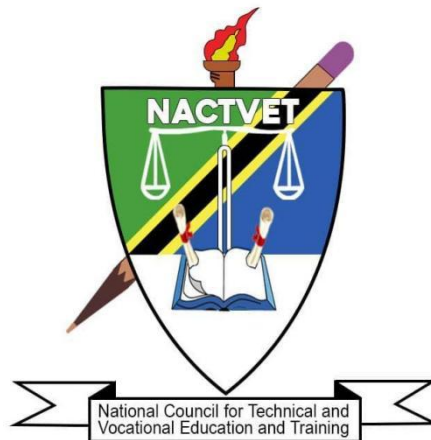


**NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND
TRAINING**



FEBRUARY 2023

PROPOSED OCCUPATIONAL STANDARDS

**OCCUPATION: ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE
TECHNICIAN**

LEVEL: NTA 6

TABLE OF CONTENT

CONTENTS

ABBREVIATIONS	ii
GLOSSARY OF TERMS	iii
1.0. INTRODUCTION.....	1
2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS	2
3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIANS	3
4.0. VALIDITY PERIOD	4
5.0. OCCUPATIONAL STANDARDS.....	4
5.1 OCCUPATIONAL STANDARDS FOR ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN – NTA 6	5
TABLE 1: DACUM CHARTS FOR ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN - NTA 6	31

ABBREVIATIONS

AC	Alternating Current
CBET	Competency Based Education and Training
DC	Direct Current
KVA	Kilovolt-Ampere
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
PPE	Personal Protective Equipment
TA	Current Transformer
TET	Technical Education and Training
TV	Voltage Transformer
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 Area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as performance tool of assessment of the pre – scribed outcomes.
Performance Criteria:	Indicate the expected end results or outcome in form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.
Standards:	A set of statement, 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, related knowledge, attitudes, performance standards, tools and materials needed, and safety concerns required of employees performing it.

Task:	A work activity that has a definite beginning and ending, is observable or measurable, consists of two or more definite steps, and leads to a product, service, or decision.
Underpinning Knowledge:	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. This process is also sometimes referred to as validation.
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. 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 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 Electrical Equipment Installation and Maintenance Technician Occupation 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. 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 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 Electrical Equipment Installation and Maintenance Technicians 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 survey 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 ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by an Electrical Equipment Installation and Maintenance Technician. 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 Electrical Equipment Installation and Maintenance Technician 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 Electrical Equipment Installation and Maintenance Technicians shall install, commission and repair electrical equipment according to drawing and technical data under the supervision of electrical engineers. Technicians are capable of installing, commissioning and repairing the electrical equipment such as ordinary lighting equipment, cable, busbar, motor, switchgear, transformer, metering equipment, as well as the electrical equipment monitored by computer on installation and maintenance site. Generally, the Electrical Equipment Installation and Maintenance Technician performs the following responsibilities:

- a) Drawings reading and equipment inspection
- b) Electrical equipment installation
- c) Installation and repair of ordinary electrical lighting equipment
- d) Electrical testing
- e) Preparation before construction
- f) Electrical equipment installation and maintenance
- g) Metering equipment installation and repair

- h) Electrical commissioning
- i) Electrical equipment installation and repair in special places
- j) Electrical equipment commissioning and repair
- k) Metering equipment testing and verification
- l) Trial operation of electrical equipment

The Occupational standards have been clustered into NTA qualification levels i.e. NTA level 4-6.

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 ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN – NTA 6

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	ELECTRICAL EQUIPMENT INSTALLATION AND REPAIR IN SPECIAL PLACES	DUTY NO.	601
TASK TITLE	CHOOSING ELECTRICAL EQUIPMENT ACCORDING TO THE PLACE LEVEL	TASK NO.	6011
PERFORMANCE CRITERIA	The person performing this task must be able to choose electrical equipment according to technical requirements, manufacturer's installation manual and place level.		
RANGE STATEMENT	The task can be performed in special places under the supervision of electrical engineers. The tools and equipment needed include: 1. Grounding wire; 2. Electroprobe; 3. Safety sign; 4. Safety rope; 5. Safety helmet.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Take health and safety precautions when performing the task; 2. Choose suitable tools and data for task; 3. Identify the partition of explosive hazardous area in the target place; 4. Identify the classification of combustible substances and dust in the target place; 5. Identify the ignition temperature of combustible substances in the target place; 6. Identify the lowest ignition temperature of combustible dust cloud and dust layer in target place; 7. Identify the electrical equipment type to be installed in the target place;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Identify the level of place with explosion and fire risks; 1.2 Identify the type of explosion-proof electrical equipment; 1.3 Choose electrical equipment for the place with explosion and fire risks. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Classification principle for the places with explosion and fire risks; 2.2 Selection principle of explosion-proof electrical equipment. 3.0 Theories The person performing this task must be able to explain the following contents:	

8. Identify the explosion-proof electric signs in target place; 9. Choose electrical equipment according to the hazard level in the target place; 10. Check and test the electrical equipment.	3.1 Type of explosion-proof electrical equipment; 3.2 Sign of explosion-proof electrical equipment; 3.3 Classification of hazardous places. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills.
FINAL PRODUCT OR SERVICE DESCRIPTION	Electrical equipment shall be selected according to technical requirements, national standards and place levels.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on operation site; 2. Safe operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	ELECTRICAL EQUIPMENT INSTALLATION AND REPAIR IN SPECIAL PLACES	DUTY NO.	601
TASK TITLE	LINE LAYING	TASK NO.	6012
PERFORMANCE CRITERIA	The person performing this task must be able to lay lines according to technical requirements, standards and specifications.		
RANGE STATEMENT	The task can be performed in special places under the supervision of electrical engineers. The tools and equipment needed include: 1. Electrical measuring instruments such as level gauge, range finder, length recorder, multimeter, tramegger, clamp ammeter and ground resistance tester; 2. Installation tools such as construction power panel, electric hand drill, impact drill, press pliers, tapping machine, pipe bender and threading machine; 3. Elbow, bracket, bracing wire, expansion screw, welding rod and other materials; 4. Protective baffle, fireproof coating, fireproof bag, fire break and anti-fire plug; 5. Personal protective articles, safety civilized construction tools, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Take health and safety precautions when performing the task; 2. Choose suitable tools and equipment; 3. Check the equipment and facilities 4. Prefabricate and process the workpieces; 5. Install the fasteners, brackets and protective grounding device; 6. Lay steel pipes and wires in the environment with explosion and fire risks according to the task place and steel pipe laying mode; 7. Lay and install cables in the environment with explosion and fire risk according to the task place and steel pipe laying mode;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Check the certificates of equipment and facilities; 1.2 Install the fasteners and brackets; 1.3 Lay steel pipes and wires in the environment with explosion and fire risks; 1.4 Lay cables in the environment with explosion and fire risks; 1.5 Connect the wires and steel pipes; 1.6 Complete isolation and sealing in the environment with explosion and fire risks; 1.7 Install the explosion-proof flexible connection pipes. 2.0 Principle The person performing this task must be able to explain the following principles:	

8. Install the fireproof baffle according to the task place and steel pipe laying mode; 9. Pour the fireproof coating according to the task place and steel pipe laying mode; 10. Fill the fireproof bag according to the task place and steel pipe laying mode; 11. Wrap the fire break according to the task place and steel pipe laying mode; 12. Clean the tools, equipment and workplace; 13. Store the tools and equipment.	2.1 Connection principle between steel pipes, between steel pipe and electrical equipment and between steel pipe and its accessories; 2.2 Construction specification for electrical devices in the environment with explosion and fire risks; 2.3 Operation specification for laying steel pipes and wires; 2.4 Operation specification for laying cables. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Technical requirements for steel pipes and wires in the environment with explosion and fire risks; 3.2 Technical requirements for cables and wires in the environment with explosion and fire risks. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Climbing operation skills; 4.6 Commissioning skills.
FINAL PRODUCT OR SERVICE DESCRIPTION	The wires are laid according to technical requirements, standards and specifications
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on operation site; 2. Safe operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Equipment installation and maintenance knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	ELECTRICAL EQUIPMENT INSTALLATION AND REPAIR IN SPECIAL PLACES	DUTY NO.	601
TASK TITLE	INSTALLATION AND REPAIR OF EXPLOSION-PROOF ELECTRICAL EQUIPMENT	TASK NO.	6013
PERFORMANCE CRITERIA	The person performing this task must be able to install and repair explosion-proof electrical equipment according to technical requirements, standards and specifications.		
RANGE STATEMENT	The task can be performed in special places under the supervision of electrical engineers. The tools and equipment needed include: 1. Electrical measuring instruments such as level gauge, range finder, length recorder, multimeter, tramegger, clamp ammeter, ground resistance tester; 2. Installation tools such as construction power panel, electric hand drill, impact drill, press pliers, tapping machine, wrench, ladder, ruler, pipe bender and threading machine; 3. Bracket, bracing wire, expansion screw, welding rod and other materials; 4. Protective baffle, fireproof coating, fireproof bag, fire break and anti-fire plug; 5. Personal protective articles, safety civilized construction tools, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Acquire necessary tools and equipment for performing task; 2. Observe the occupational health and safety precautions when performing the task; 3. Check the equipment to be installed; 4. Install the fasteners and brackets; 5. Install and connect the explosion-proof lamps, electrical apparatus and motor according to the types of explosion-proof electrical equipment; 6. Install the protective grounding device;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Install the explosion-proof lamps; 1.2 Install the explosion-proof electric apparatus according to the type; 1.3 Ensure the correct wiring of explosion-proof electric apparatus according to the type; 1.4 Install the explosion-proof motor; 1.5 Ensure the correct wiring of explosion-proof motor; 1.6 Repair the explosion-proof electric apparatus. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Technical specifications for installing explosion-proof lamps;	

7. Complete isolation and sealing for preventing fire and explosion of electrical equipment; 8. Disassemble the explosion-proof electrical equipment and identify the faults; 9. Repair or replace the explosion-proof electrical equipment; 10. Clean the tools, equipment and workplace; 11. Store the tools and equipment.	2.2 Technical specifications for installing and wiring of explosion-proof apparatus; 2.3 Technical specifications for installation and wiring of explosion-proof motor. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Installation knowledge of explosion-proof electrical equipment; 3.2 Knowledge of grounding device; 3.3 Repair knowledge of explosion-proof electrical equipment. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Climbing operation skills; 4.6 Commissioning skills; 4.7 Fault analysis and treatment skills.
FINAL PRODUCT OR SERVICE DESCRIPTION	The explosion-proof electrical equipment shall be installed and repaired according to technical requirements, standards and specifications.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on construction site; 2. Safety operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Equipment installation and maintenance knowledge; 6. Equipment commissioning knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	COMMISSIONING AND REPAIR OF ELECTRICAL EQUIPMENT	DUTY NO.	602
TASK TITLE	FAULT TREATMENT OF CABLES	TASK NO.	6021
PERFORMANCE CRITERIA	The person performing this task must be able to treat cable faults according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task can be performed on the repair site under the supervision of electrical engineers. The tools and equipment needed include: 1. Common electrical tools such as screwdriver, needle-nose pliers, diagonal pliers and wire stripper; 2. Multimeter, microammeter, psychrometer, etc.; 3. Protective resistor; 4. Test wire, traverse with shielding layer and power panel; 5. Testing instruments such as tramegger, ground resistance tester, double bridge or DC resistance tester and infrared thermal imager; 6. Testing instruments such as voltage regulator, testing transformer, high-voltage DC generator and complete set of frequency conversion and series resonance testing equipment; 7. Personal protective articles such as insulating shoes, gloves and work clothes.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe the occupational health and safety precautions when performing the task; 2. Choose suitable tools, instruments and equipment for the task; 3. Measure the temperature with infrared thermal imager; 4. Measure the insulation resistance and ground resistance of cable; 5. Cable path detection; 6. DC withstand voltage and leakage current test of cable lines; 7. AC withstand voltage test of cable line; 8. Judge the phase-sequence fault and fault property of cable;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Analyse and judge the cable faults; 1.2 Identify and measure the fault points of cable; 1.3 Treat the cable faults. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Treatment principles of cable fault; 2.2 Measurement and testing principles. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Basic knowledge of cable; 3.2 Cable operation and maintenance knowledge;	

9. Identify the failure points accurately with the bridge method; 10. Identify the failure points accurately with the acoustic-magnetic synchronization method; 11. Treat the heating problem of cable parts; 12. Repair the damage of cable sheath; 13. Connect the co-axial cables; 14. Arrange the tools, equipment and workplace.	3.3 Treatment method of cable fault. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Commissioning skills; 4.6 Fault analysis and treatment skills.
FINAL PRODUCT OR SERVICE DESCRIPTION	Cable fault shall be treated according to technical requirements and manufacturer's maintenance manual.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on construction site; 2. Safety operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Equipment installation and maintenance knowledge; 6. Equipment commissioning knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE	DUTY NO.	602
TASK TITLE	TRANSFORMER COMMISSIONING AND REPAIR	TASK NO.	6022
PERFORMANCE CRITERIA	The person performing this task must be able to install and maintain transformers according to technical requirements and manufacturer's installation/commissioning/ maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools and equipment needed include: 1. Monkey wrench, vice, needle-nose pliers, wire stripper, screwdriver, testing wire, insulation tape and grounding wire; 2. Safety protection articles and tools such as insulating gloves and shoes, safety helmet and belt, voltage tester and grounding discharging rod; 3. Insulation resistance tester, DC resistance tester, transformer ratio tester, dielectric loss tester, hygrothermograph, multimeter, ammeter and timer.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Acquire necessary tools and equipment for performing the task; 2. Observe the occupational health and safety precautions when performing the task, Analyse the test conditions and identify the safety hazards; 3. Complete technical preparation before test and determine the test judgment basis according to the test plan and standards; 4. Prepare the equipment before test and choose testing equipment according to the test plan; 5. Check the voltage regulation and switching device of transformers, and carry out connection for DC resistance test, insulation resistance test, voltage ratio & polarity and connection group test, dielectric loss factor and capacitance test and		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Conduct test wiring; 1.2 Judge the data authenticity; 1.3 Analyse the equipment abnormality; 1.4 Judge whether the main transformer is normal. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Technical specifications for electrical equipment test; 2.2 Technical specifications for operation and maintenance of transformers; 2.3 Basic working principles of transformers; 2.4 Operation principles of transformers. 3.0 Theories	

the insulation resistance test of the iron core and clamps according to the test plan; 6. Calculate the measurement results according to test data and judge the data compliance; 7. Analyse the measured data abnormality due to test conditions and equipment; 8. Analyse the results of winding deformation test, partial discharge and AC withstand voltage tests; 9. Commissioning the action of gas relay; 10. Commissioning the action of oil pressure quick break device; 11. Commissioning the temperature measuring device and its secondary circuit; 12. Check the overall sealing property; 13. Check whether the iron cores and clamps of transformers are grounded reliably; 14. Check whether the body and shell of transformers are grounded reliably; 15. Check the thermometer; 16. Check whether the transformer oil is qualified; 17. Arrange the tools, equipment and workplace.	The person performing this task must be able to explain the following contents: 3.1 Installation and maintenance knowledge of transformers; 3.2 Technical requirements for transformer maintenance; 3.3 Testing of transformers; 3.4 Possible faults and causes of transformers. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Climbing operation skills; 4.6 Commissioning skills; 4.7 Fault analysis and treatment skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Transformers shall be commissioned and repaired according to technical requirements and manufacturer's installation/commissioning/maintenance manual.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on construction site; 2. Safety operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Equipment installation and maintenance knowledge; 6. Equipment commissioning knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE	DUTY NO.	602
TASK TITLE	SWITCHGEAR COMMISSIONING AND REPAIR	TASK NO.	6023
PERFORMANCE CRITERIA	The person performing this task must be able to install and maintain switches according to technical requirements and manufacturer's installation/commissioning/ maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools and equipment needed include: 1. Monkey wrench, vice, needle-nose pliers, wire stripper, screwdriver and testing wire; 2. Safety protection articles and tools such as insulating gloves and shoes, safety helmet and belt, voltage tester and grounding discharging rod; 3. Insulation resistance tester, circuit resistance tester, switchgear characteristic tester, AC withstand voltage device, hygrothermograph, multimeter, ammeter and timer.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Acquire necessary tools and equipment for performing the task; 2. Observe the occupational health and safety precautions when performing the task, Analyse the test conditions and identify the safety hazards; 3. Complete technical preparation before test and determine the test judgment basis according to the test plan and standards; 4. Prepare the equipment before test and choose testing equipment according to the test plan; 5. Carry out connection for the switchgear insulation resistance test, circuit resistance test, mechanical characteristic test and AC withstand voltage test according to the test plan;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Conduct test wiring; 1.2 Judge the data authenticity; 1.3 Analyse the measured data abnormality; 1.4 Judge the test results. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Technical specifications for electrical equipment test; 2.2 Technical specifications for operation and maintenance of switchgears; 2.3 Operation principles of switchgears; 3.0 Theories The person performing this task must be able to explain the following contents:	

6. Calculate the measurement results according to test data and judge the data compliance; 7. Analyse the measured data abnormality due to test conditions and equipment; 8. Switch interlock and commissioning; 9. Check the opening/closing coil resistance of switches; 10. Check the trip-proof function of switches; 11. Check the insulation property of auxiliary circuits and control circuits; 12. Switchgear transmission and commissioning; 13. Arrange the tools, equipment and workplace.	3.1 Installation and maintenance knowledge of switchgears; 3.2 Technical requirements for maintenance of switchgears; 3.3 Operation and control circuit diagrams of switchgears; 3.4 Possible faults and causes of switchgears. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Climbing operation skills; 4.6 Commissioning skills; 4.7 Fault analysis and treatment skills;
DESCRIPTION OF THE END PRODUCT / SERVICE	Switchgear shall be commissioned and repaired according to technical requirements and manufacturer's installation/commissioning/maintenance manual.
DETAILED KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on construction site; 2. Safety operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Equipment installation and maintenance knowledge; 6. Equipment commissioning knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	COMMISSIONING AND REPAIR OF ELECTRICAL EQUIPMENT	DUTY NO.	602
TASK TITLE	INSTALLATION AND COMMISSIONING OF ELECTRICAL EQUIPMENT MONITORED BY COMPUTER	TASK NO.	6024
PERFORMANCE CRITERIA	The person performing this task must be able to install and commission the electrical equipment monitored by computer according to technical requirements and manufacturer's installation and commissioning manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools and equipment needed include: 1. Electrical tools such as screwdriver, wire stripper, wrench and network crimping pliers; 2. Multimeter, tone-type ammeter, optical power meter, etc.; 3. Cable conductor, optical cable pigtail, grounding wire, network cable and registered jack; 4. Debugging computer; 5. Protection debugging apparatus, AC sampling apparatus and network cable tester; 6. Label printer, power panel, etc.; 7. Personal protection articles such as insulating shoes/gloves and work clothes; 8. Design drawings, and equipment installation, commissioning and operation instructions.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe the occupational health and safety precautions when performing the task; 2. Choose suitable tools and instruments for the task; 3. Fabricate the network parallel lines; 4. Complete equipment installation as well as cabling and connection of detection points and control points according to installation instructions and wiring design drawings;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Complete assembly and wiring of electrical equipment parts; 1.2 Control the electrical equipment manually or through the computer; 1.3 Commissioning the instruments and equipment with commissioning instruments; 1.4 Remove the communication faults and circuit faults.	

5. Configure the equipment parameters such as communication and setting values; 6. Use general computer instructions; 7. Check and modify the database graph connection and other settings; 8. Ensure the normal communication between equipment and monitoring computer, and treat the communication outage fault; 9. Check the measurement quantity with monitoring master station, and debug and verify the functions of equipment; 10. Complete transmission and operation of electrical equipment, and check whether the field signals are consistent with the monitoring computer; 11. Execute the computer control programme and remove the fault when control equipment is failed; 12. Fill in the commissioning report; 13. Arrange the tools, equipment and workplace.	2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Specifications for equipment monitoring information management; 2.2 Processes and standards for equipment installation and wiring; 2.3 Technical specifications for equipment commissioning. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Principles of signal and control circuit; 3.2 Network topological structure; 3.3 Data transmission principles of signal and measurement quantity; 3.4 Logic principles for equipment function realization. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Commissioning skills; 4.6 Fault analysis and treatment skills.
FINAL PRODUCT OR SERVICE DESCRIPTION	The electrical equipment monitored by computer is installed and commissioned according to technical requirements and manufacturer's installation and commissioning manuals.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on construction site; 2. Safety operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Equipment installation and maintenance knowledge; 6. Equipment commissioning knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE	DUTY NO.	602
TASK TITLE	INSPECTION AND REPAIR OF MOTOR	TASK NO.	6025
PERFORMANCE CRITERIA	The person performing this task must be able to check and repair motors according to technical requirements and manufacturer's installation/commissioning/maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools and equipment needed include: 1. Monkey wrench, box-end wrench, hammer, vice, needle-nose pliers, wire stripper, screwdriver, testing wire, insulation tape and grounding wire; 2. Safety protection articles and tools such as insulating gloves, anti-smashing shoes, canvas gloves, voltage tester and grounding discharging rod; 3. Insulation resistance tester, DC resistance tester, AC withstand voltage device, hygrothermograph, multimeter and ammeter; 4. Elastic gusset for wiping, lubricating agent/grease/oil, silica gel, diesel oil, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Acquire necessary tools, equipment and materials for performing the task; 2. Observe the occupational health and safety precautions when performing the task, Analyse the test conditions and identify the safety hazards; 3. Check the main electrical wiring and control equipment; 4. Check the electric motor drive; 5. Disassemble the motor; 6. Remove, process, fabricate and repair the stator winding; 7. Repair the iron core, rotor winding and rotating shaft;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Disassemble and check the motor; 1.2 Complete test wiring and operation; 1.2 Process the test data; 1.3 Analyse the equipment defects; 1.4 Judge whether the motor is abnormal or not. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Specifications for motor operation; 2.2 Specifications for motor maintenance; 2.3 Technological requirements for motor installation; 2.3 Operation principles of motor.	

8. Assemble and install the motor; 9. Check the power supply, wiring, fasteners and rotating shaft of motor; 10. Measure the insulation resistance and winding DC resistance; 11. Carry out trial operation of motor and record the no-load/load test data; 12. Treat and remove the defects; 13. Arrange the tools, equipment and workplace.	3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Basic knowledge of motor; 3.2 Circumstantial knowledge of insulation materials 3.3 Troubleshooting knowledge of motor. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Commissioning skills; 4.6 Fault analysis and treatment skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The motor shall be commissioned and repaired according to technical requirements and manufacturer's installation/commissioning/ maintenance manual.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on construction site; 2. Safety operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Equipment installation and maintenance knowledge; 6. Equipment commissioning knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	COMMISSIONING AND REPAIR OF ELECTRICAL EQUIPMENT	DUTY NO.	603
TASK TITLE	TESTING OF CURRENT TRANSFORMER	TASK NO.	6031
PERFORMANCE CRITERIA	The person performing this task must be able to test and judge the quality and operating state of current transformers according to technical requirements and manufacturer's installation/commissioning/maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools and equipment needed include: 1. Safety protection articles and tools such as voltage tester, insulating gloves/shoes, safety helmet, security wires and grounding discharging rod; 2. Transformer overall characteristic tester, insulation resistance tester, AC withstand voltage tester, transformation ratio tester and DC resistance tester; 3. Transformer error measurement device, partial discharge measurement device, single-phase self-couple voltage regulator, double-frequency withstand voltage equipment and capacitive voltage divider; 4. Multimeter, tramegger and thermometer.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe the occupational health and safety precautions when performing the task, Analyse the test conditions and identify the safety hazards; 2. Complete technical preparation before test and determine the test judgment basis according to the test plan and standards; 3. Prepare the equipment before test and choose testing equipment according to the test plan; 4. Check the appearance of current transformer on site; 5. Conduct withstand voltage test and insulation resistance test, stability test, polarity measurement, partial discharge measurement, DC resistance		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Choose suitable measuring equipment; 1.2 Confirm the test method and conditions; 1.3 Identify and treat the faults of testing equipment; 1.4 Identify and treat the faults of current transformers; 1.5 Analyse and judge the test results; 1.6 Analyse the operating state of current transformers. 2.0 Principle The person performing this task must be able to explain the following principles:	

measurement, no-load current and volt-ampere characteristics measurement and basic error measurement on low-voltage current transformer according to test procedures and plan; 6. Keep the test records and judge the performance and failure cause of current transformer according to test results; 7. Arrange the tools, equipment and workplace.	2.1 Technical requirements and specifications for power metering device; 2.2 Technical requirements and specifications for electrical equipment test; 2.3 Verification regulations for measuring current transformer; 2.4 Delivery test standards for electrical equipment in electrical installation engineering; 2.5 Delivery and preventive test procedures for electrical equipment. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Testing of current transformer; 3.2 Possible faults and causes of current transformer; 3.3 Structure and working principles of current transformer; 3.4 Secondary circuit diagram of current transformer. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Operation skills of testing instruments and equipment; 4.6 Fault analysis and treatment skills.
FINAL PRODUCT OR SERVICE DESCRIPTION	The current transformer shall be commissioned, maintained and repaired according to technical specification and equipment instructions.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safe operation of operation tools; 2. Safe operation of instruments; 3. Safe operation of electrical equipment; 4. Occupational health and safety.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	COMMISSIONING AND REPAIR OF ELECTRICAL EQUIPMENT	DUTY NO.	603
TASK TITLE	TESTING OF VOLTAGE TRANSFORMER	TASK NO.	6032
PERFORMANCE CRITERIA	The person performing this task must be able to test and judge the quality and operating state of voltage transformer according to technical requirements and manufacturer's installation/commissioning/maintenance manual.		
RANGE STATEMENT	Voltage transformer can be commissioned and repaired under the supervision of electrical engineers. The tools and equipment needed include: 1. Safety protection articles and tools such as voltage tester, insulating gloves/shoes, safety helmet, security wires and grounding discharging rod 2. Transformer overall characteristic tester, insulation resistance tester, AC withstand voltage tester, transformation ratio tester and DC resistance tester 3. Transformer error measurement device, partial discharge measurement device, single-phase self-couple voltage regulator, double-frequency withstand voltage equipment and capacitive voltage divider 4. Multimeter, tramegger and thermometer.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe the occupational health and safety precautions when performing the task, Analyse the test conditions and identify the safety hazards; 2. Complete technical preparation before test and determine the test judgment basis according to the test plan and standards; 3. Prepare the equipment before test and choose testing equipment according to the test plan; 4. Check the appearance of the voltage transformer on site; 5. Conduct withstand voltage test and insulation resistance test, stability test, polarity		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Choose suitable measuring equipment 1.2 Confirm the test method and conditions 1.3 Identify and treat the faults of testing equipment 1.4 Identify and treat the faults of the voltage transformer 1.5 Analyse and judge the test results 1.6 Analyse and judge the operating state of the voltage transformer 2.0 Principle The person performing this task must be able to explain the following principles:	

measurement, partial discharge measurement, DC resistance measurement, no-load current, volt-ampere characteristics measurement and basic error measurement on the low-voltage voltage transformer according to test procedures and plan; 6. Keep the test records and judge the performance or failure cause of the voltage transformer according to the test results; 7. Arrange the tools, equipment and workplace.	2.1 Technical requirements and specifications for power metering device 2.2 Technical requirements and specifications for electrical equipment test 2.3 Verification procedures for measuring the voltage transformer 2.4 Delivery test standards for electrical equipment in electrical installation engineering 2.5 Delivery and preventive test procedures for electrical equipment 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Testing of the voltage transformer 3.2 Possible faults and causes of the voltage transformer 3.3 Structure and working principles of the voltage transformer 3.4 Secondary circuit diagrams of the voltage transformer 4.0 Essential Skills 4.1 Communication skills 4.2 Electrical drawing reading skills 4.3 Teamwork skills 4.4 Report writing skills 4.5 Operation skills of testing instruments and equipment 4.6 Fault analysis and treatment skills
FINAL PRODUCT OR SERVICE DESCRIPTION	The voltage transformer shall be commissioned, maintained and repaired according to technical specifications and equipment instructions
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safe operation of operation tools; 2. Safe operation of instruments; 3. Safe operation of electrical equipment; 4. Occupational health and safety.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	TESTING AND CALIBRATION OF METERING EQUIPMENT	DUTY NO.	603
TASK TITLE	CALIBRATION OF METERING INSTRUMENT	TASK NO.	6033
PERFORMANCE CRITERIA	The person performing this task must be able to verify metering instruments according to technical requirements and manufacturer's product manual.		
SCOPE DESCRIPTION:	The task can be performed in the metering instrument calibration room under the supervision of electrical equipment installation and repair engineers. The tools and equipment needed include: 1. Digital standard ammeter, voltmeter, power meter, reactive power meter, phase meter and power factor meter; 2. Digital standard current source, voltage source and power source; 3. Standard resistance box or active resistor; 4. High-stability AC/DC voltage, current and power source; 5. Verification device of ground resistance meter; 6. Verification device of insulation resistance meter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe the occupational health and safety precautions when performing the task; 2. Choose suitable tools and equipment; 3. Check whether there are name, trademark and correct use information on equipment; 4. Check the basic error of instruments; 5. Check the zero deviation of instruments; 6. Check the insulating property of instruments; 7. Check the insulation resistance of instruments; 8. Check the damping of instruments; 9. Arrange the tools, equipment and workplace.		Detailed knowledge about: 1.0 Methods; The person performing this task must be able to explain how to: 1.1 Check the appearance of instruments; 1.2 Test the instruments. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Basic management requirements of metering equipment; 2.2 Verification regulations of indicating instruments for electrical measurement. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Basic knowledge of instruments; 3.2 Inspection methods of instruments. 4.0 Essential Skills	

	4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Instruments shall be tested according to technical specifications and manufacturer's product manual.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on construction site; 2. Safety operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Instrument calibration knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	TRIAL OPERATION OF ELECTRICAL EQUIPMENT	DUTY NO.	604
TASK TITLE	INSPECTION AND PREPARATION BEFORE TRIAL OPERATION	TASK NO.	6041
PERFORMANCE CRITERIA	The person performing this task must be able to check and prepare electrical equipment before trial operation according to technical requirements and manufacturer's installation/commissioning/maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools and equipment needed include: 1. Personal protective articles, such as insulating shoes/gloves and work clothes; 2. Phasing tester, multimeter, thermodetector, wave recorder, insulation resistance tester, voltmeter, ammeter, voltage tester, etc.; 3. Common electrical tools (needle-nose pliers, screwdriver, diagonal pliers, insulation tape, etc.).		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe the occupational health and safety precautions when performing the task; 2. Choose suitable tools and equipment for task; 3. Prepare complete drawings and manufacturer data of equipment for trial operation; 4. Check and confirm whether the equipment and its protection devices are in good condition, and whether the body and all accessories have defects or meet the energized operation conditions; 5. Confirm the electrical equipment is qualified after test; 6. Check whether there are foreign matters on the equipment and clean the surrounding environment;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Choose suitable tools and equipment; 1.2 Confirm the electrical equipment and its protection devices are in good condition; 1.3 Confirm the electrical equipment meet the energized operation conditions 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Standards for electrical equipment test; 2.2 Procedures for power dispatching; 2.3 Procedures for electrical safety; 2.4 Procedures for trial operation; 2.5 Basic working principle of electrical equipment 3.0 Theories The person performing this task must be able to explain the following contents:	

7. Check whether the temporary grounding wire is removed or not; 8. Check whether the position of transformer tap switch is correct; 9. Check whether the valves of transformers are opened/closed correctly; 10. Check whether the oil discharge measures are intact and the fire prevention facilities are complete; 11. Confirm the input power voltage and the power line connection are correct; 12. Verify whether the instruments installed on equipment for measuring the trial operation parameters are qualified.	3.1 Quality inspection of electrical equipment; 3.2 On-load test 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Commissioning skills; 4.6 Fault analysis and treatment skills; 4.7 Skills in checking quality inspection and evaluation records; 4.8 Skills in reading and understanding the trial operation plan of general engineering projects
FINAL PRODUCT OR SERVICE DESCRIPTION	Electrical equipment shall be checked and prepared before trial operation according to technical requirements and manufacturer's installation/commissioning/maintenance manual.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on construction site; 2. Safety operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Equipment installation and maintenance knowledge; 6. Equipment commissioning knowledge.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	TRIAL OPERATION OF ELECTRICAL EQUIPMENT	DUTY NO.	604
TASK TITLE	TRIAL OPERATION	TASK NO.	6042
PERFORMANCE CRITERIA	The person performing this task must be able to carry out trial operation of electrical equipment according to technical requirements and manufacturer's installation/commissioning/maintenance manual.		
RANGE STATEMENT	T The task may be carried out under the supervision of electrical engineers. The tools and equipment needed include: 1. Personal protective articles, such as insulating shoes/gloves and work clothes; 2. Phasing tester, multimeter, thermodetector, wave recorder, insulation resistance tester, voltmeter, ammeter, voltage tester, etc.;; 3. Common electrical tools (needle-nose pliers, screwdriver, diagonal pliers, insulation tape, etc.).		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe the occupational health and safety precautions when performing the task; 2. Choose suitable tools and equipment for task; 3. Conduct impact test, no-load test, on-load test and other trial operation items; 4. Ensure the trial operation time meets the requirement for trial operation of electrical equipment; 5. Record the current, voltage, temperature and operation time, and confirm the indication and data of instruments are normal; 6. Observe the abnormality; if any, power off the equipment immediately; 7. Remove the general faults during trial operation; 8. Keep quality records during trial operation of electrical equipment;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Conduct impact test, no-load test, on-load test and other trial operation items; 1.2 Remove possible faults during trial operation; 1.3 Ensure the trial operation is qualified. 2.0 Principle The person performing this task must be able to explain the following principles 2.1 Procedures for electrical operation; 2.2 Procedures for power dispatching; 2.3 Procedures for electrical safety; 2.4 Procedures for trial operation. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Quality inspection of electrical equipment; 3.2 On-load test; 3.3 Basic working principles of electrical equipment.	

9. Arrange the tools, equipment and workplace.	4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Commissioning skills; 4.6 Fault analysis and treatment skills.
FINAL PRODUCT OR SERVICE DESCRIPTION	Trial operation of electrical equipment shall be carried out according to technical requirements and manufacturer's installation/commissioning/maintenance manual.
CIRCUMSTANTIAL KNOWLEDGE:	Detailed knowledge about: 1. Safety analysis on construction site; 2. Safety operation of operation tools; 3. Safety operation of measuring instruments; 4. Occupational health and safety knowledge; 5. Equipment installation and maintenance knowledge; 6. Equipment commissioning knowledge.

TABLE 1: DACUM CHARTS FOR ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN - NTA 6

DUTIES	TASKS	ENABLERS
1.0 Electrical equipment installation and repair in special places	1.1 Choosing electrical equipment according to the place level. 1.2 Line laying. 1.3 Installation and repair of the explosion-proof electric equipment.	General skills and knowledge • Cooperating with others using communication skills and report to the superiors • Safety, health and environmental knowledge • Use the manufacturer manual • Identify the level of place with explosion and fire risks • Choose electrical equipment for the place with explosion and fire risks • Lay lines in the place with explosion and fire risks • Install the explosion-proof electrical equipment Tools and equipment • Personal protective equipment (PPE), such as safety shoes, goggles, gloves, hearing protection device and helmet • Electrical measuring instruments such as level gauge, range finder, length recorder, multimeter, tramegger, clamp ammeter and ground resistance tester • Installation tools such as construction power panel, electric hand drill, impact drill, press pliers, tapping machine, pipe bender and threading machine • Installation tools such as electric hand drill, impact drill, press pliers, tapping machine, pipe bender and threading machine Materials • Qualified channel steel, galvanized flat steel, elbow, bracket and bracing wire • Screw, washer, spring washer, anchor bolt, expansion screw and steel gasket

DUTIES	TASKS	ENABLERS
		• Crimping terminals, plastic pipe, electrical tape, antirust paint, electrode, calcium carbide, oxygen, cement, sand, soldering tin and flux • Protective baffle, fireproof coating, fireproof bag, fire break and anti-fire plug Requirements for employees Teamwork spirit, honesty and trustworthiness, passion and dedication, safety awareness and devotion

2.0 Electrical equipment installation and maintenance	2.1 Fault treatment of cables 2.2 Transformer commissioning and repair. 2.3 Switchgear commissioning and repair. 2.4 Installation and commissioning of electrical equipment monitored by computer. 2.5 Inspection and repair of motor.	General skills and knowledge • Cooperating with others using communication skills and report to the superiors • Safety, health and environmental knowledge • Use the manufacturer manuals of various electrical equipment • Identify and treat the cable faults • Test and repair the transformers • Test and repair the switchgears • Use the electrical equipment monitored by computer • Check and repair the motors Tools and equipment • Personal protective equipment (PPE), such as safety shoes, goggles, gloves, hearing protection device and helmet. • Whole set of tool kit • Measuring equipment and instruments such as multimeter, tramegger, ground resistance tester, thermometer and timer • DC resistance tester, transformation ratio tester and dielectric loss tester • Circuit resistance tester, switchgear characteristic tester and AC withstand voltage device • Overall characteristic tester of transformer, insulation resistance tester, AC withstand voltage tester, transformation ratio tester and DC resistance tester • Error measurement device of transformer, partial discharge measurement device, single-phase self-couple voltage regulator, double-frequency withstand voltage equipment and capacitive voltage divider Materials • Insulation tape • Wires, switch, socket and other devices
--	---	--

		Requirements for employees Teamwork spirit, honesty and trustworthiness, passion and dedication, safety awareness and devotion
--	--	---

3.0 Testing and verification of metering equipment	3.1 Testing of current transformer. 3.2 Testing of voltage transformer. 3.3 Calibration of metering instruments.	General skills and knowledge • Cooperating with others using communication skills and report to the superiors • Safety, health and environmental knowledge • Report writing skills • Use the manufacturer manual • Verification items of transformers • Verification items of metering instruments • Analyse and judge the operating state of transformers • Fault analysis and treatment skills Tools and equipment • Safety protection articles and tools such as voltage tester, insulating gloves/shoes, safety helmet, security wire and grounding discharging rod • Overall characteristic tester of transformer, insulation resistance tester, AC withstand voltage tester, transformation ratio tester and DC resistance tester • Error measurement device of transformer, partial discharge measurement device, single-phase self-couple voltage regulator, double-frequency withstand voltage equipment and capacitive voltage divider • Measuring equipment and instruments such as multimeter, tramegger and thermometer • Digital standard current source, voltage source and power source; Materials • Insulation tape • Wires, switch, socket and other devices Requirements for employees Teamwork spirit, honesty and trustworthiness, passion and
---	---	---

		dedication, safety awareness and devotion
--	--	---

DUTIES	TASKS	ENABLERS
4.0 Trial operation of electrical equipment	4.1 Inspection and preparation before trial operation. 4.2 Trial operation.	General skills and knowledge - Cooperating with others using communication skills and report to the superiors - Safety, health and environmental knowledge - Report writing skills - Use the manufacturer manual - Necessary conditions for trial operation - Trial operation plan Tools and equipment - Personal protective equipment (PPE), such as safety shoes, goggles, gloves, hearing protection device and helmet - Common electrical tools such as needle-nose pliers, screwdriver, diagonal pliers and insulation tape - Phasing tester, multimeter, thermometer, wave recorder, insulation resistance tester, voltmeter, ammeter, voltage tester, etc. Materials - Trial operation plans, manufacturer manuals and delivery test reports Requirements for employees Teamwork spirit, honesty and trustworthiness, passion and dedication, safety awareness and devotion