipment; 5. Connect communication management machines with monitoring computers; 6. Check the backend monitoring data; 7. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use wire strippers and crimpling pliers; 1.2 Crimp wiring terminals of the RS485 communication line; 1.3 Install cable trays and tubes; 1.4 Connect the communication port between the equipment and collectors; 1.5 Use a USB to RS485 interface equipment and serial debugging software to debug equipment communication. **2.0 Principle** The person performing this task must be able to explain the following principles:

	2.1 Connection diagram of the monitoring system; 2.2 Wiring diagram of equipment communication lines; 2.3 Requirements and standards for communication lines and bushings. **3.0 Theories** The person performing this task must be able to explain: 3.1 Design of solar PV power station monitoring systems; 3.2 Debugging methods and steps for communication systems; 3.3 Definition of inverter communication ports and collector wiring terminal interfaces; 3.4 Structure and layout of solar PV power station monitoring systems. **4.0 Essential skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and civilized construction skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV power station monitoring equipment isinstalled in accordance with technical requirements and standard operation procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Computer Basics; 2. Occupational health and safety; 3. Engineering management.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSTALL THE SOLAR PV POWER SYSTEM	**DUTY NO.**	602
TASK TITLE	INSTALL THE SOFTWARE FOR THE SOLAR PV POWER SYSTEMS	**TASK NO.**	6023
PERFORMANCE CRITERIA	The person performing this task must be able to install software for solar PV power systems in accordance with technical requirements and User Manual.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. System CD-ROM; 2. CD-ROM of related software of solar PV power stations 3. Safety gear.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Configure the running environment for computer system hardware and software; 2. Install the monitoring system software of solar PV power stations; 3. Install the production management system software of solar PV power stations; 4. Install the operation and maintenance analysis system software of solar PV power stations; 5. Debug and check the software function and parameter integrity of solar PV power stations; 6. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Configure the running environment for computer hardware and software systems in accordance with software operation requirements of solar PV power stations; 1.2 Set up software catalogues and system tasks of solar PV power stations; 1.3 Test the functions of the software. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of the installation and function integrity test of related software of solar PV power stations. **3.0 Theories** The person performing this task must be able to explain: 3.1 Configuration of the running environment for computers of solar PV power station software; 3.2 Installation process and function test of solar PV power station software.

	4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Computer software operation.
DESCRIPTION OF THE END PRODUCT / SERVICE	The software for the solar PV power system is installed in accordance with technical requirements and User Manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic operation of computers; 2. Installation and setup methods of common software.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSTALL THE SOLAR PV POWER SYSTEM	**DUTY NO.**	602
TASK TITLE	INSTALL THE SOLAR PV POWER SYSTEM METERING EQUIPMENT	**TASK NO.**	6024
PERFORMANCE CRITERIA	The person performing this task must be able to install solar PV power system metering equipment in accordance with technical requirements and wiring diagrams.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Diagonal plier; 2. Electrician's knife; 3. Wire stripper; 4. Test pencil; 5. Clamp ammeter; 6. Phase-sequence meter; 7. Screwdriver; 8. Safety helmet; 9. Insulating gloves; 10. Insulating shoes.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Install fixed electric energy meter metering boxes; 2. Install fixed electric energy meters; 3. Install three-phase watt-hour meter wiring; 4. Install single-phase watt-hour meter wiring; 5. Install two-way metering watt-hour meter wiring; 6. Adjust the power-on debugging and record the relevant parameters of watt-hour meters; 7. Clean the tools, equipment and workplace; 8. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select electric meters according to different wiring schemes and complete the input and output wiring; 1.2 Measure circuit conditions with clamp ammeters. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Electrical wiring principle of watt-hour meters; 2.2 Structures of different types of watt-hour meters. **3.0 Theories** The person performing this task must be able to explain:

	3.1 Wiring of metering devices; 3.2 Risk spot analysis. **4.0 Essential skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Construction safety and civility.
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV power system metering equipment is installed in accordance with technical requirements and standard operation procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Electrician safety basics; 2. Occupational health and safety; 3. Engineering management.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSTALL THE SOLAR PV POWER SYSTEM	**DUTY NO.**	602
TASK TITLE	INSTALL THE SOLAR PV POWER SYSTEM COMBINER BOX	**TASK NO.**	6025
PERFORMANCE CRITERIA	The person performing this task must be able to install solar PV power system combiner box in accordance with technical requirements and standard operation procedures.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Wrench, diagonal plier, screwdriver and other hardware tools; 2. Wire stripper; 3. Crimpling plier; 4. Electric drill; 5. Special wrench for photovoltaic connector; 6. Wire buckle; 7. Multimeter; 8. Tape measure; 9. Grounding resistance tester; 10. Personal protective equipment, such as insulating shoes, safety helmet and insulating gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the appearance quality of the combiner box before installation; 2. Fix the combiner box; 3. Pull out all fuses; 4. Conduct the input wiring of the combiner box; 5. Conduct the output wiring of the combiner box; 6. Conduct the grounding connection of the combiner box; 7. Conduct the communication wiring of the combiner box; 8. Install the fuses; 9. Check the terminals and wiring; 10. Debug circuit breakers and fuses;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Install the combiner box in different installation environments; 1.2 Connect the positive and negative cables of the solar PV group string; 1.3 Install the combiner box output cable; 1.4 Connect the grounding wire; 1.5 Connect the communication line; 1.6 Debug and check the combiner box; 1.7 Test the grounding resistance using a grounding resistance tester. **2.0 Principle** The person performing this task must be able to explain the following principles:

11. Test the grounding resistance of the box; 12. Clean the tools, equipment and workplace; 13. Observe health, occupational and environmental safety rules and regulations.	2.1 Working principles of combiner box; 2.2 Electrical connection principles of combiner box; **3.0 Theories** The person performing this task must be able to explain: 3.1 Internal composition of the combiner box; 3.2 Electrical connection diagram of the combiner box; 3.3 Precautions for combiner box installation and debugging. **4.0 Essential skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Construction safety and civility.
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV power system combiner box is installed according to technical requirements and standard operation procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Electrician safety basics; 2. Occupational health and safety; 3. Engineering management.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSTALL THE SOLAR PV POWER SYSTEM	**DUTY NO.**	602
TASK TITLE	INSTALL THE SOLAR PV POWER SYSTEM INVERTER	**TASK NO.**	6026
PERFORMANCE CRITERIA	The person performing this task must be able to install solar PV power system inverter in accordance with technical requirements and standard operation procedures.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Wrench, diagonal plier, screwdriver and other hardware tools; 2. Wire stripper; 3. Crimpling plier; 4. Electric drill; 5. Special wrench for photovoltaic connector; 6. Wire buckle; 7. Multimeter; 8. Tape measure; 9. Grounding resistance tester; 10. Personal protective equipment, such as insulating shoes, safety helmet and insulating gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the appearance quality and accessories of inverter before installation; 2. Install the inverter; 3. Connect the AC side cable of the inverter; 4. Connect the DC side cable of the inverter; 5. Connect the RS485 communication line; 6. Check the terminals and wiring; 7. Debug the inverter; 8. Clean the tools, equipment and workplace;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to:

9. Observe health, occupational and environmental safety rules and regulations.	1.1 Fix inverter in different installation environments; 1.2 Install the inverter wall mount; 1.3 Check the status of the inverter switch and safety protection measures; 1.4 Assemble the inverter connector; 1.5 Install the matching RS485 connector; 1.6 Set the inverter communication address; 1.7 Check inverter parameters and operating state. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of the electrical connection of inverter; 2.2 Working principles of inverter. **3.0 Theories** The person performing this task must be able to explain: 3.1 Inverter circuit structure; 3.2 Inverter performance parameters; 3.3 Inverter topology. **4.0 Essential skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Construction safety and civility.
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV power system inverter is installed according to the technical requirements and standard operation procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Electrician safety basics; 2. Occupational health and safety; 3. Engineering management.

<table>
<tr><td>OCCUPATION</td><td>RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>INSTALL THE SOLAR PV POWER SYSTEM</td><td>DUTY NO.</td><td>602</td></tr>
<tr><td>TASK TITLE</td><td>INSTALL THE LIGHTNING PROTECTION FACILITIES FOR SOLAR POWER SYSTEMS</td><td>TASK NO.</td><td>6027</td></tr>
<tr><td>PERFORMANCE CRITERIA</td><td colspan="3">The person performing this task must be able to install lightning protection facilities for solar PV power systems in accordance with construction drawings and standard operation procedures.</td></tr>
<tr><td>RANGE STATEMENT</td><td colspan="3">This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer.
The tools and equipment to be used include:
1. Wrench, diagonal pliers, screwdriver and other hardware tools;
2. Shovel;
3. Electric drill;
4. Tramegger;
5. Electric welding machine;
6. Hand saws;
7. Multimeter;
8. Tape measure;
9. Generators;
10. Safety protection articles, such as insulated shoes, safety helmets, insulating gloves, goggles, protective clothing, safety fences, etc.</td></tr>
<tr><td colspan="4">EVIDENCE REQUIREMENT</td></tr>
<tr><td colspan="2">PRACTICAL PERFORMANCE</td><td colspan="2">UNDERPINNING KNOWLEDGE</td></tr>
<tr><td colspan="2">The person performing this task must be able to do the following:
1. Lay the grounding wire;
2. Bury the vertical grounding electrode;
3. Bury and lay the grounding trunk line;
4. Connect the grounding wire of electrical equipment;
5. Conduct quality acceptance;
6. Clean the tools, equipment and workplace;
7. Observe health, occupational and environmental safety rules and regulations.</td><td colspan="2">Detailed knowledge about:
1.0 Methods
The person performing this task must be able to explain how to:
1.1 Prepare and inspect grounding material;
1.2 Install vertical and horizontal grounding electrodes;
1.3 Select and install lightning protectors;
1.4 Conduct the grounding installation of lighting protection equipment.

2.0 Principle
The person performing this task must be able to explain the following principles:</td></tr>
</table>

	2.1 Specifications for the lightning protection of solar PV power station. **3.0 Theories** The person performing this task must be able to explain: 3.1 Typical lightning protection schemes for solar PV power stations; 3.2 Precautions for grounding electrode installation and electrical equipment grounding. **4.0 Essential skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Construction safety and civility.
DESCRIPTION OF THE END PRODUCT / SERVICE	The lighting protection facilities for the solar PV power system are installed in accordance with the technical requirements and standard operation procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Electrician safety basics; 2. Occupational health and safety; 3. Engineering management.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSPECT AND HAND OVER THE SOLAR PV POWER GENERATION SYSTEM	**DUTY NO.**	603
TASK TITLE	INSPECT THE OPERATION OF PRIMARY EQUIPMENT OF THE SOLAR PV POWER SYSTEM	**TASK NO.**	6031
PERFORMANCE CRITERIA	The person performing this task must be able to inspect the operation of primary equipment of the solar PV power system according to technical requirements and electrical safety operation manual.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Complete set of electrical tools; 2. Multimeter; 3. Oscilloscopes; 4. Power meter; 5. Personal protective equipment, such as safety helmets, electrical protective clothing, insulating shoes and insulating gloves; 6. Fire extinguishers; 7. Insulation monitor; 8. Safety gear.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with live operation safety regulations when performing this task; 2. Select multimeter, insulation monitor and electrical tools; 3. Check the appearance of solar PV modules; 4. Test the operating parameters of solar PV modules; 5. Check the foundation stability of solar PV module supports; 6. Check the stability and safety of on-site wiring of primary equipment in solar PV power stations; 7. Check the insulation of primary equipment lines in solar PV power stations;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Conduct visual inspection of solar PV modules; 1.2 Use a multimeter; 1.3 Check the foundation stability of solar PV module supports; 1.4 Check the stability and safety of on-site wiring of primary equipment in solar PV power stations; 1.5 Use an insulation monitor; 1.6 Carry out electrical safety inspection of electrical equipment in solar PV power stations. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of photovoltaic power generation;

8. Check the electrical safety of electrical equipment in solar PV power stations; 9. Clean the tools, equipment and workplace; 10. Store tools and equipment; 11. Observe health, occupational and environmental safety rules and regulations.	2.2 Working principles of primary equipment in solar PV power stations. **3.0 Theories** The person performing this task must be able to explain: 3.1 Precautions for tool operation; 3.2 Primary equipment of solar PV power stations and its functions. **4.0 Essential skills** 4.1 Communication skills; 4.2 Operating skills for common tools; 4.3 Teamwork skills; 4.4 Report writing skills. **5.0 Mathematical skills** 5.1 Basic mathematical operation ability.
DESCRIPTION OF THE END PRODUCT / SERVICE	The operation of primary equipment in the solar PV power system is inspected according to technical requirements and the electrical safety operation manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Knowledge of environmental protection and waste disposal.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSPECT AND HAND OVER THE SOLAR PV POWER GENERATION SYSTEM	**DUTY NO.**	603
TASK TITLE	INSPECT THE WORKING CONDITION OF THE SOLAR PV MODULES	**TASK NO.**	6032
PERFORMANCE CRITERIA	The person performing this task must be able to inspect the working condition of the solar PV modules according to technical requirements and manufacturer's operation manual.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Complete set of electrical tools; 2. Multimeter, infrared thermal imager, I-V tester; 3. Personal protective equipment, such as safety helmets, electrical protective clothing, insulating shoes and insulating gloves; 4. Fire extinguishers 5. Safety gear.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with live operation safety regulations when performing this task; 2. Select multimeter, infrared thermal imager and I-V tester; 3. Measure the characteristic parameters of solar PV modules; 4. Check the appearance of solar PV modules; 5. Check the junction box of solar PV modules; 6. Clean the tools, equipment and workplace; 7. Store tools and equipment; 8. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use an I-V tester; 1.2 Ash and dirt treatment of solar PV modules; 1.3 Use an infrared thermal imager. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of photovoltaic power generation; 2.2 Principles of solar PV module inspection. **3.0 Theories** The person performing this task must be able to explain: 3.1 Hot spot effect; 3.2 Characteristic parameters of solar PV modules. **4.0 Essential skills** 4.1 Communication skills; 4.2 Operating skills for common tools;

	4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Analysis skills. **5.0 Mathematical skills** 5.1 Basic mathematical operations.
DESCRIPTION OF THE END PRODUCT / SERVICE	The working condition of solar PV modules are tested according to technical requirements and manufacturer's operation manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Knowledge of environmental protection and waste disposal.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSPECT AND HAND OVER THE SOLAR PV POWER GENERATION SYSTEM	**DUTY NO.**	603
TASK TITLE	INSPECT THE WORKING CONDITION OF THE SOLAR PV COMBINER BOX	**TASK NO.**	6033
PERFORMANCE CRITERIA	The person performing this task must be able to inspect the working condition of the solar PV combiner boxes according to technical requirements and the manufacturer's operation manual.		
RANGE STATEMENT	This task may be executed in PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Complete set of electrical tools; 2. Clamp ammeter, multimeter, infrared thermal imager; 3. Personal protective equipment, such as safety helmets, electrical protective clothing, insulating shoes and insulating gloves; 4. Fire extinguishers; 5. Safety gear.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with live operation safety regulations when performing this task; 2. Select clamp ammeter, infrared thermal imager and electrical tools; 3. Check the appearance of solar PV combiner box and the operation of each component; 4. Check if there are problems such as overheat, peculiar smell, broken wire, with each component; 5. Check the lightning protection module for breakdown; 6. Check that the data collector is working properly; 7. Check whether the incoming and outgoing cables of the combiner box are in good condition;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Check the circuit of combiner box components; 1.2 Check the appearance and operation of photovoltaic combiner box; 1.3 Identify the faults with solar PV combiner box; 1.4 Use a clamp ammeter; 1.5 Use electrical tools. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Working principles of solar PV combiner box; 2.2 Specifications and safe operation of clamp ammeters. **3.0 Theories** The person performing this task must be able to explain: 3.1 Causes of solar PV combiner box failure;

8. Clean the tools, equipment and workplace; 9. Store tools and equipment; 10. Observe health, occupational and environmental safety rules and regulations.	3.2 Troubleshooting method of solar PV combiner box. **4.0 Essential skills** 4.1 Communication skills; 4.2 Operating skills for common tools; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Analysis skills. **5.0 Mathematical skills** 5.1 Basic mathematical operations.
DESCRIPTION OF THE END PRODUCT / SERVICE	The working condition of the combiner box is inspected according to the technical requirements, manufacturer's operation manual, and diagnosis certificate issuing criteria.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Knowledge of environmental protection and waste disposal.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	INSPECT AND HAND OVER THE SOLAR PV POWER GENERATION SYSTEM	**DUTY NO.**	603
TASK TITLE	INSPECT THE WORKING STATE OF THE SOLAR PV INVERTER	**TASK NO.**	6034
PERFORMANCE CRITERIA	The person performing this task must be able to inspect the working condition of the solar PV inverters according to technical requirements and the manufacturer's operation manual.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Complete set of electrical tools; 2. Multimeter, insulation monitor; 3. Personal protective equipment, such as safety helmets, electrical protective clothing, insulating shoes and insulating gloves; 4. Fire extinguishers; 5. Safety gear.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with live operation safety regulations when performing this task; 2. Select multimeter, electrical tools and insulation monitor; 3. Check the appearance of solar PV inverter; 4. Check the safety performance of solar PV inverter; 5. Check the electrical performance of solar PV inverter; 6. Check the communication performance of solar PV inverter; 7. Check the insulation performance of solar PV inverter; 8. Clean the tools, equipment and workplace; 9. Store tools and equipment;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use a multimeter to detect various operating parameters; 1.2 Conduct solar PV inverter communication check; 1.3 Conduct Inverter incoming and outgoing cable detection; 1.4 Check the lightning protector; 1.5 Use an insulation monitor. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Working principles of solar PV inverter. **3.0 Theories** The person performing this task must be able to explain: 3.1 Common faults of solar PV inverter and their causes; 3.2 Troubleshooting method of solar PV inverter.

10. Observe health, occupational and environmental safety rules and regulations.	**4.0 Essential skills** 4.1 Communication skills; 4.2 Operating skills for common tools; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Analysis skills. **5.0 Mathematical skills** 5.1 Basic mathematical operations.
DESCRIPTION OF THE END PRODUCT / SERVICE	The working condition of the solar PV inverter is inspected according to the technical requirements and the manufacturer's operation manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Knowledge of environmental protection and waste disposal.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	OPERATE AND MAINTAIN THE SOLAR PV POWER SYSTEM	**DUTY NO.**	604
TASK TITLE	ADJUST THE SOLAR PV ARRAY COMBINATIONS	**TASK NO.**	6041
PERFORMANCE CRITERIA	The person performing this task must be able to adjust the solar PV array combinations according to technical requirements and the operation and maintenance regulations of solar PV power stations.		
RANGE STATEMENT	This task may be executed in a workshop under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Theodolite; 2. Level ruler; 3. Compass; 4. Universal socket; 5. One set of hexagon wrenches; 6. One set of torque wrenches; 7. Clamp ammeter; 8. Voltage tester; 9. Personal protective equipment (insulating gloves, safety helmets, goggles, insulating shoes and work clothes).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the solar PV array; 2. Select appropriate measuring and inspection tools for solar PV array adjustment; 3. Measure the tilt angle of solar PV array; 4. Test solar PV array spacing; 5. Measure the azimuth of the solar PV array; 6. Adjust the tilt angle, spacing and azimuth angle of solar PV array; 7. Clean the tools, equipment and workplace; 8. Store the tools and equipment; 8. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect solar PV array components; 1.2 Select the appropriate measurements for solar PV array tuning; 1.3 Adjust solar PV array spacing. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles for tuning solar PV arrays; 2.2 The principle of "The Four Do-not-harms" of production safety. 3.0 Theories The person performing this task must be able to explain: 3.1 PV array tilt angle setting; 3.2 PV array azimuth setting;

	3.3 PV array spacing setting. **4.0 Essential skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Security skills; 4.6 Safe operation skills. **5.0 Mathematical skills** 5.1 Skills in using computing tools; 5.2 Measuring skills; 5.3 Graphic skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV array combinations are adjusted according to technical requirements and solar PV power station operation and maintenance regulations.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Knowledge of environmental protection and waste disposal.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	OPERATE AND MAINTAIN THE SOLAR PV POWER SYSTEM	**DUTY NO.**	604
TASK TITLE	MONITOR THE OPERATION PARAMETERS OF THE SOLAR PV POWER SYSTEMS.	**TASK NO.**	6042
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the operation parameters of solar PV power stations according to technical requirements and operation and maintenance regulations of solar PV power systems.		
RANGE STATEMENT	This task may be executed in solar PV power stations under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Anemometer; 2. Irradiator; 3. Thermometer; 4. Computer equipped with PV power station operation and maintenance monitoring system; 5. Personal protective equipment (insulating gloves, safety helmets, goggles, insulating shoes and work clothes).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to: 1. Check the operation and maintenance configuration software of solar PV power stations; 2. Observe the environmental monitoring data of solar PV power stations; 3. Observe the power prediction data of solar PV power stations; 4. Observe the power generation data of solar PV power stations; 5. Analyze and process the observed operation data of the power stations; 6. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use solar PV power station operation and maintenance configuration software; 1.2 Use configuration software to query correct environmental monitoring data (environmental temperature, component temperature, wind speed, wind direction, solar radiation), power prediction data and power generation data; 1.3 Use analysis software to process data, such as ambient temperature, module temperature, wind speed, wind direction, solar radiation, power and power production. **2.0 Principle** The person performing this task must be able to explain the following principles:

	2.1 Principle of calculation of environmental monitoring data for solar PV power stations; 2.2 Principle of calculation of power prediction data for solar PV power stations; 2.3 Principle of calculation of generating capacity data for solar PV power stations. **3.0 Theories** The person performing this task must be able to explain: 3.1 Impacts of its environmental monitoring data on solar PV power stations; 3.2 Impacts of its power prediction data on solar PV power stations; 3.3 Impacts of its generating capacity data on solar PV power stations. **4.0 Essential skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Fundamentals of computer; 4.4 Computer information retrieval skills; 4.5 Computer office software operation skills. **5.0 Mathematical skills** 5.1 Analytical skills; 5.2 Operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The operation parameters of the solar PV power systems are monitored in accordance with technical requirements and operation and maintenance regulations of solar PV power stations.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Computer operation; 2. Occupational health and safety.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	OPERATE AND MAINTAIN THE SOLAR PV POWER SYSTEM	**DUTY NO.**	604
TASK TITLE	CONFIGURE THE RELEVANT PARAMETERS FOR ROOFTOP SOLAR PV GENERATION SYSTEMS IN A RATIONAL WAY	**TASK NO.**	6043
PERFORMANCE CRITERIA	The person performing this task must be able to rationally configure the relevant parameters for rooftop solar PV power generation system according to technical requirements and operation and maintenance regulations of solar PV generation systems.		
RANGE STATEMENT	This task may be executed in the workshop under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. GPS measuring instrument; 2. Level ruler; 3. Graph meter; 4. Irradiator; 5. Personal protective equipment (insulating gloves, safety helmets, goggles, insulating shoes and work clothes).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to: 1. Choose the right tool to measure solar PV power stations' site parameters; 2. Select the type of solar PV array combinations; 3. Select the type of energy storage equipment; 4. Select the type of inverters; 5. Select the type of combiner boxes; 6. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Measure the latitude and longitude of the solar PV power station site with a GPS surveyor; 1.2 Measure the roof size, area, slope and irradiance of solar PV power stations on the rooftop; 1.3 Select solar PV array combinations; 1.4 Select energy storage equipment; 1.5 Select the inverters; 1.6 Select Combiner boxes. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principle of configuration of parameters related to rooftop solar PV generation systems. **3.0 Theories** The person performing this task must be able to explain:

	3.1 Performance of solar PV modules for rooftop solar PV generation systems; 3.2 Performance of energy storage equipment for rooftop solar PV generation systems; 3.3 Performance of inverters for rooftop solar PV generation systems; 3.4 Performance of combiner boxes for rooftop solar PV generation systems. **4.0 Essential skills** 4.1 Communication skills; 4.2 On-site investigation skills; 4.3 Teamwork skills; 4.4 Security skills. **5.0 Mathematical skills** 5.1 Operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The relevant parameters of the rooftop solar PV generation system are rationally configured according to technical requirements and operation and maintenance regulations of solar PV generation systems.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Program management; 2. Occupational health and safety.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	OPERATE AND MAINTAIN THE SOLAR PV POWER SYSTEM	**DUTY NO.**	604
TASK TITLE	CARRY OUT THE SOLAR PV MODULE PERFORMANCE TESTING AND CLEANING AND COMMON TROUBLESHOOTING	**TASK NO.**	6044
PERFORMANCE CRITERIA	The person performing this task must be able to conduct performance testing and cleaning of solar PV modules and common troubleshooting according to technical requirements and solar PV power station operation and maintenance regulations.		
RANGE STATEMENT	This task may be executed in the workshop under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 3. Infrared thermal imaging tester; 4. Irradiator; 5. Thermometer; 6. MC4 photovoltaic connector; 7. The solar PV cable terminal fabrication tools (wire strippers, crimpling pliers, wire cutters, spanners for MC4 wrenches, etc.); 8. The solar PV module cleaning tools (cleaning cloth, dust-free cloth, portable solar PV cleaning machines); 9. Universal socket; 10. One set of hexagon wrenches; 11. One set of torque wrenches; 12. Clamp ammeters; 13. Personal protective equipment (insulating gloves, safety helmets, goggles, insulating shoes and work clothes).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to: 1. Check solar PV modules 2. Test solar PV module performance; 3. Clean solar PV module; 4. Replace solar PV module; 5. Replace the junction box of solar PV modules; 6. Produce MC4 connectors for photovoltaics 7. Complete solar PV module wiring; 8. Clean the tools, equipment and workplace; 9. Store tools and equipment;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Conduct inspection of solar PV modules; 1.2 Conduct solar PV module performance tests; 1.3 Use solar PV module cleaning tools 1.4 Replace solar PV modules; 1.5 Replace solar PV modules and their junction boxes; 1.6 Produce MC4 connectors for photovoltaics **2.0 Principle**

10. Observe health, occupational and environmental safety rules and regulations.	The person performing this task must be able to explain the following principles: 2.1 Working principle of the components of solar PV modules; 2.2 Principle of solar PV module performance testing and cleaning; 2.3 Causes of common faults in solar PV modules and principles of handling. **3.0 Theories** The person performing this task must be able to explain: 3.1 Analysis of the impact of solar PV modules' appearance anomalies on module performance; 3.2 Analysis of the impact of solar PV modules' electrical indicator anomalies on module performance; **4.0 Essential skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Security skills. **5.0 Mathematical skills** 5.1. Operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV modules performance testing and cleaning and common troubleshooting are carried out according to technical requirements and solar PV power station operation and maintenance regulations
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Intelligent control.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	OPERATE AND MAINTAIN THE SOLAR PV POWER SYSTEM	**DUTY NO.**	604
TASK TITLE	PERFORM THE SOLAR PV COMBINER BOXES TESTING AND TROUBLESHOOTING COMMON FAULTS	**TASK NO.**	6045
PERFORMANCE CRITERIA	The person performing this task must be able to perform the solar PV combiner boxes testing and troubleshooting common faults in accordance with technical requirements and solar PV power station operation and maintenance regulations.		
RANGE STATEMENT	This task may be executed in the workshop under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Voltage tester; 2. Clamp ammeter; 3. Wire strippers, crimpling pliers, vise pliers, and wire cutters; 4. Personal protective equipment (insulating gloves, safety helmets, goggles, insulating shoes and work clothes).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be ab0.19le to: 1. Check the abnormal appearance of combiner boxes; 2. Check combiner box sealing mark; 3. Inspect and test electrical connection components; 4. Fasten terminals; 5. Replace fuses; 6. Replace communication modules; 7. Check and tighten the 485 communication lines; 8. Clean the tools, equipment and workplace; 9. Store tools and equipment; 10. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Check the overall cleanliness and sealing of combiner boxes; 1.2 Electrical connection test of combiner box; 1.3 Repair open circuit faults in combiner boxes; 1.4 Repair short-circuit faults in combiner boxes; 1.5 Repair communication faults in combiner boxes. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Working principle of the components of combiner boxes. **3.0 Theories** The person performing this task must be able to explain: 3.1 Analysis of common failure causes and handling of combiner boxes;

	3.2 Analysis of the impact of common appearance anomalies of solar PV combiner boxes on its performance; 3.3 Analysis of the impact of common electrics anomalies of solar PV combiner boxes on its performance. 4.0 Essential skills 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Electrical operation safety skills. **5.0 Mathematical skills** 5.1 Analytical skills; 5.2 Operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV combiner boxes testing and cleaning and troubleshooting common faults are carried out in accordance with technical requirements and solar PV power station operation and maintenance regulations.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Computer security operation.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	OPERATE AND MAINTAIN THE SOLAR PV POWER SYSTEM	**DUTY NO.**	604
TASK TITLE	PERFORM FAULT DETECTION AND TROUBLESHOOTING OF ROOFTOP INDEPENDENT SOLAR PV POWER GENERATION SYSTEMS	**TASK NO.**	6046
PERFORMANCE CRITERIA	The person performing this task must be able to carry out fault detection and troubleshooting of rooftop independent generation systems in accordance with technical requirements and solar PV power generation systems operation and maintenance regulations.		
RANGE STATEMENT	This task may be executed in the workshop under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Irradiator; 2. Thermometer; 3. Infrared thermal imaging tester; 4. Universal socket; 5. One set of torque wrenches; 6. One set of hexagon wrenches; 7. Clamp ammeter; 8. Voltage tester; 9. Personal protective equipment (insulating gloves, safety helmets, goggles, insulating shoes and work clothes).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to: 1. Inspect rooftop independent generation system components; 2. Check combiner boxes of rooftop independent generation systems; 3. Check inverters of rooftop independent generation systems; 4. Check DC cables of rooftop independent generation systems; 5. Fasten or replace solar PV modules; 6. Repair solar PV module faults; 7. Repair combiner boxes faults; 8. Repair inverter faults; 9. Repair DC cable faults; 10. Clean the tools, equipment and workplace; 11. Store tools and equipment;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Conduct component testing and fault repair of rooftop independent generation systems; 1.2 Conduct combiner box testing and fault repair of rooftop independent generation systems; 1.3 Conduct inverter testing and fault repair of rooftop independent generation systems; 1.4 Conduct DC cable testing and fault repair of rooftop independent generation systems. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Working principle of rooftop independent generation system components;

12. Observe health, occupational and environmental safety rules and regulations.	2.2 Working principle of rooftop independent generation system combiner boxes; 2.3 Working principle of rooftop independent generation system inverters. **3.0 Theories** The person performing this task must be able to explain: 3.1 Analysis of the impact of common rooftop independent generation systems' appearance anomalies on its performance; 3.2 Analysis of the impact of common rooftop independent generation systems' electrics anomalies on its performance. **4.0 Essential skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Equipment selection ability; 4.5 Security skills; 4.6 Sense of responsibility. **5.0 Mathematical skills** 5.1 Computing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The fault detection and troubleshooting of rooftop independent PV power generation systems are performed in accordance with technical requirements and solar PV power generation operation and maintenance regulations
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Computer security operation; 2. Occupational health and safety

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	**OCCUPATION CODE**	
DUTY TITLE	OPERATE AND MAINTAIN THE SOLAR PV POWER SYSTEM	**DUTY NO.**	604
TASK TITLE	PERFORM SOLAR PV INVERTER TROUBLESHOOTING	**TASK NO.**	6047
PERFORMANCE CRITERIA	The person performing this task must be able to carry out solar PV inverter troubleshooting in accordance with technical requirements and solar PV power station operation and maintenance regulations.		
RANGE STATEMENT	This task may be executed in the workshop under the supervision of a Renewable Energy Engineering Engineer. The tools and equipment to be used include: 1. Clamp ammeter; 2. Voltage tester; 3. Thermometer; 4. Electric soldering iron; 5. Personal protective equipment (insulating gloves, safety helmets, goggles, insulating shoes and work clothes).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to: 1. Check the inverters; 2. Test the inverter electrical parameters 3. Fasten terminals; 4. Analyze inverter faults; 5. Clean the inverter dust; 6. Replace inverters; 7. Repair inverter insulation faults; 8. Repair the inverter boot-up unresponsive faults; 9. Repair inverter DC overvoltage faults; 10. Repair inverter busbar voltage faults; 11. Repair inverter grid faults; 12. Clean the tools, equipment and workplace; 13. Store tools and equipment; 14. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Check the inverters; 1.2 Conduct tests on the electrical parameters of the inverters; 1.3 Replace inverters; 1.4 Repair inverter insulation faults 1.5 Repair the inverter boot-up unresponsive faults; 1.6 Repair inverter DC overvoltage faults; 1.7 Repair inverter busbar voltage faults; 1.8 Repair inverter grid faults. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Cause analysis and processing of inverter insulation; 2.2 Cause analysis and processing of inverter boot-up unresponsive faults; 2.3 Cause analysis and processing of inverter DC overvoltage faults; 2.4 Cause analysis and processing of inverter busbar voltage faults; 2.5 Cause analysis and processing of inverter grid faults.

	3.0 Theories The person performing this task must be able to explain: 3.1 Analysis of the impact of inverter insulation faults on system operation; 3.2 Analysis of the impact of inverter boot-up unresponsive faults; 3.3 Analysis of the impact of inverter DC overvoltage faults on system operation; 3.4 Analysis of the impact of inverter busbar voltage faults on system operation; 3.5 Analysis of the impact of inverter grid faults on system operation. **4.0 Essential skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; **5.0 Mathematical skills.** 5.1 Computing skills;
DESCRIPTION OF THE END PRODUCT / SERVICE	The solar PV inverter troubleshootings are performed according to technical requirements and solar PV power station operation and maintenance regulations.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety consciousness; 2. Electrical safety operation.

APPENDIX: DACUM CHARTS FOR RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR) - NTA LEVEL 6

DUTIES	TASKS	ENABLERS
6.1 Interpret and review diagram of PV power generationssystem	6.1.1 Interpret topological structure diagrams of solar PV power generation systems. 6.1.2 Interpret solar PV power module assembly drawings. 6.1.3 Interpret low voltage distribution diagrams for solar PV power systems. 6.1.4 Calculate the auxiliary power load of the solar PV power systems 6.1.5 Establish the quantity of materials for assembling the solar solar PV modules..	**Generic skills and knowledge** · Cooperating with others using communication skills and reporting to the superiors · Interpretation of topological structure diagram of PV generation system · Interpretation of PV Module Assembly Drawing · Interpretation of low voltage distribution diagram of PV power station · Electrical engineering skills and knowledge · Power supplies technical knowledge · PV generation technical knowledge · Basic computer operations · Fundamentals of numerical computing **Tools and equipment** · Computer · Calculator · Magnifying glass · AutoCAD software · Office software. **Worker behaviors** · Team spirit, communication skills, safe and civilized construction, standard construction, and service awareness.
6.2 Install the solar PV power generation system	6.2.1 Install the solar PV powersystem modules and supports. 6.2.2 Install the solar PV power station monitoring equipment. 6.2.3 Install the software for the solar PV power systems.	**Generic skills and knowledge** · Cooperating with others using communication skills and reporting to ssuperiors · Basic computer operations · Analysis and numerical computing skills · Team cooperation ability and interpersonal skills

DUTIES	TASKS	ENABLERS
	6.2.4 Install the solar PV power system metering equipment. 6.2.5 Install the solar PV power system combiner boxes. 6.2.6 Install the solar PV power systems inverters. 6.2.7 Install and lightning protection facilities for solar PV power systems.	· Report writing ability · Ability of innovation **Tools and equipment** · Wrench, socket, plier, screwdriver and other hardware tools · Electric drills, angle grinders, level gauges, angle measuring instrument, electric welding machine, etc. · Complete set of common utensils for PV power stations **Materials** · PV connectors and metal heads, · cable ducts, cable ties, DC cables, AC cables, grounding wires, RS485 communication lines, earthing pole materials, etc. **Worker behaviors** · Team spirit, communication skills, safe and civilized construction, standard construction, and service awareness.
6.3 Inspect and handover the solar solar PV power generation system	6.3.1 Inspect the operation of primary equipment in the solar PV power system. 6.3.2 Inspect the working condition of the solar PV modules. 6.3.3 Inspect the working condition of the combiner boxes. 6.3.4 Inspect the working condition of the solar PV inverter.	**Generic skills and knowledge** · Teamwork, communication skills and reporting to superiors · Use of common electrical tools and measuring tools · Use of product installation manuals and user's manuals · Computer operation skills · Operation and maintenance of solar PV power stations · Interpretation of technical drawings **Tools and equipment**

DUTIES	TASKS	ENABLERS
		· Multimeters, screwdrivers, wrenches, screwdrivers and other common tools **Materials** · PV module cleaner, rosin, soldering tin, welding rods, hexagonal bolts for solar PV, MC4 terminals, cables for solar PV **Worker behaviors** · Team spirit, communication skills, safe and civilized construction, standard construction, and service awareness.
6.4 Operate and maintain the solar PV power system	6.4.1 Adjust the solar PV array combinations. 6.4.2 Monitor the operation parameters of the solar PV power systems . 6.4.3 Configure the relevant parameters of rooftop solar PV generation systems in a rational way. 6.4.4 Carry outt the solar PV module performance testing and cleaning and common troubleshooting. 6.4.5 Perform the solar PV combiner boxes and troubleshoot common faults. 6.4.6 Perform fault detection and troubleshooting of rooftop independent solar PV power generation systems. 6.4.7 Perform solar PV inverter troubleshootings.	**Generic skills and knowledge** · Cooperating with others using communication skills and reporting to the superiors · Communication ability · Computer operation ability · Ability to use electrician's tools · Electrician knowledge · Skills and knowledge in electrical engineering · Knowledge and skills in welding **Tools and equipment** · Personal protective equipment (insulating gloves, safety helmets, goggles, insulating shoes and work clothes) · PV cable terminal fabrication tools (wire strippers, crimpling pliers, wire cutters, and spanners for MC4 wrenches) · Pyrometer and infrared thermography tester · Clamp ammeter and voltage tester

DUTIES	TASKS	ENABLERS
		· Cleaning cloth, dust-free cloth and portable solar PV cleaning machines · Theodolite, level ruler, compass, goniometer and irradiator · Hexagonal wrenches, torque wrenches, universal sockets **Materials** · PV module cleaner, rosin, soldering tin, welding rods, hexagonal bolts for solar PV, MC4 terminals, cables for solar PV **Worker behaviors** · Team spirit, communication skills, safe and civilized construction, standard construction, and service awareness.