NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

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PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN

LEVEL: NTA 4

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ABBREVIATIONS

6s	Seiri, Seiton, Seiso, Setketsu, Shtsuke and Safety
CBET	Competency Based Education and Training
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
PCB	Printed Circuit Board
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training

GLOSSARY OF TERMS

Circumstantial Knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.
Competence:	The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based Education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/Training Programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational Area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as a performance tool of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation**.**
Performance Criteria:	Indicate expected end results or outcomes in the form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.

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

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical and Vocational Education and Training of Tanzania 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 Occupational 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 Electronic Equipment Assembly and Repair 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. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of engineers 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. Engineers 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 Electronic Equipment Assembly and Repair Technicians were key informants in the survey to discover occupational trends. The 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 engineers 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 engineers 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 ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by an Electronic Equipment Assembly and Repair 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 Electronic Equipment Assembly and Repair 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 Electronic Equipment Assembly and Repair Technician shall be mainly engaged in Printed Circuit Board (PCB) assembly, debugging and repair of power supply and circuits, office equipment repair and service acceptance under the supervision of engineers. They can also perform electronic equipment assembly, debugging and repair, service acceptance and other work in the workshop or user site. Generally, the Electronic Equipment Assembly and Repair Technician performs the following responsibilities:

a) Manual assembly of PCB

b) Semi-automatic mixing assembly of PCB

c) Automatic mixing assembly of PCB

d) DC voltage-stabilized power and debugging of basic circuits

e) Debugging of switching power supply

f) Debugging of high-voltage power supply

g) Debugging of analog-digital hybrid circuits

h) Maintenance of analog-digital hybrid circuits

i) Installation and debugging of electronic equipment

j) Debugging of high frequency circuits

k) Faults and maintenance of electronic equipment

l) Quality inspection and acceptance of small electronic products

m) Quality inspection and acceptance of electronic equipment installation

n) Quality inspection and acceptance of electronic equipment repair

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

4.0. VALIDITY PERIOD

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

5.0. OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN – NTA 4

<table>
<tr><td>OCCUPATION</td><td>ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>MANUAL ASSEMBLY OF PCB</td><td>DUTY NO.</td><td>401</td></tr>
<tr><td>TASK TITLE</td><td>ASSEMBLY OF PCB</td><td>TASK NO.</td><td>4011</td></tr>
<tr><td>PERFORMANCE CRITERIA</td><td colspan="3">The person performing this task must be able to complete the assembly of PCB in accordance with technical requirements and industry standards.</td></tr>
<tr><td>RANGE STATEMENT</td><td colspan="3">The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers.
The tools and equipment to be used include:
1. Welding tools such as electric soldering irons and heat guns;
2. Multimeters;
3. Electrostatic protection kits;
4. Lead forming tooling/equipment;
5. Magnifiers;
6. Commonly-used tools such as tweezers, diagonal pliers, and needle-nose pliers;
7. Personal protective equipment.</td></tr>
<tr><td colspan="4">EVIDENCE REQUIREMENT</td></tr>
<tr><td colspan="2">PRACTICAL PERFORMANCE</td><td colspan="2">UNDERPINNING KNOWLEDGE</td></tr>
<tr><td colspan="2">The person performing this task must be able to do the following:
1. Correctly read the specifications, models, pin numbers and other information of two lead components;
2. Conduct lead correction for two lead components;
3. Tin the leads of two lead components;
4. Determine the installation sequence of components according to the type, package size and electrostatic sensitivity level of components;
5. Welding two lead components;
6. Detect two lead components with multimeters;
7. Remove and replace two lead components;
8. Observe the health and safety prevention measures during working;
9. Keep the workplace clean;</td><td colspan="2">Detailed knowledge about:
1.0 Methods
The person performing this task must be able to explain how to:
1.1 Read the specifications, models, pin numbers and other information of two lead components;
1.2 Conduct lead correction for two lead components;
1.3 Tin two lead components;
1.4 Determine the installation sequence of components;
1.5 Complete the welding of PCB with manual welding equipment;
1.6 Conduct the overhaul of PCB.

2.0 Principle
The person performing this task must be able to explain the following principles:
2.1 Process requirements for the assembly of PCB;</td></tr>
</table>

10. Arrange and store the tools and equipment.	2.2 Specific procedures and process requirements for manual welding; 2.3 Principle of PCB overhaul. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Knowledge of assembling PCB; 3.2 Basic knowledge of using welding equipment and tools. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Solidarity and cooperation skills; 4.3 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The assembly of PCB is completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Electrostatic protection; 2. Occupational health and safety; 3. Waste disposal methods; 4. 6s management.

OCCUPATION	ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MANUAL ASSEMBLY OF PCB	**DUTY NO.**	401
TASK TITLE	CONDUCTOR PROCESSING	**TASK NO.**	4012
PERFORMANCE CRITERIA	The person performing this task must be able to complete conductor processing in accordance with technical requirements and industry standards.		
RANGE STATEMENT	The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers. The tools and equipment to be used include: 1. Multimeters; 2. Welding tools such as electric soldering irons and heat guns; 3. Electrostatic protection kits; 4. Commonly-used tools such as diagonal pliers, needle-nose pliers, wire strippers and crimpling pliers; 5. Personal protective equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Use conductor processing tools (crimpling pliers and wire strippers); 2. Withdraw conductors according to actual needs; 3. Peel both ends of the conductor; 4. Clean the conductor after peeling; 5. Twist the head of the peeled conductor; 6. Conduct tin leaching for the conductor after twisting its head; 7. Weld the conductor manually; 8. Conduct health and safety prevention; 9. Keep the workplace clean; 10. Store the tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Cut the conductor; 1.2 Peel the conductor; 1.3 Clean the conductor; 1.4 Twist the head of the conductor; 1.5 Conduct tin leaching for the conductor. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Operation specification of conductor processing; 2.2 Operation specification of tools and equipment. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Classification of conductors; 3.3 Conducting materials;

	3.4 Techniques and methods of conductor processing. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Solidarity and cooperation skills; 4.3 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Conductor processing is completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Electrostatic protection; 3. Proper use of personal protective equipment; 4. 6s management.

OCCUPATION	ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MANUAL ASSEMBLY OF PCB	**DUTY NO.**	401
TASK TITLE	THREAD CONNECTION	**TASK NO.**	4013
PERFORMANCE CRITERIA	The person performing this task must be able to complete thread connection in accordance with technical requirements and industry standards.		
RANGE STATEMENT	The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers. The tools and equipment to be used include: 1. Thread connection tools such as non-constant force wrenches, constant force wrenches, screwdrivers and torque multipliers; 2. Torque testing tools; 3. Personal protective equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the thread connection sequence; 2. Conduct pre-fastening; 3. Conduct fastening; 4. Increase the fastening level; 5. Check the installation correctness of screw joints and the installation quality of fasteners; 6. Keep the workplace clean; 7. Store the tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Read documents related to the thread connection process; 1.2 Identify bolts and nuts; 1.3 Use thread connection tools; 1.4 Connect multiple threads. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Specifications for the use of thread connection tools and torque testing tools; 2.2 Installation process requirements for screw joints and fasteners. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Ways of thread connection; 3.2 Methods of using thread connection tools and torque testing tools; 3.3 Techniques and methods of thread connection.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Customer service skills; 4.3 Solidarity and cooperation skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Thread connection is completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Occupational health and safety; 2. Proper use of personal protective equipment; 3. 6s management.

OCCUPATION	ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	DC VOLTAGE-STABILIZED POWER AND DEBUGGING OF BASIC CIRCUITS	**DUTY NO.**	402
TASK TITLE	DIAGRAM RECOGNITION AND ANALYSIS OF ELECTRONIC CIRCUITS	**TASK NO.**	4021
PERFORMANCE CRITERIA	The person performing this task must be able to complete the design and trial manufacture of PCB in accordance with technical requirements and industry standards.		
RANGE STATEMENT	The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers. The tools and equipment to be used include: 1. Altium Designer and computers; 2. Multimeters; 3. Vernier calipers; 4. Magnifiers; 5. Commonly-used tools such as tweezers, diagonal pliers, and needle-nose pliers.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the schematic diagram of electronic circuits; 2. Draw the schematic diagram of electronic circuits; 3. Design the PCB with single-sided board; 4. Design and conduct trial manufacture of the PCB with double-sided board; 5. Observe the health and safety prevention measures; 6. Conduct surveying and mapping of components and production library documents; 7. Keep the workplace clean; 8. Store the tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Design PCB using Altium Designer; 1.2 Use a multimeter; 1.3 Use a vernier caliper; 1.4 Use Altium Designer. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Code for PCB design; 2.2 Manufacturing process specifications of PCB. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Basic knowledge of using Altium Designer;

	3.2 Basic knowledge of thermal transfer printing single-sided PCB platemaking equipment. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Solidarity and cooperation skills; 4.3 Report writing skills; 4.4 Mathematical literacy.
DESCRIPTION OF THE END PRODUCT / SERVICE	The design and production of PCB are completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. 6s management.

OCCUPATION	ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	DC VOLTAGE-STABILIZED POWER AND DEBUGGING OF BASIC CIRCUITS	**DUTY NO.**	402
TASK TITLE	DETECTION OF UNIT CIRCUIT INTEGRITY AND SHORT CIRCUIT	**TASK NO.**	4022
PERFORMANCE CRITERIA	The person performing this task must be able to complete the detection of unit circuit integrity and short circuit in accordance with technical requirements and industry standards.		
RANGE STATEMENT	The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers. The tools and equipment to be used include: 1. Multimeters; 2. Oscilloscopes; 3. Signal generators; 4. DC voltage-stabilized power; 5. Electrostatic protection kits; 6. Commonly-used tools such as tweezers, diagonal pliers, and needle-nose pliers; 7. Personal protective equipment.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Abide by the preventive measures for health and safety when performing this task; 2. Conduct the test of unit circuit integrity; 3. Conduct the detection of unit circuit short circuit; 4. Record the test results; 5. Use tools and equipment correctly; 6. Keep the workplace clean; 7. Store the tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Detect unit circuit integrity and short circuit without power; 1.2 Detect unit circuit integrity and short circuit after power-on. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Specifications of the unit circuit integrity test; 2.2 Specifications of the unit circuit short circuit test. **3.0 Theories** The person performing this task must be able to explain the following:

	3.1 Knowledge of DC voltage-stabilized power and related unit circuits; 3.2 Performance indicators of DC voltage-stabilized power. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Solidarity and cooperation skills; 4.3 Report writing skills; 4.4 Mathematical literacy.
DESCRIPTION OF THE END PRODUCT / SERVICE	The detection of unit circuit integrity and short circuit is completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Electrostatic protection; 2. Safety operation of soldering iron; 3. 6s management.

OCCUPATION	ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	DC VOLTAGE-STABILIZED POWER AND DEBUGGING OF BASIC CIRCUITS	**DUTY NO.**	402
TASK TITLE	COMPLETION OF DEBUGGING OF DC VOLTAGE-STABILIZED POWER	**TASK NO.**	4023
PERFORMANCE CRITERIA	The person performing this task must be able to complete the debugging of DC voltage-stabilized power in accordance with technical requirements and industry standards.		
RANGE STATEMENT	The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers. The tools and equipment to be used include: 1. Multimeters; 2. Transformers; 3. DC voltage-stabilized power; 4. Oscilloscopes; 5. Electrostatic protection kits; 6. Commonly-used tools such as tweezers, diagonal pliers, and needle-nose pliers; 7. Personal protective equipment.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Test the step-down circuit; 2. Test the rectifier circuit; 3. Test the filter circuit; 4. Test the voltage-stabilized circuit; 5. Debug the DC voltage-stabilized power circuit; 6. Test the performance parameter of DC voltage-stabilized power; 7. Test circuit parameters with multimeters, oscilloscopes and other instruments and apparatus; 8. Observe the health and safety prevention measures during working; 9. Record the test results; 10. Keep the workplace clean; 11. Store the tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Debug the DC voltage-stabilized power circuit; 1.2 Test the performance indicator of DC voltage-stabilized power. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Composition and function of DC voltage-stabilized power; 2.2 Working principles of DC voltage-stabilized power; 2.3 Main performance indicators of DC voltage-stabilized power.

	3.0 Theories The person performing this task must be able to explain the following: 2.1 Debugging process of DC voltage-stabilized power; 2.2 Analysis of test results of DC voltage-stabilized power. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Solidarity and cooperation skills; 4.4 Report writing skills; 4.5 Mathematical literacy.
DESCRIPTION OF THE END PRODUCT / SERVICE	The debugging of DC voltage-stabilized power is completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Electrostatic protection; 2. Occupational health and safety; 3. 6s management.

OCCUPATION	ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	DC VOLTAGE-STABILIZED POWER AND DEBUGGING OF BASIC CIRCUITS	**DUTY NO.**	402
TASK TITLE	DEBUGGING OF ANALOG UNIT CIRCUITS AND DIGITAL UNIT CIRCUITS	**TASK NO.**	4024
PERFORMANCE CRITERIA	The person performing this task must be able to complete the debugging of analog unit circuits and digital unit circuits in accordance with technical requirements and industry standards.		
RANGE STATEMENT	The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers. The tools and equipment to be used include: 1. Multimeters; 2. Electric soldering irons; 3. DC voltage-stabilized power; 4. Oscilloscopes; 5. Signal generators; 6. Logic testing pens; 7. Electrostatic protection kits; 8. Magnifiers; 9. Commonly-used tools such as tweezers, diagonal pliers, and needle-nose pliers; 10. Personal protective equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Debug the diode application circuit; 2. Debug the triode application circuit; 3. Debug the integrated operational amplifier application circuit; 4. Debug the power amplifier circuit; 5. Debug the signal generation and processing circuit; 6. Debug the gate circuit; 7. Debug the combinational logic circuit; 8. Debug the sequential logic circuit; 9. Debug the pulse waveform generation circuit; 10. Use common instruments and apparatus; 11. Record the test data;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use instruments and apparatus; 1.2 Debug the analog unit circuit; 1.3 Debug the digital unit circuit. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Test flow of analog unit circuits and digital unit circuits; 2.2 Working principles and performance indicators of analog electronic circuits;

12. Observe the health and safety prevention measures during working; 13. Keep the workplace clean; 14. Store the tools.	2.3 Working principles and performance indicators of digital electronic circuits. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Related theories of analog unit circuits and digital unit circuits; 3.2 Related theories of the analog unit circuit and digital unit circuit test. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Solidarity and cooperation skills; 4.4 Report writing skills; 4.5 Mathematical literacy.
DESCRIPTION OF THE END PRODUCT / SERVICE	The debugging of analog unit circuits and digital unit circuits is completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Specifications for the use of welding tools such as soldering irons; 2. Safe use of electricity; 3. Electrostatic protection; 4. Occupational health and safety; 5. 6s management.

OCCUPATION	ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	QUALITY INSPECTION AND ACCEPTANCE OF SMALL ELECTRONIC PRODUCTS	**DUTY NO.**	403
TASK TITLE	INSPECTION OF THE ASSEMBLY QUALITY OF SMALL ELECTRONIC PRODUCTS	**TASK NO.**	4031
PERFORMANCE CRITERIA	The person performing this task must be able to complete the inspection of the assembly quality of small electronic products in accordance with technical requirements and industry standards.		
RANGE STATEMENT	The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers. The tools and equipment to be used include: 1. Multimeters; 2. Electric soldering irons; 3. DC voltage-stabilized power; 4. Oscilloscopes; 5. Signal generators; 6. Logic testing pens; 7. Electrostatic protection kits; 8. Magnifiers; 9. Commonly-used tools such as tweezers, diagonal pliers, and needle-nose pliers; 10. Personal protective equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Inspect the welding process of small electronic products; 2. Inspect the assembly quality of small electronic products; 3. Troubleshoot small electronic products with instruments and apparatus; 4. Test small electronic products with instruments and apparatus; 5. Record the test results; 6. Observe the health and safety prevention measures during working; 7. Keep the workplace clean; 8. Store the tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Read documents related to assembly quality overhaul process of small electronic products; 1.2 Inspect the assembly quality of small electronic products with instruments and apparatus correctly; 1.3 Overhaul PCB. **2.0 Principles** The person performing this task must be able to explain the following principles:

	2.1 Assembly process requirements for small electronic products; 2.2 Test requirements for small electronic products. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Relevant theoretical knowledge of analog electronic technology; 3.2 Relevant theoretical knowledge of digital electronic technology. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Solidarity and cooperation skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The inspection of the assembly quality of small electronic products is completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe use of electricity; 2. Electrostatic protection; 3. Occupational health and safety; 4. 6s management.

OCCUPATION	ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	QUALITY INSPECTION AND ACCEPTANCE OF SMALL ELECTRONIC PRODUCTS	**DUTY NO.**	403
TASK TITLE	MANUAL RECORDING OF DATE INFORMATION, PRODUCT INFORMATION AND FAULT INFORMATION ON SITE	**TASK NO.**	4032
PERFORMANCE CRITERIA	The person performing this task must be able to complete the manual recording of date information, product information and fault information on site in accordance with technical requirements and industry standards.		
RANGE STATEMENT	The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers. The tools and equipment to be used include: 1. Information record tables; 2. Computers; 3. Pens; 4. Small electronic products.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Manually record the date information of small electronic products on site; 2. Manually record the product information of small electronic products on site; 3. Manually record the fault information of small electronic products on site; 4. Observe the health and safety prevention measures during working; 5. Keep the workplace clean.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Record the production date, out-in-warehouse and other related information of small electronic products; 1.2 Record the fault information of small electronic products. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles and specifications for manual recording of date information, product information and fault information on site. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Information processing specification;

	3.3 Theories and methods of fault analysis. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Solidarity and cooperation skills; 4.4 Report writing skills; 4.5 Product data analysis skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The manual recording of date information, product information and fault information on site is completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe operation of computers; 2. Occupational health and safety; 3. 6s management.

OCCUPATION	ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	QUALITY INSPECTION AND ACCEPTANCE OF SMALL ELECTRONIC PRODUCTS	**DUTY NO.**	403
TASK TITLE	USE OF SERVICE ACCEPTANCE AND DELIVERY TOOLS	**TASK NO.**	4033
PERFORMANCE CRITERIA	The person performing this task must be able to use service acceptance and delivery tools in accordance with technical requirements and industry standards.		
RANGE STATEMENT	The task can be performed in the PCB assembly workshop under the supervision of electronic equipment assembly and repair engineers. The tools and equipment to be used include: 1. Computers; 2. Service acceptance and delivery tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Use computer office software; 2. Use service acceptance and delivery tools such as display materials, marketing auxiliary categories and automated operation management systems; 3. Observe the health and safety prevention measures during working; 4. Keep the workplace clean; 5. Store the tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use Office software; 1.2 Use service acceptance and delivery tools such as display materials, marketing auxiliary categories and automated operation management systems. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Specifications for the use of service acceptance and delivery tools. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Functions of service acceptance and delivery tools; 3.2 Types of service acceptance and delivery tools; 3.3 Use of service acceptance and delivery tools.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Customer service skills; 4.3 Solidarity and cooperation skills; 4.4 Report writing skills; 4.5 Customer data analysis skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The acceptance and delivery of services are completed in accordance with technical requirements and industry standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. 6s management.

TABLE 1: DACUM CHARTS FOR ELECTRONIC EQUIPMENT ASSEMBLY AND REPAIR TECHNICIAN - NTA 4

DUTY TITLE	TASK TITLE	ENABLERS
1.0 Manual assembly of PCB	1.1 Assembly of PCB. 1.2 Conductor processing. 1.3 Thread connection.	**General skills and knowledge** · Basic knowledge of electronics and electricity · Basic knowledge of mechanical assembly · Basic usage of tools and instruments · Knowledge of work safety · Knowledge of relevant laws and regulations · Problem-solving ability · Report writing skills **Tools and equipment** · Welding tools such as soldering irons · Thread connection tools such as non-constant force wrenches, constant force wrenches, screwdrivers and torque multipliers · Computers · Office software **Materials** · Product process documents · Solder wires **Requirements for employees** · Time management · 6s management · Honesty and responsibility · Solidarity and cooperation
2.0 DC voltage-stabilized power and	2.1 Diagram recognition and analysis of electronic circuits. 2.2 Detection of unit circuit integrity and short circuit.	**General skills and knowledge** · Basic knowledge of electronics and electricity

DUTY TITLE	TASK TITLE	ENABLERS
debugging of basic circuits	2.3 Completion of debugging of DC voltage-stabilized power. 2.4 Debugging of analog unit circuits and digital unit circuits.	· Basic knowledge of mechanical assembly · Specifications for the design of PCB · Basic usage of tools and instruments · Specifications for service quality control · Knowledge of work safety · Knowledge of relevant laws and regulations · Problem-solving ability · Communication skills · Interpersonal skills **Tools and equipment** · Computers · Welding tools such as soldering irons · Instruments and apparatus such as multimeters and oscilloscopes · Product manuals **Materials** · Product process documents · Product debugging manuals · Solder wires **Requirements for employees** · Time management · Logical thinking · Honesty and responsibility
3.0 Quality inspection and acceptance of small electronic products	3.1 Inspection of the assembly quality of small electronic products. 3.2 Manual recording of date information, product information and fault information on site.	**General skills and knowledge** · Underpinning knowledge of computer hardware · Application skills of computer operating system and office software

DUTY TITLE	TASK TITLE	ENABLERS
	3.3 Use of service acceptance and delivery tools.	· Basic knowledge of electronics and electricity · Basic knowledge of mechanical assembly · Basic repair methods of information technology equipment · Basic usage of tools and instruments · Specifications for service quality control · Knowledge of work safety · Knowledge of relevant laws and regulations · Problem-solving ability · Analysis skills **Tools and equipment** · Computers · Product manuals · Commonly-used disassemble tools; **Materials** · Spare parts; **Requirements for employees** · Solidarity and cooperation · Logical thinking · Honesty and responsibility