THE NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

OCCUPATIONAL STANDARDS

OCCUPATION: RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO)

LEVEL: NTA LEVEL 6

FEBRUARY 2024

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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, 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 STANDARD 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 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 LEVEL6

<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>CARRY OUT THE HYDROPOWER OPERATIONS</td><td>DUTY NO.</td><td>601</td></tr>
<tr><td>TASK TITLE</td><td>START THE HYDROELECTRIC POWER GENERATING SYSTEM</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 start the hydroelectric power generation system in accordance with the technical requirements and operation specifications.</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 tester, insulating pen and other insulating tools;
4. Other auxiliary tools;
5. Safety gera.</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. 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;</td><td colspan="2">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;</td></tr>
</table>

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; 15. Observe health, occupational and environmental safety rules and regulations.	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 in accordance with technical requirements and operation specifications.
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	CARRY OUT THE HYDROPOWER OPERATIONS	**DUTY NO.**	601
TASK TITLE	MONITOR THE OPERATING CONDITIONS AND PARAMETERS OF THE POWER GENERATION SYSTEM	**TASK NO.**	6012
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the operating conditions and parameters of the hydroelectric power generation system in accordance with the technical requirements and operation specifications.		
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; 5. Safewty gear.		

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; 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 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 operating conditions and parameters of the hydroelectric power generation system are monitored in accordance with technical requirements and operation specifications.
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	CARRY OUT THE HYDROPOWER OPERATIONS	**DUTY NO.**	601
TASK TITLE	MONITOR AND ADJUST THE DRAINAGE GATE AND AUXILIARY EQUIPMENT OF THE HYDROELECTRIC POWER GENERATION SYSTEM	**TASK NO.**	6013
PERFORMANCE CRITERIA	The person performing this task must be able to monitor and adjust the drainage gate and auxiliary equipment of the hydroelectric power generation system in accordance with the technical requirements and operation specifications.		
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; 5. Safety gear.		

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;

10. Observe health, occupational and environmental safety rules and regulations.	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 drainage gate and auxiliary equipment of the hydroelectric power generation system are monitored and adjusted in accordance with technical requirements and operation specifications.
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	CONDUCT INSPECTION DURING HYDROPOWER OPERATIONS	**DUTY NO.**	602
TASK TITLE	ENSURE NORMAL OPERATIONS OF EQUIPMENT AND HANDLE COMMON ABNORMALITIES AND FAULTS	**TASK NO.**	6021
PERFORMANCE CRITERIA	The person performing this task must be able to ensure normal operations of equipment and handle common abnormalities and faults according to the technical requirements and regulations.		
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; 7. Safety gear.		

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; 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 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	The normal operation of equipment and handling of common abnormalities and faults is ensured according to the standard operation procedures.
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	CONDUCT INSPECTION DURING HYDROPOWER OPERATIONS	**DUTY NO.**	602
TASK TITLE	CONDUCT HYDROGEOLOGICAL 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 hydrogeological measuring and forecasting and reservoir regulation in the hydropower station in accordance with the technical requirements and regulations.		
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; 5. Safety gear.		

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; 9. 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 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 hydrogeological measuring and forecasting and reservoir regulation in the hydropower station are conducted in accordance with the technical requirements and regulations.
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	CONDUCT INSPECTION DURING HYDROPOWER OPERATIONS	**DUTY NO.**	602
TASK TITLE	CARRY OUT MAINTENANCE OF THE HYDRAULIC TURBINE, GENERATOR, AND TRANSFORMER	**TASK NO.**	6023
PERFORMANCE CRITERIA	The person performing this task must be able to carry out the maintainance of hydraulic turbine, generator and transformer, in accordance with the technical requirements and regulations.		
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; 5. Safety gear.		

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; 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 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 maintenance of the hydraulic turbines, generators, and transformers is carried out in accordance with technical requirements and regulations.
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	CONDUCT INSTALLATION AND NETWORKING OF POWER TRANSFORMATION AND DISTRIBUTION EQUIPMENT	**DUTY NO.**	603
TASK TITLE	PATROL, INSPECT, AND MONITOR 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.		
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; 5. Safety gear.		

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; 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 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 operating conditions of substations, power distribution neworking and converter station equipment are patrolled, inspected and monitored according to the technical requirements and regulations.
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	CONDUCT INSTALLATION AND NETWORKING OF POWER TRANSFORMATION AND DISTRIBUTION EQUIPMENT	**DUTY NO.**	603
TASK TITLE	EXECUTE SCHEDULING COMMANDS AND PERFORM SWITCHING OPERATIONS	**TASK NO.**	6032
PERFORMANCE CRITERIA	The person performing this task must be able to execute scheduling commands and perform switching operations according to the technical requirements and regulations.		
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; 5. Safety gear.		

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; 9. 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 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 scheduling commands are executed and the switching operations are performed in accordance with technical requirements and regulations.
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	CONDUCT INSTALLATION AND NETWORKING OF POWER TRANSFORMATION AND DISTRIBUTION EQUIPMENT	**DUTY NO.**	603
TASK TITLE	IDENTIFY, ANALYZE, AND HANDLE THE ABNORMALITIES OF THE POWER SUPPLY AND DISTRIBUTION EQUIPMENT	**TASK NO.**	6033
PPERFORMANCE CRITERIA	The person performing this task must be able to identify, analyze, and handle the abnormalities of the power supply and distribution equipment according to the technical requirements and regulations.		
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; 5. Safety gear.		

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; 4. Identify abnormalities of the power supply distribution equipment; 5. Analyze the abnormalities of fthe power supply distribution 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.

9. Observe health, occupational and environmental safety rules and regulations.	**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 abnormalities of the power supply and distribution equipment are identified, analyzed, and handled in accordance with technical requirements and regulations for the installation and networking of the power transformation and distribution 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	OPERATE AND OVERHAUL THE POWER DISTRIBUTION NETWORK EQUIPMENT	**DUTY NO.**	604
TASK TITLE	ANALYZE AND MANAGE THE EQUIPMENT OPERATION DATA IN SUBSTATIONS, POWER DISTRIBUTION NETWORKS, AND CONVERTER STATIONS	**TASK NO.**	6041
PERFORMANCE CRITERIA	The person performing this task must be able to analyze and manage the operational data of equipment in substations, power distribution networks, and converter stations according to technical requirements and regulations.		
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; 5. Safety gear.		

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. Prepare and archive equipment operation records, reports, and technical files; 4. Collect operational data on regular basis; 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;	**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. **3.0 Theories**

9. Observe health, occupational and environmental safety rules and regulations.	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 equipment operations data in substations, power distribution networks, and converter stations are analyzed and managed according to the technical requirements and regulations.
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	OPERATE AND OVERHAUL THE POWER DISTRIBUTION NETWORK EQUIPMENT	**DUTY NO.**	604
TASK TITLE	MAINTAIN THE EQUIPMENT IN SUBSTATIONS, POWER DISTRIBUTION NETWORKS, AND CONVERTER STATIONS	**TASK NO.**	6042
PERFORMANCE CRITERIA	The person performing this task must be able to maintain the equipment in substations, power distribution networks, and converter stations according to the technical requirements and regulations.		
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; 5. Safety gear.		

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. Maintain equipment daily; 5. Manage the equipment in a safe manner; 6. Maintain the 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**

10. Observe health, occupational and environmental safety rules and regulations.	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 equipment in substations, power distribution neworks and converter stations are maintained according to the technical requirements and regulations for the operation and maintenance of power transformation and distribution equipment
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	OPERATE AND OVERHAUL THE POWER DISTRIBUTION NETWORK EQUIPMENT	**DUTY NO.**	604
TASK TITLE	APPROVE DELIVERY OF NEWLY INVESTED AND OVERHAULED EQUIPMENT FOR POWER GENERATION AND DISTRIBUTION	**TASK NO.**	6043
PERFORMANCE CRITERIA	The person performing this task must be able to approve the delivery of newly invested and overhauled equipment for power generation and distribution according to technical requirements and regulations.		
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; 5. Safety gear.		

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. Approve delivery of 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 Approve delivery 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:

10. Observe health, occupational and environmental safety rules and regulations.	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 delivery of newly invested and overhauled equipment for power generation and distribution is approved according to the technical requirements and regulations.
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	OPERATE AND OVERHAUL THE POWER DISTRIBUTION NETWORK EQUIPMENT	**DUTY NO.**	604
TASK TITLE	FILL IN OPERATION LOGS AND TECHNICAL RECORDS	**TASK NO.**	6044
PERFORMANCE CRITERIA	The person performing this task must be able to fill in the operation logs and technical records according to the technical requirements and regulations.		
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; 5. Safety gear.		

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:

11. Observe health, occupational and environmental safety rules and regulations.	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 operation logs and technical records are filled in according to technical requirements and regulations.
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	CARRY OUT MAINTENANCE AND REPAIR OF HYDRAULIC STRUCTURES IN HYDROPOWER STATIONS	**DUTY NO.**	605
TASK TITLE	MAINTAIN THE BUILDINGS AND STRUCTURES, WATER STOPPING FACILITIES, DRAINAGE AND MONITORING FACILITIES IN THE HYDROPOWER STATION	**TASK NO.**	6051
PERFORMANCE CRITERIA	The person performing this task must be able to maintain the buildings, structures, water-stopping, drainage, and monitoring facilities in hydropower station, 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; 5. Safety gear.		

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; 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 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 buildings and structures, water-stopping facilities, drainage, monitoring facilities, and monitoring facilities in the hydropower station are maintained in accordance with the technical requirements and regulations.
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	CARRY OUT MAINTENANCE AND REPAIR OF HYDRAULIC STRUCTURES IN HYDROPOWER STATIONS	**DUTY NO.**	605
TASK TITLE	CONDUCT 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 conduct the emergency treatment of temporary water seepage and popeline dredging of buildings and structures in the hydropower station 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; 5. Safety gear.		

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;

7. Observe health, occupational and environmental safety rules and regulations.	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 emergency treatment of temporary water seepage and pipeline dredging of buildings and structures in the hydropower station is conducted in accordance with the technical requirements and regulations for maintenance and repair of the hydraulic structures.
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.

APPENDIX: DACUM CHARTS FOR RENEWABLE ENERGY ENGINEERING TECHNICIAN (HYDRO) – NTA LEVEL 6

DUTIES	TASKS	ENABLERS
1.0 Carry out the hydropower operations	1.1 Start the hydroelectric power generating system. 1.2 Monitor the operating conditions and parameters of the power generating system. 1.3 Monitor and adjust the drainage gate and auxiliary equipment of the hydroelectric power generation system.	**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 Conduct inspection during hydropower operations	2.1 Ensure normal operations of equipment and handle common abnormalities and faults. 2.2 Conduct hydrogeological measuring and forecasting and reservoir regulation in the hydropower station. 2.3 Carry out maintenance of the 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 Conduct installation and networking Power transformation and distribution equipment	3.1 Patrol, inspect, and monitor the operating conditions of substations, power distribution networking, and converter station equipment. 3.2 Execute scheduling commands and perform switching operations. 3.3 Identify analyze and handle the abnormalities of the power supply and distribution equipment	**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 Operate and overhaul the power distribution network equipment	4.1 Analyze and manage the equipment operations data in substations, power distribution networks, and converter stations. 4.2 Maintain the equpment in substations, power distribution networks, and converter stations. 4.3 Approve delivery of newly invested and overhauled equipment for power generation and distribution.	**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 · Safety operation skills · First aid skills

DUTIES	TASKS	ENABLERS
	4.4 Fill in operation logs and technical records.	· 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 **Requirements for employees**

DUTIES	TASKS	ENABLERS
		· 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 Carry out maintenance and repair of hydraulic structures in hydropower stations	5.1 Maintain the buildings and structures, water stopping facilities, drainage facilities, and monitoring facilities in the hydropower station. 5.2 Conduct 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 · The concepts, types, functions, and structural principles of water diversion and drainage buildings

DUTIES	TASKS	ENABLERS
		· 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