NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

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PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)

LEVEL: NTA 6

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ABBREVIATIONS

AGC	Automatic Generation Control
AVC	Automatic Voltage Control
CBET	Competency Based Education and Training
LCU	Local Control Unit
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
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. (Example: baker)
Occupational Analysis:	A process used to identify the tasks that are important to employees in any given occupation.
Occupational Area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.
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 a performance tool of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation**.**
Performance Criteria:	Indicate expected end results or outcomes in the form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a

	composite of three completely interdependent components: cognitive, affective, and psychomotor.
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 analysing each task to determine the steps, circumstantial knowledge, attitudes, performance standards, tools and materials needed, as well as safety concerns required for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, and consists of two or more definite steps that leads to a product, service, or decision.
Underpinning Knowledge:	Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification Process:	The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.

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. 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 Education has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupation Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing 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 delivery across all public and private institutions.

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

In TET delivery, Tanzania 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. TET institutions will be required to benchmark their curricula with relevant occupational standards.

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 (TET).

The Renewable Energy Engineering Technician (Hydro) has its own set of occupational standards. 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 STANDARD DEVELOPMENT PROCESS

The Occupational standards development process began with an examination of major documents that guide Tanzanian skill development. The *10-year National Skills Development Strategy (2016-2026)* was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE 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 workshop comprised of expert workers and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The occupational standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the Occupational Standards. Engineers, supervisory technicians on the job, and experienced Renewable Energy Engineering Technicians (Hydro) were key informants in the survey to discover occupational trends. This information was used to gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of ... online surveys were completed by experts from the labour market across the country. Apart from the surveys aiding in defining the scope for the occupational analysis, they also served to engage a wide cross-section of experts in the occupation. Apart from this, the stakeholders' forum was attended by ... participants from different parts of the country representing various companies.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR RENEWABLE ENERGY ENGINEERING TECHNICIANS (HYDRO)

These standards cover a broad range of duties and tasks that can be performed by a Renewable Energy Engineering Technician (Hydro). However, the occupational standards are not meant to replace

individual job descriptions. Instead, 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 (Hydro) 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.

The Renewable Energy Engineering Technician (Hydro) shall start, operate and monitor the running conditions of the hydroelectric generator set and related equipment under the supervision of engineers. They can also adjust working conditions and handle abnormal situations according to hydrological measuring and forecasting and reservoir regulation; install power transformation and distribution equipment, conduct grid connection and operation scheduling, and operate and maintain related equipment; overhaul the working environment and operating conditions of related buildings and constructions in hydropower stations. Generally, a Renewable Energy Engineering Technician (Hydro) performs the following responsibilities:

a) Being on duty during hydropower operation

b) Inspection during hydropower operation

c) Power transformation and distribution equipment installation and networking

d) Operation and overhaul of power transformation and distribution equipment

e) Maintenance and repair of hydraulic structures in hydropower stations

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

4.0. VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0. OCCUPATIONAL STANDARDS

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

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	BEING ON DUTY DURING HYDROPOWER OPERATION	**DUTY NO.**	601
TASK TITLE	STARTING THE HYDROELECTRIC GENERATOR SET AND AUXILIARY EQUIPMENT, AND THE EQUIPMENT OF THE FACTORY-OWNED SUBSTATION	**TASK NO.**	6011
PERFORMANCE CRITERIA	The person performing this task must be able to start the hydroelectric power generation system in accordance with the technical requirements and operation specifications for hydroelectric power generation operation.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage tester, insulating pen and other insulating tools; 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Prepare before startup; 2. Inspect before startup; 3. Test before startup; 4. Manually start the operation limit of hydro generator to idle; 5. Start the upper computer of the hydro generator to idle; 6. Start the local control unit (LCU) of the hydro generator to the idle state; 7. Control the increase of speed during startup; 8. Manually start the operation limit of hydro generator to no-load; 9. Manually start the hydro generator pulse to no-load;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Manually start the hydro generator and complete the idling operation; 1.2 Manually start the hydro generator and complete the no-load operation; 1.3 Control the speed of the hydro generator during the startup; 1.4 Monitor and check the startup. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Basic knowledge of the power system; 2.2 The concepts, principles, types, and structures of hydro generator sets;

10. Start the upper computer of the hydro generator to no-load; 11. Start the local control unit (LCU) of the hydro generator to no-load; 12. Monitor and check the startup; 13. Clean the tools, equipment and workplaces; 14. Standardize the storage of operating tools and equipment.	2.3 The concept, principle, and design of primary electrical wiring in power plants; 2.4 The concepts, functions, and principles of power distribution devices; 2.5 The composition, function, and principle of the DC system; 2.6 The principle of asynchronous motors; 2.7 The types, functions, and principles of auxiliary equipment for hydraulic turbines. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The methods and steps for starting the hydroelectric power generation system; 3.2 The use of control elements during the start-up process of the hydroelectric power generation system. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The hydroelectric power generation system is started.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	BEING ON DUTY DURING HYDROPOWER OPERATION	**DUTY NO.**	601
TASK TITLE	MONITORING THE OPERATING CONDITIONS AND PARAMETERS OF THE GENERATOR SETS, FACTORY OWNED SUBSTATIONS, AND AUXILIARY EQUIPMENT	**TASK NO.**	6012
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the operation of the hydroelectric power generation system in accordance with the technical requirements and operation specifications for hydroelectric power generation operation.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage tester, insulating pen and other insulating tools; 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Perform startup and parallel operation of the monitoring system of power generation phase; 2. Change the operating conditions of idle, no-load, and power generation of the generator; 3. Adjust voltage, current, frequency, and power; 4. Conduct the leading phase operation of the generators; 5. Conduct the AGC (automatic generation control) operation on the generator set; 6. Conduct the AVC (automatic voltage control) operation on the generator set; 7. Conduct stable control and operation of the generator set.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Start the monitoring system of the power generation phase; 1.2 Alter the operating conditions of the generator; 1.3 Adjust the voltage, current, frequency, and power of the power generation system; 1.4 Operate the generator set system. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Basic knowledge of the power system; 2.2 The concepts, principles, types, and structures of hydro generator sets; 2.3 The concept, principle, and design of primary electrical wiring in power plants; 2.4 The concepts, functions, and principles of power distribution devices;

	2.5 The composition, function, and principle of the DC system; 2.6 The principle of asynchronous motors; 2.7 The types, functions, and principles of auxiliary equipment for hydraulic turbines; 2.8 The concepts, functions, and principles of AGC and AVC; 2.9 Basic structure and operating principles of the hydroelectric power generation system. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Principles for determining the operating conditions of the hydroelectric power generation system; 3.2 Principles and methods for the operation and monitoring of the hydroelectric power generation system. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The hydroelectric power generation system is monitored.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	BEING ON DUTY DURING HYDROPOWER OPERATION	**DUTY NO.**	601
TASK TITLE	OPERATING, MONITORING, AND ADJUSTING OF THE DRAINAGE GATE AND AUXILIARY EQUIPMENT	**TASK NO.**	6013
PERFORMANCE CRITERIA	The person performing this task must be able to control related equipment of the hydroelectric power generation system in accordance with the technical requirements and operation specifications for hydroelectric power generation operation.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage tester, insulating pen and other insulating tools; 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Adjust the generator set's electric speed controller/AGC water head; 2. Monitor the vibration area of the hydro generator at each water head; 3. Control the system voltage; 4. Control the system frequency; 5. Control the parallel initial load; 6. Monitor and ensure the normal operation of the hydro generator; 7. Monitor the operation limit parameters of the hydro generator; 8. Monitor the vibrating/swing parameters of the hydro generator; 9. Monitor the leading phase operation limit parameters of the hydro generator.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Adjust the water head of the generator set system; 1.2 Monitor the operating parameters of the hydro generator; 1.3 Control the voltage, frequency, and load of the system. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The concepts, principles, types, and structures of hydro generator sets; 2.2 The concept, principle, and design of primary electrical wiring in power plants; 2.3 The concepts, functions, and principles of power distribution devices; 2.4 The composition, function, and principle of the DC system;

	2.5 The principle and operation of asynchronous motors. 2.6 Basic structure and operating principles of the hydroelectric power generation system; **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Basic control methods for hydroelectric power generation systems; 3.2 Monitoring rules and control procedures for hydroelectric power generation systems. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The hydroelectric power generation system is adjusted.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	INSPECTION DURING HYDROPOWER OPERATION	**DUTY NO.**	602
TASK TITLE	PATROL AND INSPECTION OF EQUIPMENT, AND ANALYSIS AND HANDLING OF ABNORMAL SITUATIONS AND ACCIDENTS	**TASK NO.**	6021
PERFORMANCE CRITERIA	The person performing this task must be able to ensure the normal operation of equipment and handle common abnormalities and faults according to the technical requirements and regulations for inspecting hydroelectric power operation.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Inspection equipment such as angle gauge, level gauge, vertical instrument, detector and vernier caliper; 4. Monitoring and analysing equipment such as voltage regulators, vibration recorders, and static electricity testers; 5. Voltage tester, insulating pen and other insulating tools; 6. Other auxiliary tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Inspect the microprocessor-based protector and protection input conditions; 2. Inspect indoor electrical equipment, main transformers, and outlet wires; 3. Regularly inspect all electromechanical equipment; 4. Regularly inspect post equipment; 5. Inspect backup equipment; 6. Review working logs.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect the microprocessor-based protector; 1.2 Inspect indoor electrical equipment; 1.3 Judge the abnormal situations of the generator set; 1.4 Fill in the "Patrol Inspection Record". **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The operating principle of the hydraulic turbine; 2.2 The operation principles and using instructions for the generators and transformers in hydropower stations; 2.3 The types, judging principles, and causes of common faults in hydropower stations.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Key points and methods for inspecting hydraulic turbines, generators, and transformers in hydropower stations; 3.2 The principles for diagnosing faults of hydraulic turbines, generators, and transformers in hydropower stations, and corresponding overhaul methods and repair techniques; 3.3 The writing requirements and specific writing methods for patrol inspection working logs. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in filling out forms and writing reports; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Patrol inspection on the hydroelectric power generation system is conducted.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	INSPECTION DURING HYDROPOWER OPERATION	**DUTY NO.**	602
TASK TITLE	HYDROLOGICAL MEASURING AND FORECASTING AND RESERVOIR REGULATION IN THE HYDROPOWER STATION	**TASK NO.**	6022
PERFORMANCE CRITERIA	The person performing this task must be able to conduct hydrological measuring and forecasting and reservoir regulation in the hydropower station in accordance with the technical requirements and regulations for inspecting hydroelectric power operation.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage tester, insulating pen and other insulating tools; 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Maintain and overhaul the main and auxiliary equipment in the hydropower station; 2. Record water regime; 3. Dispatch ship locks; 4. Operate and adjust hydro generators; 5. Investigate mechanical accidents; 6. Conduct transformer power transmission; 7. Power off the transformer; 8. Operate the circuits and busbars.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Maintain and repair equipment; 1.2 Operate transformers and circuits; 1.3 Dispatch ship locks; 1.4 Record the water regime and adjust the hydro generators. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Characteristic curves, and principles of cavitation and vibration of hydraulic turbines. 2.2 Theoretical methods and operating procedures for reservoir regulation in the hydropower station; 2.3 Methods, basis, and operating regulations for transformer equipment and circuit adjustment. **3.0 Theories**

	The person performing this task must be able to explain the following: 3.1 The methods, basis, and techniques for monitoring and forecasting the water regime in hydropower stations; 3.2 Basic knowledge of waterpower utilization; 3.3 General knowledge and skills for reservoir regulation. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in filling out forms and writing reports; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The hydroelectric power generation system is scheduled.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	INSPECTION DURING HYDROPOWER OPERATION	**DUTY NO.**	602
TASK TITLE	MAINTENANCE OF THE THREE MAIN EQUIPMENT OF HYDRAULIC TURBINE, GENERATOR, AND TRANSFORMER	**TASK NO.**	6023
PERFORMANCE CRITERIA	The person performing this task must be able to maintain, overhaul and debug commonly-used equipment in the hydropower station in accordance with the technical requirements and regulations for inspecting hydroelectric power operation.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage tester, insulating pen and other insulating tools; 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Switch the excitation system of the hydro generator; 2. Operate the power distribution devices; 3. Run the motors; 4. Operate the power system of the plants; 5. Run and operate the DC system; 6. Run and operate the power transmission and distribution system; 7. Run and operate the hydro generator sets and transformers.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Start and operate the hydro generator; 1.2 Run the electric motors and power distribution devices; 1.3 Operate auxiliary equipment and drainage gates; 1.4 Reasonably operate under various abnormal conditons; 1.5 Correctly inspect, maintain, and formulate safety measures for the operation of generator sets and equipment under abnormal conditions. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The types, basic structures, and working principles of hydraulic turbines, generators, and transformers;

	2.2 Troubleshooting methods and operating procedures for hydraulic turbines, generators, and transformers. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The principles for determining the normal operating parameters of hydraulic turbines, generators, and transformers; 3.2 The description of common faults and phenomena of hydraulic turbines, generators, and transformers; 3.3 The knowledge of hydraulic transmission, gear transmission, belt transmission, and chain transmission; 3.4 The method for the operation and maintenance of the computer monitoring system. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in filling out forms and writing reports; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to complete the maintenance of the hydraulic turbines, generators, and transformers.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	POWER TRANSFORMATION AND DISTRIBUTION EQUIPMENT INSTALLATION AND NETWORKING	**DUTY NO.**	603
TASK TITLE	PATROL, INSPECTION, AND MONITORING OF THE OPERATING CONDITIONS OF SUBSTATIONS, POWER DISTRIBUTION NETWORKING, AND CONVERTER STATION EQUIPMENT	**TASK NO.**	6031
PERFORMANCE CRITERIA	The person performing this task must be able to patrol, inspect, and monitor the operating conditions of the power transformation and distribution equipment according to the technical requirements and regulations for the installation and networking of the power transformation and distribution equipment.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage tester, insulating pen and other insulating tools; 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Observe the safety precautions; 2. Select appropriate tools and equipment; 3. Monitor and read the instruments; 4. Patrol and inspect transformers, circuit breakers, instrument transformers, power capacitors, and secondary systems; 5. Operate and maintain power supply and distribution circuits; 6. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Analyse and discover abnormalities in power transformation and distribution equipment; 1.2 Prepare various inspection instructions; 1.3 Organize and conduct various inspection and guiding work. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The concepts, types, structures, and working principles of power transformation and distribution equipment and converter station equipment; 2.2 The concepts, types, structures, and working principles of primary and secondary systems.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 The principles and methods for discovering defects and hidden dangers through the main inspection methods of viewing, listening, smelling, and touching; 3.2 The principles and methods for detecting the nature of faults using tools and instruments. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in filling out forms and writing reports; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to inspect the power transformation and distribution equipment and the converter station equipment.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	POWER TRANSFORMATION AND DISTRIBUTION EQUIPMENT INSTALLATION AND NETWORKING	**DUTY NO.**	603
TASK TITLE	EXECUTION OF SCHEDULING COMMANDS AND PERFORMING OF SWITCHING OPERATIONS	**TASK NO.**	6032
PERFORMANCE CRITERIA	The person performing this task must be able to switch the state of the electrical equipment or change the operation mode of the power system according to the technical requirements and regulations for the installation and networking of power transformation and distribution equipment.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage tester, insulating pen and other insulating tools; 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Observe the safety precautions; 2. Select appropriate tools and equipment; 3. Inspect the position of the switches and breakers; 4. Inspect load distribution; 5. Install and dismantle the grounding wire; 6. Install or dismantle the fuse of the control circuit and voltage transformer circuit; 7. Switch the protection circuit and check if there is no voltage; 8. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select suitable tools and equipment; 1.2 Check the switches, breakers, and load conditions; 1.3 Install or dismantle circuit fuses. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The concepts, functions, and types of circuit breakers; 2.2 The concepts, functions, and types of high-voltage isolation switches. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The principles and methods for the operation of circuit breakers;

	3.2 The principles and methods for operating high-voltage isolation switches; 3.3 The principles and methods for electrical verification. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in filling out forms and writing reports; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to conduct the switching operation and the scheduling task.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	POWER TRANSFORMATION AND DISTRIBUTION EQUIPMENT INSTALLATION AND NETWORKING	**DUTY NO.**	603
TASK TITLE	IDENTIFICATION AND ANALYSIS OF EQUIPMENT ABNORMALITIES, AND REPORTING AND HANDLING	**TASK NO.**	6033
PERFORMANCE CRITERIA	The person performing this task must be able to analyse and handle the abnormalities of the power supply and distribution equipment according to the technical requirements and regulations for the installation and networking of the power transformation and distribution equipment, promptly remove faults, and ensure normal operation.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage tester, insulating pen and other insulating tools; 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Observe the safety precautions; 2. Select appropriate tools and equipment; 3. Handle common faults of voltage transformers; 4. Handle common faults of current transformers; 5. Handle grounding faults of the DC system; 6. Handle faults of the busbars; 7. Handle faults of the capacitor; 8. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Cut off and isolate power supply and distribution equipment; 1.2 Remove abnormalities in power supply and distribution equipment; 1.3 Test the performance of equipment and circuits. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The concepts, functions, types, and structures of instrument transformers; 2.2 The concept, function, type, and structure of the DC system; 2.3 The concepts, functions, types, and structures of busbars and capacitors. **3.0 Theories**

	The person performing this task must be able to explain the following: 3.1 The principles and methods for handling faults of the instrument transformers; 3.2 The principles and methods for handling faults in the DC system; 3.3 The principles and methods for troubleshooting capacitors; 3.4 The principles and methods for handling busbar faults. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in filling out forms and writing reports; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The power transformation and distribution system is inspected.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Regulations and detailed rules of the local government.

<table>
<tr><td>OCCUPATION</td><td>RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>OPERATION AND OVERHAUL OF POWER DISTRIBUTION NETWORK EQUIPMENT</td><td>DUTY NO.</td><td>604</td></tr>
<tr><td>TASK TITLE</td><td>ANALYSIS AND MANAGEMENT OF THE EQUIPMENT OPERATION DATA IN SUBSTATIONS, POWER DISTRIBUTION NETWORKS, AND CONVERTER STATIONS</td><td>TASK NO.</td><td>6041</td></tr>
<tr><td>PERFORMANCE CRITERIA</td><td colspan="3">The person performing this task must be able to reasonably analyse and manage the operational data of equipment in substations, power distribution networks, and converter stations according to the technical requirements and regulations for the operation and maintenance of power transformation and distribution equipment.</td></tr>
<tr><td>RANGE STATEMENT</td><td colspan="3">The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro).
The tools and equipment to be used include:
1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes;
2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools;
3. Voltage testers, insulating pens, insulating rods, etc.
4. Other auxiliary tools.</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. Observe the preventive measures for safety and environmental during working;
2. Select appropriate tools and equipment;
3. Prepare and archive equipment operation records, reports, and technical files;
4. Regularly collect operational data;
5. Inspect, monitor, and detect equipment with electricity;
6. Analyse the occurrence of equipment abnormalities and faults;
7. Clean and organize the workplace;
8. Arrange and store the tools and equipment.</td><td colspan="2">Detailed knowledge about:
1.0 Methods
The person performing this task must be able to explain how to:
1.1 Identify the operational data of power transformation and distribution equipment, and converter equipment;
1.2 Analyse, archive, and manage operation data of the equipment.

2.0 Principles
The person performing this task must be able to explain the following principles:
2.1 The concepts, functions, types, and structures of power transformation and distribution station network and converter station equipment;
2.2 The principles and standards for recording the operation and maintenance data ledger.</td></tr>
</table>

	3.0 Theories The person performing this task must be able to explain the following: 3.1 The principles and methods for equipment operation and maintenance; 3.2 The principles and methods for analysing equipment status; 3.3 The identification methods for operational data of power transformation and distribution network. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in data collection, organization, and analysis; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to analyse the records of the data of the power transformation and distribution station network.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Professional ethics and integrity; 2. Work safety and environmental protection; 3. Knowledge of laws and regulations; 4. Knowledge of quality control; 5. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	OPERATION AND OVERHAUL OF POWER DISTRIBUTION NETWORK EQUIPMENT	**DUTY NO.**	604
TASK TITLE	OPERATION, MAINTENANCE AND OVERHAUL OF EQUIPMENT IN SUBSTATIONS, POWER DISTRIBUTION NETWORKS, AND CONVERTER STATIONS	**TASK NO.**	6042
PERFORMANCE CRITERIA	The person performing this task must be able to reasonably maintain the equipment in substations, power distribution networks, and converter stations according to the technical requirements and regulations for the operation and maintenance of power transformation and distribution equipment.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage testers, insulating pens, insulating rods, etc. 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Observe the preventive measures for safety and environmental during working; 2. Select appropriate tools and equipment; 3. Improve the work plans for maintaining equipment; 4. Daily maintain equipment; 5. Manage the equipment in a safe manner; 6. Specially maintain faulty equipment; 7. Analyse equipment operation and maintenance management work; 8. Clean and organize the workplace; 9. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Operate and maintain power transformation and distribution station network and converter station equipment; 1.2 Overhaul the power transformation and distribution station network and converter station equipment. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The concepts, functions, types, and structures of power transformation and distribution station network and converter station equipment; 2.2 The principles and theories of the system operation of the power transformation and distribution station network.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Operating procedures, testing methods, and fault identification techniques for the operation and maintenance of the network system of power transformation and distribution station; 3.2 Reporting principles, investigation methods, and handling techniques for the faults in the network system of power transformation and distribution station. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in data collection, organization, and analysis; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to inspect and maintain the network system of power transformation and distribution.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Professional ethics and integrity; 2. Work safety and environmental protection; 3. Knowledge of laws and regulations; 4. Knowledge of quality control; 5. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	OPERATION AND OVERHAUL OF POWER DISTRIBUTION NETWORK EQUIPMENT	**DUTY NO.**	604
TASK TITLE	ACCEPTANCE OF NEWLY INVESTED AND OVERHAULED EQUIPMENT	**TASK NO.**	6043
PERFORMANCE CRITERIA	The person performing this task must be able to reasonably accept newly invested and overhauled equipment according to the technical requirements and regulations for the operation, maintenance, and overhaul of power transformation and distribution equipment.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage testers, insulating pens, insulating rods, etc. 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Observe the preventive measures for safety and environmental during working; 2. Select appropriate tools and equipment; 3. Accept newly invested or overhauled equipment; 4. Inspect newly invested or overhauled equipment; 5. Describe the issues that exist during acceptance; 6. Propose measures for rectifying; 7. Review and accept standard operation procedures; 8. Clean and organize the workplace; 9. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect newly invested or overhauled equipment; 1.2 Acceptance of newly invested and overhauled equipment. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The concepts, functions, types, and structures of power transformation and distribution station network and converter station equipment; 2.2 The principles and theories of the system operation of the power transformation and distribution station network. **3.0 Theories** The person performing this task must be able to explain the following:

	3.1 Principles, standards, and procedures for accepting the network system of power transformation and distribution station; 3.2 Accepting methods and items for the network system of power transformation and distribution station; 3.3 Accepting methods and project details for auxiliary equipment and facilities. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in data collection, organization, and analysis; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to accept the equipment of power transformation and distribution.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Professional ethics and integrity; 2. Work safety and environmental protection; 3. Knowledge of laws and regulations; 4. Knowledge of quality control; 5. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	OPERATION AND OVERHAUL OF POWER DISTRIBUTION NETWORK EQUIPMENT	**DUTY NO.**	604
TASK TITLE	FILLING IN OPERATION LOGS AND TECHNICAL RECORDS	**TASK NO.**	6044
PERFORMANCE CRITERIA	The person performing this task must be able to fill in the operation log and technical records reasonably according to the technical requirements and regulations for the operation, maintenance, and overhaul of power transformation and distribution equipment.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage testers, insulating pens, insulating rods, etc. 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Observe the preventive measures for safety and environmental during working; 2. Select appropriate tools and equipment; 3. Read and transcribe the data on the instruments; 4. Formulate various operation report forms; 5. Fill in operation logs and reports; 6. Fill in daily operation and maintenance records; 7. Record any abnormalities or faults that occur in the equipment; 8. Record equipment defects; 9. Clean and organize the workplace; 10. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Record the operation data of the power transformation and distribution station network; 1.2 Record the technical operation data of the power transformation and distribution station network. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The principles and theories of the system operation of the power transformation and distribution station network; 2.2 Knowledge of operational data indicators of the network system of power transformation and distribution station. **3.0 Theories** The person performing this task must be able to explain the following:

	3.1 The content composition, recording principles, and recording methods of the operation logs and work records of the network system of power transformation and distribution station; 3.3 The concepts, functions, types, structures, and transcribing methods of instruments in the network system of power transformation and distribution station; 3.4 The identification principles and recording methods for abnormal data in the network system of power transformation and distribution station. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in data collection, organization, and analysis; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to fill out of technical operation records.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Professional ethics and integrity; 2. Work safety and environmental protection; 3. Knowledge of laws and regulations; 4. Knowledge of quality control; 5. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	MAINTENANCE AND REPAIR OF HYDRAULIC STRUCTURES IN HYDROPOWER STATIONS	**DUTY NO.**	605
TASK TITLE	MAINTENANCE AND OVERHAUL OF THE SURFACE OF BUILDINGS AND STRUCTURES, WATER STOPPING FACILITIES, DRAINAGE FACILITIES, AND MONITORING FACILITIES IN THE HYDROPOWER STATION	**TASK NO.**	6051
PERFORMANCE CRITERIA	The person performing this task must be able to maintain the normal operation of the hydraulic structures in the hydropower station, and carry out regular repair to the buildings and auxiliary facilities in accordance with the technical requirements and regulations for maintenance and repair of the hydraulic structures.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage testers, insulating pens, insulating rods, etc. 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Remove faults in mechanical organizations; 2. Set up steel pipe scaffold; 3. Repair the surface damage of concrete and reinforced concrete buildings; 4. Repair drainage facilities; 5. Replace the water stopping devices of hydraulic steel gates and their hoists and other equipment; 6. Replace and repair monitoring equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Judge the faults of hydraulic structures; 1.2 Repair the surface of buildings and structures, water stopping facilities, and drainage facilities; 1.3 Overhaul and replace monitoring equipment. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The knowledge of hydropower station construction; 2.2 The concepts, types, functions, and structural principles of dam foundation, dam abutment, dam body, and plant;

	2.3 The concepts, types, functions, and structural principles of water diversion and drainage buildings; 2.4 The concept, types, functions, and structural principles of electromechanical and metal structures, observation facilities. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The structures and functions of hydraulic structures in the hydropower station; 3.2 The types, judgment principles, and causes of common faults in hydraulic structures of the hydropower station; 3.3 The standardized treatment principles and methods for common faults in hydraulic structures of the hydropower station. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in data collection, organization, and analysis; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to maintain the structures of the hydropower station.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Professional ethics and integrity; 2. Work safety and environmental protection; 3. Knowledge of laws and regulations; 4. Knowledge of quality control; 5. Regulations and detailed rules of the local government.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)	**OCCUPATION CODE**	
DUTY TITLE	MAINTENANCE AND REPAIR OF HYDRAULIC STRUCTURES IN HYDROPOWER STATIONS	**DUTY NO.**	605
TASK TITLE	EMERGENCY TREATMENT OF TEMPORARY WATER SEEPAGE AND PIPELINE DREDGING OF BUILDINGS AND STRUCTURES IN THE HYDROPOWER STATION	**TASK NO.**	6052
PERFORMANCE CRITERIA	The person performing this task must be able to maintain the normal operation of the hydraulic structures in the hydropower station, and carry out emergency handling of the sudden water seepage and deposition of buildings and structures in accordance with the technical requirements and regulations for maintenance and repair of the hydraulic structures.		
RANGE STATEMENT	The task can be performed in small and medium-sized hydropower stations under the supervision of renewable energy engineers (hydro). The tools and equipment to be used include: 1. PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes; 2. Multimeters, trameggers, ammeters, infrared thermometers and other operating tools; 3. Voltage testers, insulating pens, insulating rods, etc. 4. Other auxiliary tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Remove faults in mechanical organizations; 2. Set up steel pipe scaffold; 3. Deal with cracks in concrete and reinforced concrete buildings; 4. Clean the deposit on the surface of dredging facilities in buildings, water collection wells and inspection chambers in plants; 5. Control the construction quality during the fault handling process; 6. Conduct safety assurance and environmental protection measures during the construction process.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Judge the faults of hydraulic structures; 1.2 Treat temporary water seepage and deposition in buildings or structures during emergencies; 1.3 Ensure the construction quality during the emergency treatment process. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The knowledge of hydropower station construction; 2.2 The concepts, types, functions, and structural principles of dam foundation, dam abutment, dam body, and plant; 2.3 The concepts, types, functions, and structural principles of water diversion and drainage buildings;

	2.4 The concept, types, functions, and structural principles of electromechanical and metal structures, observation facilities. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The structures and functions of hydraulic structures in the hydropower station; 3.2 The types, judgment principles, and causes of sudden faults in hydraulic structures of the hydropower station; 3.3 The standardized treatment principles and methods for sudden faults in hydraulic structures of the hydropower station. **4.0 Essential Skills** 4.1 Safety operation skills; 4.2 First aid skills; 4.3 Communication skills; 4.4 Learning skills; 4.5 Management skills; 4.6 Skills in data collection, organization, and analysis; 4.7 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to maintain the structures of the hydropower station during emergencies.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Professional ethics and integrity; 2. Work safety and environmental protection; 3. Knowledge of laws and regulations; 4. Knowledge of quality control; 5. Regulations and detailed rules of the local government.

TABLE 1: DACUM CHARTS FOR RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO) - NTA 6

DUTIES	TASKS	ENABLERS
1.0 Being on duty during hydropower operation	1.1 Starting the hydroelectric generator set and auxiliary equipment, and the equipment of the factory-owned substation. 1.2 Monitoring the operating conditions and parameters of the generator sets, factory owned substations, and auxiliary equipment. 1.3 Operating, monitoring, and adjusting of the drainage gate and auxiliary equipment.	**General skills and knowledge** **General skills:** · Skills for starting and operating hydro generators · Skills for running, operating and monitoring hydro generators · Skills for judging abnormalities and handling accidents of hydro generators · Safety operation skills · First aid skills · Communication skills · Learning skills · Management skills · Teamwork skills **General knowledge:** · Basic knowledge of the power system · The concepts, principles, types, and structures of hydro generator sets · The concept, principle, and design of primary electrical wiring in power plants · The concepts, principles, types, and structures of power distribution devices · The concepts, principles, types, and structures of DC systems · The concepts, principles, types, and structures of asynchronous motors · The types, functions, principles and operating of auxiliary equipment for hydraulic turbines **Tools and equipment** · PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes · Drilling tools, fastening tools, electric welding machines, cutting machines, etc. · Voltage tester, insulating pen and other insulating tools

DUTIES	TASKS	ENABLERS
		· Other auxiliary tools **Materials** · Commonly-used conductive materials for wiring · Commonly-used insulation materials · Workbooks, instructions, etc. · Commonly-used lubricating oil materials **Requirements for employees** · Abide by laws, regulations and related provisions; · Work diligently and responsibly, and be strict with oneself; · Be humble and cautious, unite and collaborate, and actively cooperate; · Strictly observe process standards to ensure quality; · Study hard, and continuously improve professional level; · Ensure safe, environment-friendly, and civilized production.
2.0 Inspection during hydropower operation	2.1 Patrol and inspection of equipment, and analysis and handling of abnormal situations and accidents. 2.2 Hydrological measuring and forecasting and reservoir regulation in the hydropower station. 2.3 Maintenance of the three main equipment of hydraulic turbine, generator, and transformer.	**General skills and knowledge** **General skills:** · Skills in inspecting, monitoring and forecasting the operation of hydraulic turbines, generators, and transformers · Skills for identifying faults of hydraulic turbines, generators, and transformers · Skills for maintaining hydraulic turbines, generators, and transformers · Safety operation skills · First aid skills · Communication skills · Learning skills · Management skills · Skills in filling out forms and writing reports · Teamwork skills

DUTIES	TASKS	ENABLERS
		General knowledge: · Operating principles and instructions for commonly-used equipment in hydropower stations · Basic structures and common faults of commonly-used equipment in hydropower stations · Specification and operating procedures of hydropower station equipment · Operation of various equipment **Tools and equipment** · PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes · Drilling tools, fastening tools, electric welding machines, cutting machines, etc. · Voltage tester, insulating pen and other insulating tools · Other auxiliary tools **Materials** · Commonly-used conductive materials for wiring · Commonly-used insulation materials · Workbooks, instructions, etc. · Commonly-used lubricating oil materials **Requirements for employees** · Abide by laws, regulations and related provisions · Work diligently and responsibly, and be strict with oneself · Be humble and cautious, unite and collaborate, and actively cooperate · Strictly observe process standards to ensure quality · Study hard, and continuously improve professional level · Ensure safe, environment-friendly, and civilized production

DUTIES	TASKS	ENABLERS
3.0 Power transformation and distribution equipment installation and networking	3.1 Patrol, inspection, and monitoring of the operating conditions of substations, power distribution networking, and converter station equipment. 3.2 Execution of scheduling commands and performing of switching operations. 3.3 Identification and analysis of equipment abnormalities, and reporting and handling.	**General skills and knowledge** **General skills:** · Skills for inspecting and monitoring equipment of the power transformation and distribution station and converter station · Skills for identifying faults of the equipment of the power transformation and distribution station and converter station · Skills for maintaining equipment of the power transformation and distribution station and converter station · Safety operation skills · First aid skills · Communication skills · Learning skills · Management skills · Skills in filling out forms and writing reports · Teamwork skills **General knowledge:** · The concepts, types, structures, and working principles of power transformation and distribution equipment and converter station equipment · The concepts, types, structures, and working principles of primary and secondary systems · The concepts, functions, and types of circuit breakers · The concepts, functions, and types of high-voltage isolation switches. · The concepts, functions, types, and structures of instrument transformers · The concept, function, type, and structure of the DC system · The concepts, functions, types, and structures of busbars and capacitors **Tools and equipment**

DUTIES	TASKS	ENABLERS
		· PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes · Drilling tools, fastening tools, electric welding machines, cutting machines, etc. · Voltage tester, insulating pen and other insulating tools · Other auxiliary tools **Materials** · Commonly-used conductive materials for wiring · Commonly-used insulation materials · Workbooks, instructions, etc. · Commonly-used lubricating oil materials **Requirements for employees** · Abide by laws, regulations and related provisions · Work diligently and responsibly, and be strict with oneself · Be humble and cautious, unite and collaborate, and actively cooperate · Strictly observe process standards to ensure quality · Study hard, and continuously improve professional level · Ensure safe, environment-friendly, and civilized production
4.0 Operation and overhaul of power distribution network equipment	4.1 Analysis and management of the equipment operation data in substations, power distribution networks, and converter stations. 4.2 Operation, maintenance and overhaul of equipment in substations, power distribution networks, and converter stations;	**General skills and knowledge** **General skills:** · Skills for operating and maintaining power transformation and distribution networks · Skills for operating, overhauling and accepting power transformation and distribution networks · Skills for recording operational data of power transformation and distribution networks

DUTIES	TASKS	ENABLERS
	4.3 Acceptance of newly invested and overhauled equipment; 4.4 Filling in operation logs and technical records.	· Safety operation skills · First aid skills · Communication skills · Learning skills · Management skills · Skills in data collection, organization, and analysis · Teamwork skills **General knowledge:** · The concepts, functions, types, and structures of power transformation and distribution station network and converter station equipment · The principles and theories of the system operation of the power transformation and distribution station network · The principles and theories of the system operation of the power transformation and distribution station network · Knowledge of operational data indicators of the network system of power transformation and distribution station **Tools and equipment** · PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes · Drilling tools, fastening tools, electric welding machines, cutting machines, etc. · Voltage tester, insulating pen and other insulating tools · Other auxiliary tools **Materials** · Commonly-used conductive materials for wiring · Commonly-used insulation materials · Workbooks, instructions, etc. · Commonly-used lubricating oil materials

DUTIES	TASKS	ENABLERS
		Requirements for employees · Abide by laws, regulations and related provisions · Work diligently and responsibly, and be strict with oneself · Be humble and cautious, unite and collaborate, and actively cooperate · Strictly observe process standards to ensure quality · Study hard, and continuously improve professional level · Ensure safe, environment-friendly, and civilized production
5.0 Maintenance of hydraulic structures in hydropower stations	5.1 Maintenance and overhaul of the surface of buildings and structures, water stopping facilities, drainage facilities, and monitoring facilities in the hydropower station. 5.2 Emergency treatment of temporary water seepage and pipeline dredging of buildings and structures in the hydropower station.	**General skills and knowledge** **General skills:** · Skills for normally using construction and maintenance equipment for hydraulic structures in hydropower stations · Skills for repairing surface damage, drainage fault, aging of water stopping materials, and failure of monitoring facilities of hydraulic structures in hydropower stations · Skills for repairing sudden faults such as temporary water seepage and deposition in hydraulic structures of hydropower stations; · Safety operation skills · First aid skills · Communication skills; · Learning skills · Management skills · Skills in data collection, organization, and analysis · Teamwork skills **General knowledge:** · The knowledge of hydropower station construction · The concepts, types, functions, and structural principles of dam foundation, dam abutment, dam body, and plant

DUTIES	TASKS	ENABLERS
		· The concepts, types, functions, and structural principles of water diversion and drainage buildings · The concept, types, functions, and structural principles of electromechanical and metal structures, observation facilities **Tools and equipment** · PPEs such as safety helmets, safety shoes, goggles, gloves, and work clothes · Drilling tools, fastening tools, electric welding machines, cutting machines, etc. · Voltage tester, insulating pen and other insulating tools · Other auxiliary tools **Materials** · Commonly-used conductive materials for wiring · Commonly-used insulation materials · Workbooks, instructions, etc. · Commonly-used lubricating oil materials **Requirements for employees** · Abide by laws, regulations and related provisions · Work diligently and responsibly, and be strict with oneself · Be humble and cautious, unite and collaborate, and actively cooperate · Strictly observe process standards to ensure quality · Study hard, and continuously improve professional level · Ensure safe, environment-friendly, and civilized production