

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



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

LEVEL: NTA LEVEL 5

FEBRUARY 2024

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ABBREVIATIONS

AC	Alternating Current
CBET	Competency Based Education and Training
DC	Direct Current
KVA	Kilovolt-Ampere
NACTE	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
PPE	Personal Protective Equipment
CT	Current Transformer
TET	Technical Education and Training
VT/PT	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:	It is 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:	This is 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 to perform consistently to the standards required in 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, 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 workplace, 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 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, 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, personnel can be employed or designated to perform specific tasks in large-scale operation.

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 Levels 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 mode is identical to that of previous review, and new occupational standards are formulated according to the current situation of labour market.

5.0. OCCUPATIONAL STANDARDS

5.1. OCCUPATIONAL STANDARDS FOR ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN – NTA LEVEL 5.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	Carryout Preparation for construction	DUTY NO.	501
TASK TITLE	Safety measures and risk spot analysis	TASK NO.	5011
PERFORMANCE CRITERIA	The person performing this task must be able to complete safety measures and risk spot analysis according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used 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 Preventive measures for electric shock: Before working, recheck the safety measures, test the equipment voltage and ensure there is no electrical risk; 2 Preventive measures for mechanical injury: Wear work clothes and other protective articles correctly before entering the site, avoid injury due to falling components and carry the components with special tools; 3 Preventive measures for lifting injury: Check whether the lifting tools and load capacity are consistent with the site condition, the power supply is reliable and the steel wire rope is intact; 4 Preventive measures for wrong working position: Check whether the equipment number and name are consistent with the equipment to be repaired (or installed) in workplace;		Detailed knowledge about: 1.0. Methods The person performing this task must be able to explain how to: 1.1 Identify the risk spots on construction site; 1.2 Prevent and control the risk spots. 2.0. Principle The person performing this task must be able to explain the following principles: 2.1 Rules for safety distance of electrical equipment; 2.2 Regulations for installation and commissioning of electrical equipment; 2.3 Regulations for maintenance of electrical equipment. 3.0. Theories The person performing this task must be able to explain the following matters: 3.1 Safety education and training contents before construction; 3.2 Basic construction conditions and requirements on construction site; 3.3 Organizational and technical measures for ensuring safety;	

5 Preventive measures for injury caused by high falling objects: Wear safety helmet correctly, observe whether there are high falling objects and take protective measures timely; 6 6. Preventive measures for dangerous mental state: Carry out risk spot analysis before working and prohibit the personnel whose mental/physical condition is unsuitable for working from operation; pay attention to the mental and physical condition of operation personnel during working; if abnormal, prohibit them from working continuously; 7 Observe health, occupational and environmental safety rules and regulations.	3.4. Requirements and specifications for using tools on construction site. 4.0. Essential skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Safety measures and risk spot analysis shall be completed 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRYOUT PREPARATION FOR EQUIPMENT INSTALLATION	DUTY NO.	501
TASK TITLE	CARRYOUT PREPARATION OF INSTALLATION SITE	TASK NO.	5012
PERFORMANCE CRITERIA	The person performing this task must be able to conduct general inspection on the conditions of installation site for an electrical equipment according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Multimeter, clamp ammeter, tramegger, electric energy meter, etc.;; 2. Electroprobe, needle-nose pliers, wire stripper, electric screwdriver, etc.;; 3. Common cutting tools; 4. Electric drill, press pliers, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Check whether the doors and windows of distribution room are installed according to the design document; 2. Check whether the embedded parts and reserved holes on the construction site meet the requirements of the design document; 3. Check whether the wastewater and waste gas treatment facilities and measures on construction site are perfect; 4. Check whether the solid waste treatment facilities and measures on construction site are perfect; 5. Check whether the dust control facilities and measures on the construction site are perfect; 6. Check whether the measures for controlling equipment noise and vibration on the construction site are perfect; 7. Check whether the site installation space meets the requirement for equipment handling and lifting; 8. Check whether the foundation of parking and operation site of		Detailed knowledge about: 1.0. Methods The person performing this task must be able to explain how to: 1.1 Check the facilities on installation site; 1.2 Check the construction environment on installation site; 1.3 Check the instruments and devices for construction measurement and inspection. 2.0. Principle The person performing this task must be able to explain the following principles: 2.1 Regulations for construction conditions and operation environment inspection; 2.2 Regulations for construction conditions and environmental protection; 2.3 Specifications for verification of measuring instruments and devices. 3.0 Theories The person performing this task must be able to explain the following matters: 3.1 Electric safety of electrical equipment installation;	

transportation and lifting machinery is firm or not; 9. Check whether the isolation measures for preventing high falling objects on the construction site are perfect; 10. Check whether the transportation and lifting machinery is qualified after detection; 11. Check whether the instruments and devices for construction measurement and inspection are in validity period.	3.2 Environmental protection of electrical equipment installation site; 3.3 Construction technology of electrical equipment installation; 3.4 Verification of measuring instruments and devices; 3.5 Electrical drawing interpretation. 4.0. Essential skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills 4.6 Environmental management skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Preparation before electrical equipment installation shall be completed 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRYOUT PREPARATION FOR EQUIPMENT INSTALLATION	DUTY NO.	501
TASK TITLE	CARRYOUT INSPECTION ON AN EQUIPMENT FOR INSTALLATION	TASK NO.	5013
PERFORMANCE CRITERIA	The person performing this task must be able to conduct general inspection on equipment and materials according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Multimeter, clamp ammeter, tramegger, electric energy meter, etc.; 2. Electroprobe, needle-nose pliers, wire stripper, electric screwdriver, etc.; 3. Common cutting tools; 4. Electric drill, press pliers, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. After electrical equipment, materials and accessories arrive at the site, check whether the packaging and sealing are in good condition; 2. Check whether the specification, model, quantity and accessories of equipment, special tools and spare parts meet the requirements of the design document and the contract; 3. Check whether the equipment nameplate, technical document, delivery test report, qualification certificate and packing list are complete or not; 4. Check whether the equipment and accessories have concavity, scratch, rust or deformation; 5. Check whether the surface of energized part is smooth and flat or has cracks, wrinkles, inclusions, deformation or warp; 6. Check whether the oil-filled electric equipment leaks oil or not; 7. Check whether the pressure of gas insulated electrical equipment meets the requirements of the technical document;		Detailed knowledge about: 1.0. Methods The person performing this task must be able to explain how to: 1.1 Check the sealing condition of equipment and facilities; 1.2 Check the arrival condition of equipment and facilities; 1.3 Check the technical data of equipment and facilities; 1.3 Check the appearance and technical indexes of equipment and facilities; 1.4 Check the on-site storage condition of electrical equipment. 2.0. Principle The person performing this task must be able to explain the following principles: 2.1 Regulations for inspection of electrical equipment and accessories before installation; 2.2 Regulations for storage of electrical equipment and accessories.	

8. Check whether the sealing gasket/grease, cleaner and lubricating grease meet the requirements of the technical document; 9. Check whether the insulator and insulating sleeve has cracks or damage and whether the casting has sand holes; whether the filler in bonding area is complete and the bonding is firm; and whether the bonding surface between insulating part and flange is coated with waterproof sealant 10. Check whether the fasteners of hot galvanized/stainless steel products are sufficient 11. Arrange the equipment storage identification in flat place free of accumulated water or corrosive gas, and tack the products according to the stacking layers; 12. Store the equipment, accessories or materials which have damp-proof/rain-proof requirement indoors; 13. Ensure that the storage period and measures of equipment and devices before installation meet the requirements of technical document; 14. Store the consumables such as sealing grease and cleaning paper in packaging box or indoors; 15. Place the porcelain parts and insulators stably without tilting or collision.	3.0. Theories The person performing this task must be able to explain the following matters: 3.1 Theoretical knowledge of electrical equipment; 3.2 Storage requirements of electrical equipment. 4.0. Essential skills 4.1 Communication skills; 4.2 Electrical drawing reading skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Inspection and storage of electrical equipment and accessories shall be completed 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRYOUT INSTALLATION AND REPAIR OF ELECTRICAL EQUIPMENT	DUTY NO.	502
TASK TITLE	CARRYOU INSTALLATION AND MAINTENANCE OF TRANSFORMER	TASK NO.	5021
PERFORMANCE CRITERIA	The person performing this task must be able to install and maintain transformer according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Ammeter/voltmeter, etc.; 2. High-voltage insulating rod; 3. Voltage tester; 4. High-voltage phasing tester; 5. Insulating gloves and boots; 6. Insulating mat and cover; 7. Temporary barrier and fence; 8. Bamboo (wooden) ladder and safety rope and net; 9. Pedal and climber; 10. Wrench; 11. Crane and sling chain.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Apply the preventive measures for health and safety during working; 2. Choose suitable working tools 3. Inspect the transformer to ensure functioning before installation; 4. Check the appearance of transformer; 5. Check the seal, pressure and oil level of transformer; 6. check the body according to equipment document under the guidance of manufacturer's technicians; 7. Install the transformer accessories; 8. Phase the transformer;		Detailed knowledge about: 1.0. Methods The person performing this task must be able to explain how to: 1.1 Choose suitable tools; 1.2 Check the appearance; 1.3 Check the body; 1.4 Install the equipment; 1.5 Identify and treat the faults; 1.6 Complete site clearing and engineering handover. 2.0. Principle The person performing this task must be able to explain the following principles: 2.1 Principles for transformer operation; 2.2 Specifications for transformer installation. 3.0. Theories	

9. Conduct delivery test on transformer under the guidance; 10. Install and fix the equipment according to manufacturer's manual; 11. Complete grounding of equipment components; 12. Clean the site after working 13. Handover the site.	The person performing this task must be able to explain the following matters: 3.1 Underpinning knowledge of transformer; 3.2 Common faults of transformer. 4.0. Essential Skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The transformers is installed and maintained 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRYOUT INSTALLATION AND REPAIR OF ELECTRICAL EQUIPMENT	DUTY NO.	502
TASK TITLE	CARRYOUT INSTALLATION AND MAINTENANCE OF MOTORS	TASK NO.	5022
PERFORMANCE CRITERIA	The person performing this task must be able to install motors according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Infrared thermometer; 2. Insulated clamp; 3. Voltage tester; 4. Insulating gloves and boots; 5. Temporary barrier and fence; 6. Crane, sling chain and cord fastener; 7. Wrench; 8. Ammeter/voltmeter, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Apply preventive measures for health and safety during installation of motors; 2. Choose suitable tools 3. Ensure the equipment model is correct and attached with complete accessories and qualification certificate; 4. Check the appearance of equipment; 5. Check the seal, pressure and oil level of equipment; 6. Test the insulating strength of motor; 7. Complete wiring of motor; 8. Inspect the initial and tail ends of stator winding of one-phase and three-phase synchronous and asynchronous motor; 9. Complete Y-Δ wiring of motor; 10. Clean the surface and coat the primer, finish and protective paint of motor;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Choose suitable tools; 1.2 Check the appearance; 1.3 Check the body; 1.4 Install the equipment; 1.5 Identify and treat the faults; 1.6. Complete site clearing and engineering handover 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Principles for motor operation; 2.2 Specifications for motor installation 3.0 Theories The person performing this task must be able to explain the following matters: 3.1 Underpinning knowledge of motor; 3.2 Common faults of motor.	

11. Clean the equipment and its installation position; 12. Install the motor according to construction drawing; 13. Complete grounding of equipment components; 14. Complete site clearing; 15. Handover the site.	4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The motors are installed 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRY OUT INSTALLATION AND REPAIR OF ELECTRICAL EQUIPMENT	DUTY NO.	502
TASK TITLE	CARRY OUT BUSBAR INSTALLATION AND MAINTENANCE	TASK NO.	5023
PERFORMANCE CRITERIA	The person performing this task must be able to install busbars according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Ammeter/voltmeter, etc.;; 2. High-voltage insulating rod; 3. Voltage tester; 4. Insulating gloves and boots; 5. Insulating mat and cover; 6. Temporary barrier and fence; 7. Bamboo (wooden) ladder and safety rope and net; 8. Pedal and climber; 9. Wrench.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Apply the preventive measures for health and safety during working; 2. Choose suitable working tools; 3. Ensure the equipment model is correct and attached with complete accessories and qualification certificate; 4. Check the appearance of equipment; 5. Check the seal, pressure and oil level of equipment; 6. Install supporting insulator; 7. Clean the surface of busbar; 8. Clean the equipment and its installation position; 9. Install the equipment according to construction drawing; 10. Ground the equipment components; 11. Complete site clearing; 12. Handover the site.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Choose suitable tools; 1.2 Check the appearance; 1.3 Check the body; 1.4 Install the equipment; 1.5 Identify and treat the faults; 1.6 Complete site clearing and engineering handover. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Principles for busbar operation; 2.2 Specifications for busbar installation. 3.0 Theories The person performing this task must be able to explain the following matters: 3.1 Underpinning knowledge of busbar;	

	3.2 Common faults of busbar. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The busbars are installed and maintained 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRY OUT INSTALLATION AND REPAIR OF ELECTRICAL EQUIPMENT	DUTY NO.	502
TASK TITLE	INSTALL LIGHTNING PROTECTION AND GROUNDING DEVICES	TASK NO.	5024
PERFORMANCE CRITERIA	The person performing this task must be able to install lightning protection and grounding devices according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Ammeter/voltmeter, etc.;; 2. High-voltage insulating rod; 3. Voltage tester; 4. Insulating gloves and boots; 5. Insulating mat and cover; 6. Temporary barrier and fence; 7. Bamboo (wooden) ladder and safety rope and net; 8. Pedal and climber; 9. Wrench.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Apply preventive measures for health and safety during working; 2. Choose suitable working tools; 3. Ensure the equipment model is correct and attached with complete accessories and qualification certificate; 4. Check the appearance of lighting protection and grounding devices; 5. Install the artificial grounding electrode; 6. Install the fundamental grounding electrode; 7. Carryout installation of grounding trunk line; 8. Fabricate and Install lightning rod; 9. Complete installation of lightning conduction and strip;		Detailed knowledge about: 1.0. Methods The person performing this task must be able to explain how to: 1.1 Choose suitable tools; 1.2 Check the appearance; 1.3 Check the body; 1.4 Install the equipment; 1.5 Identify and treat the faults; 1.6 Complete site clearing and engineering handover. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Principles for operation of lighting protection and grounding devices; 2.2 Specifications for installation of lighting protection and grounding devices.	

10. Clean the equipment and its installation position; 11. Install the equipment according to construction drawings; 12. Ground the equipment components; 13. Clear the site 14. Handover the site.	3.0 Theories The person performing this task must be able to explain the following matters: 3.1 Underpinning knowledge of lighting protection and grounding devices; 3.2 Common faults of lighting protection and grounding devices. 4.0 Essential Skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The lighting protection and grounding devices are installed 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; 5. Equipment installation and maintenance plan; 6. Installation procedures.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRYOUT INSTALLATION AND REPAIR OF METERING EQUIPMENT	DUTY NO.	503
TASK TITLE	CARRY OUT THE INSTALLATION AND REPAIR OF CURRENT TRANSFORMER	TASK NO.	5031
PERFORMANCE CRITERIA	The person performing this task must be able to install and repair current transformers according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Common tools such as screwdriver, needle-nose pliers, diagonal pliers, wire stripper and cold compression pincers; 2. One anti-creeping and anti-short-circuit power strip; 3. Personal protective articles such as insulating shoes and gloves, work clothes and safety belt; 4. Multimeter, pressure gauge, thermometer and voltage tester.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following operation: 1. Apply the preventive measures for health and safety during working; 2. Choose suitable working tools; 3. Ensure the equipment model is correct and attached with complete accessories and qualification certificate; 4. Check the appearance of equipment; 5. Check the seal, pressure and oil level of equipment; 6. Check the body according to equipment document under the guidance of manufacturer's technicians; 7. Clean the equipment and its installation position; 8. Install the fasteners and brackets according to construction drawings;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Choose suitable tools 1.2 Check the appearance 1.3 Check the body 1.4 Install the equipment 1.5 Identify and treat the faults 1.6 Complete site clearing and engineering handover 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Principles for operation of current transformer 2.2 Specifications for installation of current transformer 3.0 Theories The person performing this task must be able to explain the following matters: 3.1 Underpinning knowledge of current transformer; 3.2 Common faults of current transformer.	

9. Complete grounding of equipment components; 10. Check and arrange the tools; 11. Clear the construction site; 12. Handover the site.	4.0 Essential skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The current transformers shall be installed and repaired 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRY OUT INSTALLATION AND REPAIR OF METERING EQUIPMENT	DUTY NO.	503
TASK TITLE	CARRYOUT INSTALLATION AND REPAIR OF VOLTAGE TRANSFORMER	TASK NO.	5032
PERFORMANCE CRITERIA	The person performing this task must be able to install and repair voltage transformer according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Common tools such as screwdriver, needle-nose pliers, diagonal pliers, wire stripper and cold compression pincers; 2. One anti-creeping and anti-short-circuit power strip; 3. Personal protective articles such as insulating shoes and gloves, work clothes and safety belt; 4. Multimeter, pressure gauge, thermometer and voltage tester.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following operation: 1. Apply the preventive measures for health and safety during working; 2. Choose suitable working tools; 3. Ensure the equipment model is correct and attached with complete accessories and qualification certificate; 4. Check the appearance of equipment; 5. Check the seal, pressure and oil level of equipment; 6. Check the body according to equipment document under the guidance of manufacturer's technicians; 7. Clean the equipment and its installation position; 8. Install the fasteners and brackets according to construction drawings;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Choose suitable tools; 1.2 Check the appearance; 1.3 Check the body; 1.4 Install the equipment; 1.5 Identify and treat the faults; 1.6 Complete site clearing and engineering handover. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Principles for operation of voltage transformer; 2.2 Specifications for installation of voltage transformer. 3.0 Theories The person performing this task must be able to explain the following matters: 3.1 Underpinning knowledge of voltage transformer; 3.2 Common faults of voltage transformer.	

9. Complete grounding of equipment components; 10. Check and arrange the tools; 11. Clear the construction site; 12. Handover the site.	4.0 Essential skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The voltage transformer is installed and repaired 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRY OUT INSTALLATION AND REPAIR OF METERING EQUIPMENT	DUTY NO.	503
TASK TITLE	INSTALL THE MEASURING INSTRUMENT	TASK NO.	5033
PERFORMANCE CRITERIA	The person performing this task must be able to install the measuring instruments according to technical requirements and manufacturer's product manual.		
RANGE STATEMENT	The measuring instruments shall be installed and repaired on the installation and maintenance site under the supervision of electrical engineers. The tools to be used include: 1. Common tools such as screwdriver, needle-nose pliers, diagonal pliers and wire stripper; 2. One anti-creeping and anti-short-circuit power strip; 3. Personal protective articles such as insulating shoes and gloves, work clothes and safety belt; 4. Multimeter, tramegger, electroprobe and clamp meter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following operation: 1. Apply preventive measures for health and safety during working during installation of electrical measuring instrument; 2. Choose suitable tools and equipment for task; 3. Check whether the appearance, certificate and sealing property of measuring instrument meet the specifications and requirements; 4. Check whether the parameters of measuring instrument meet the requirements; 5. Test the insulating property of measuring instrument; 6. Install the fasteners and brackets; 7. Install the test junction box; 8. Install the measuring instrument; 9. Check the configuration, polarity and secondary wiring of current transformer and voltage transformer;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Choose suitable instrument; 1.2 Measure the insulation resistance of instrument; 1.3 Install the instrument; 1.4 Judge and treat the faults of instrument. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Installation process of instrument; 2.2 Cabling and wiring principles for instrument installation. 3.0 Theories The person performing this task must be able to explain the following matters: 3.1 Purpose of instrument; 3.2 Working principle and type of instrument; 3.3 Inspection method of instrument; 3.4 Installation method of instrument;	

10. Conduct wiring according to the installation wiring diagram; 11. Clear up the tools, equipment and workplace.	3.5 Judgment and treatment method of instrument faults. 4.0 Essential skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The instruments are installed according to technical requirements and manufacturer's installation and 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	COMMISSION THE ELECTRICAL EQUIPMENT	DUTY NO.	504
TASK TITLE	CARRYOUT ENGINEERING VERIFICATION OF ELECTRICAL INSTRUMENTS	TASK NO.	5041
PERFORMANCE CRITERIA	The person performing this task must be able to verify the ammeter, voltmeter, power meter, power factor meter and electric energy meter according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Instruments to be verified such as ammeter, voltmeter, electric energy meter and power meter; 2. Needle-nose pliers, wire stripper, electric screwdriver, etc.;; 3. Field calibrator of ammeter, adjustable power supply, standard resistor, power source, adjuster, etc.;; 4. Electroprobe, insulating shoes, etc.;; 5. Lead seal, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following operation: 1. Check whether the field condition meets the verification requirements of instruments; 2. Check whether the certificates of instruments are in validity period; 3. Check whether the seal, shell and terminal button of instruments are intact; 4. Check whether the equipment and accessories have concavity, scratch, rust or deformation; 5. Check whether the difference between display time of instruments and standard time is in a specified scope; 6. Verify the circuit wiring of instruments according to drawings; 7. Operate the instrument verification devices correctly;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Check the working environment of instrument verification site; 1.2 Check the appearance of instruments; 1.3 Check the reading of instruments; 1.4 Check the wiring of instrument verification circuits; 1.5 Check the inspection error. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Ammeter inspection procedures; 2.2 Voltmeter inspection procedures; 2.2 Electric energy meter inspection procedures; 2.4 Power meter verification procedures. 3.0 Theories	

8. Set the parameters of instrument verification devices for correctness; 9. Standardize the recording of verification data; 10. Check for error; 11. Remove the testing wires correctly and restore the site.	The person performing this task must be able to explain the following matters: 3.1 Basic knowledge of instruments; 3.2 Instrument installation and repair knowledge; 3.3 Judgment and treatment method of instrument faults; 3.4 Ability to identify measuring instrument and applicability. 4.0 Essential skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3. Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Electrical Instruments are verified 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; 5. Equipment installation and maintenance plan.

OCCUPATION	ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	COMMISSION THE ELECTRICAL EQUIPMENT	DUTY NO.	504
TASK TITLE	COMMISSION AC/DC MOTORS	TASK NO.	5042
PERFORMANCE CRITERIA	The person performing this task must be able to test the AC/DC motor according to technical requirements and manufacturer's maintenance manual.		
RANGE STATEMENT	The task may be executed in the production and operation field under the supervision of an Electrical Engineer. The tools to be used include: 1. Testing instruments; 2. Needle-nose pliers, wire stripper, electric screwdriver, etc.;; 3. Safety protection articles; 4. Multimeter, clamp ammeter, tramegger, etc.;		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following operation: 1. Measure the insulation resistance of DC motor excitation winding, armature, excitation circuit and all connecting equipment; 2. Measure the DC resistance of DC motor excitation winding and variable resistor; 3. Measure the DC motor, adjust the motor brush and keep its neutrality in magnetic field; 4. Measure the insulation resistance and absorption ratio of AC motor winding; 5. Measure the insulation resistance of variable resistor, starting resistor and field suppressing resistor of AC motor; 6. Conduct idling inspection and no-load current measurement on AC/DC motor; 7. Check the polarity and its connection correctness of AC/DC motor winding;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Measure the insulation resistance and DC resistance of some DC motor parts; 1.2 Adjust the neutrality of DC motor brush in magnetic field; 1.3 Measure the insulation resistance and absorption ratio of AC motor winding; 1.4 Measure the insulation resistance of some AC motor parts; 1.5 Check the idling of AC/DC motor and measure the no-load current; 1.6 Check the polarity and its connection correctness of AC/DC motor winding; 1.7 Complete inspection of control apparatus. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Test procedures for DC motor; 2.2 Test procedures for AC motor; 2.3 Test procedures for control apparatus.	

8. Check whether the control apparatus meets the assembly requirements; 9. Check whether the cabling of control apparatus meets the requirements of the design document; 10. Check whether the control apparatus meets the testing requirement; 11. Check whether the control apparatus meets the power-on inspection requirement; 12. Tests the AC/DC motor as per requirements; 13. Standardize the recording of test data.	3.0 Theories The person performing this task must be able to explain the following matters: 3.1 Knowledge of DC motor test; 3.2 Knowledge of AC motor test; 3.3 Knowledge of insulation resistance and absorption ratio test; 3.4 Knowledge of DC resistance measurement; 3.5 Principles of control apparatus; 3.6 Identification of types of winding connections. 4.0 Essential skills 4.1 Communication skills; 4.2 Electrical drawing interpretation skills; 4.3 Teamwork skills; 4.4 Technical report writing skills; 4.5 Climbing operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The AC and DC Motors are commissioned in accordance with technical requirements
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; 5. Equipment installation and maintenance plan.

APPENDIX: DACUM CHARTS FOR ELECTRICAL EQUIPMENT INSTALLATION AND MAINTENANCE TECHNICIAN - NTA 5

DUTIES	TASKS	ENABLERS
1.0 Preparation before construction	1.1. Safety measures and risk spot analysis. 1.2. Preparation of construction conditions. 1.3. Specific measures for construction preparation.	General skills and knowledge • Communication skills • Electrical drawing reading skills • Report writing skills • Climbing operation skills • Electricity safety of electrical equipment installation • Environmental protection of electrical equipment installation site • Construction technology of electrical equipment installation Tools and equipment • Multimeter, clamp ammeter, tramegger, electric energy meter, etc. • Electroprobe, needle-nose pliers, wire stripper, electric screwdriver, etc. • Common cutting tools • Electric drill, press pliers, etc. Materials • Insulation tape • Wires, switch, socket and other devices Requirements for employees Passion and dedication, unity and cooperation, honesty and trustworthiness, diligence and thrift, safe production
2.0 Installation and repair of electrical equipment	2.1. Installation and maintenance of transformers. 2.2. Installation and maintenance of motors. 2.3. Installation and maintenance of busbars. 2.4. Installation and maintenance of lightning protection and grounding devices.	General skills and knowledge • Communication skills • Electrical drawing reading skills • Report writing skills • Climbing operation skills • Specifications for installation and operation of electrical equipment • Structure and principle of electrical equipment

DUTIES	TASKS	ENABLERS
		Tools and equipment • Ammeter/voltmeter, etc. • High-voltage insulating rod • Voltage tester • Insulating gloves and boots • Insulating mat and cover • Temporary barrier and fence • Bamboo (wooden) ladder and safety rope and net • Pedal and climber • Wrench Materials • Insulation tape • Wires, switch, socket and other devices Requirements for employees Passion and dedication, unity and cooperation, honesty and trustworthiness, diligence and thrift, safe production
3.0 Installation and repair of metering equipment	3.1. Installation and repair of current transformers. 3.2. Installation and repair of voltage transformers. 3.3. Installation and repair of metering instruments.	General skills and knowledge • Communication skills • Electrical drawing reading skills • Report writing skills • Climbing operation skills • Structure and principles of current transformers and instruments • Current transformer wiring and mechanical drawing reading knowledge Tools and equipment • Common tools such as screwdriver, needle-nose pliers, diagonal pliers and wire stripper • One anti-creeping and anti-short-circuit power strip • Personal protective articles such as insulating shoes and gloves, work clothes and safety belt • Multimeter, tramegger, electroprobe and clamp meter

DUTIES	TASKS	ENABLERS
		Materials • Insulation tape • Wires, switch, socket and other devices Requirements for employees Passion and dedication, unity and cooperation, honesty and trustworthiness, diligence and thrift, safe production
4.0 Electrical commissioning	4.1. Verification of engineering instruments. 4.2. Commissioning of general electrical equipment.	General skills and knowledge • Communication skills • Electrical drawing reading skills • Report writing skills • Climbing operation skills • Principles of verifying circuit • Measured data processing Tools and equipment • Multimeter, clamp ammeter, tramegger, electric energy meter, etc. • Electroprobe, needle-nose pliers, wire stripper, electric screwdriver, etc. • Common cutting tools • Electric drill, press pliers, etc. Materials • Insulation tape • Wires, switch, socket and other devices Requirements for employees Passion and dedication, unity and cooperation, honesty and trustworthiness, diligence and thrift, safe production.