

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**ELECTRONICS ARTISAN**

**KNQF LEVEL 3**

**PROGRAMME ISCED CODE: 0714 254B**

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# FOREWORD

The provision of quality education and training is fundamental to the government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blueprint, Vision 2030 and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010 and this resulted in the formulation of the Policy Framework for Reforming Education and Training (Sessional Paper No. 4 of 2016). A key feature of this policy is the radical change in the design and delivery of the TVET training.

This policy document requires that training in TVET institutions be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery to allow for multiple entry and exit in TVET programmes. These reforms demand that industry takes a leading role in occupational standards development to ensure it addresses competence needs.

It is against this background that these Occupational Standards have been developed for a competency-based Electronics Artisan standard. These Occupational Standards will also be the basis for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards will play a key role towards development of competent human resource for the engineering sector’s growth and development.

# PREFACE

Kenya Vision 2030 aims to transform Kenya into a newly industrializing middle-income country, providing high-quality life to all its citizens by the year 2030. Kenya intends to create globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through lifelong education and training. TVET has a responsibility to facilitate the process of inculcating knowledge, skills, and worker behaviour necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency-Based Education and Training (CBET).

TVET Act, CAP 210A and Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya for Sustainable Development emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry, as well as increase the global competitiveness of the Kenyan labour force.

This occupational standard has been developed in adherence to the Kenya National Qualifications Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes, suggested delivery methods, learning resources, and methods of assessing the trainee’s achievement. In addition, the units of learning have been grouped in modules to concretize the skills acquisition process and streamline upskilling.

I am grateful to all expert trainers and everyone who played a role in translating the Occupational Standards .

# ACKNOWLEDGMENT

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support were received from expert trainers, institutions and organizations.

I recognize with appreciation the role of the ………….. National Sector Skills Committee (NSSC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the ………….. sector for their valuable input and everyone who participated in developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that individuals aspiring to work in the ……………… Sector acquire competencies to perform their work more efficiently and effectively.

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# ABBREVIATIONS AND ACRONYMNS

A Control Version

BC Basic Competencies

CC Common Competencies

CDACC Curriculum Development, Assessment and Certification Council

CR Core Competencies

EA Electronics

EHS Environment, Health and Safety

ENG Engineering

EPRA Energy and petroleum regulatory Authority

IBMS Integrated Building Management System

IEC International Electrical Commission

IEE Institute of Electrical engineers

KEBS Kenya Bureau of Standards

OS Occupational Standards

OSHA Occupational Safety and Health Act

PPE Personal Protective Equipment

TVET Technical and Vocational Education and Training

# KEY TO UNIT CODE



# OVERVIEW

This Electronics Level 3 occupational standard consists of competencies that an individual must possess to perform electrical installation, perform electrical and electronics equipment and appliances repairs and apply electrical instrumentation so that he/she can maintain electronics system according to the national and international standards.

Electronics Level 3 qualification comprises of the following core units:

**CORE UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| 0713 251 18A | Perform Electrical Installation I |
| 0713 251 19A | Perform Electrical and Electronics Equipment and Appliances Repairs |
| 0713 251 20A | Apply Electrical instrumentation |

# 

# CORE UNITS OF COMPETENCY

## PERFORM ELECTRICAL INSTALLATION I

**UNIT CODE**: 0713 251 16A

**UNIT DESCRIPTION**

This unit specifies the competencies required for performing electrical installation. Competencies required includes; preparation of list of tools equipment and materials, perform piping and laying of cables, mounting of electrical components and terminating of electrical installation.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  *(****Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Prepare of list of tools equipment and materials | * 1. Identified ***written communication methods*** are applied based on the workplace policy   2. Pathways of ***oral communication*** are established as per workplace policy.   3. Personal management is demonstrated through self-awareness, self-esteem, emotional intelligence, stress management and assertiveness based on scope of work.   4. Tools, equipment and materials are identified and list prepared as per established procedure   5. Tools, equipment and materials are checked for ***specifications*** as per their functionality   6. Tools, equipment and materials are assembled and stored as per established procedure |
| 1. Perform piping and laying of cables | * 1. Safety procedures are observed in adherence to OSHA   2. Tools are cleaned as per the workshop standard operating procedure   3. Tools are stored in their respective sections as per the workshop procedures   4. Piping is performed as per working drawing   5. Piping is performed in line with standard operating procedure   6. Number and size of cables are laid in a conduit as per the ***IEE regulations***   7. Cables, conduits, enclosures and support systems are installed as per the working drawing   8. Cables are drawn-in in line with standard operating procedures   9. Surface wiring is performed as in line with established **standard**. |
| 1. Perform mounting of electrical components | * 1. Components to be mounted are identified as per ***installation*** requirements   2. Components are mounted in adherence toIEE regulations   3. Components are mounted in line with standard operating procedure |
| 1. Terminate Electrical Installation | * 1. Personal finances are managed as per financial procedures and standards   2. Cable lugging and jointing is performed as per the standards operating procedure.   3. Cables are terminated as per the IEE regulations   4. Labelling of the cables is performed as per the complexity of the installation. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance

| **Variable** | **Range** |
| --- | --- |
| 1. written communication methods may include and not limited to: | * Memos * Letters * Notices * SMS |
| 1. Oral communication pathways may include and not limited to: | * Telephone calls * Face-to-face * Meetings * Interviews |
| 1. Installation may include but is not limited to: | * Domestic installation * Basic wiring diagrams * Piping * Laying of cables * Mounting of sockets, junction boxes, consumer units, switches * Wiring systems |
| 1. Established regulations may include but is not limited to: | * NEMA regulations * OSHA regulation * IEE regulations * EPRA regulations |
| 1. Standard may include but is not limited to: | * British Standard * KEBS standard |
| 1. IEE regulations may include but is not limited to: | * 17th Edition |
| 1. Specifications may include but is not limited to: | * Make / model * Size * Class |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

* The individual needs to demonstrate knowledge and understanding of:
* The manufacturer's warranty requirements relating to electrical installation systems and related components.
* The legal requirements relating to electrical installations
* Kenyan legislation and workplace procedures relevant to:
* Health and safety;
* Environment (including waste disposal);
* Appropriate personal protective equipment (PPE).
* Workplace procedures for:
* Work place communication;
* Time management
* Materials management
* The use of technical information including
* The importance of using the correct sources of technical information.
* Interpreting circuits, drawings, specifications and instructions

**FOUNDATION SKILLS**

**The individual needs to demonstrate the following foundation skills:**

* Communications (verbal and written);
* Time management;
* Problem solving
* Decision making;
* First aid;
* Planning;
* Negotiation

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Effected written communication based on workplace requirements.   2. Determined and prepared a list of tools, equipment and materials as per established procedure   3. Checked tools, equipment and materials for specifications and functionality as per the standard operating procedure   4. Laid number and size of cables in a conduit as per the IEE regulations   5. Drawn-in cables line with standard operating procedures   6. Mounted components in accordance to the working drawings   7. Terminated cables as per the IEE regulations   8. Performed labelling of the cables as per the complexity of the job.   9. Checked firmness of the installation as per established procedures   10. Performed short circuit test in adherence to IEE regulation |
| 1. Resource Implications | The following resources must be provided:  Resources same as that of workplace are advised to be applied  including Measuring tape, calculator, stationery and cables, bending spring, draw wire, electrical accessories etc |
| 1. Methods of Assessment | Competency may be assessed through:   1. Observation 2. Oral questioning 3. Practical demonstration 4. Written tests |
| 1. Context of Assessment | Competency may be assessed   * 1. On the job   2. Off the job   3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM ELECTRICAL AND ELECTRONIC EQUIPMENT AND APPLIANCES REPAIRS

**UNIT CODE**: 0713 251 17A

**UNIT DESCRIPTION**

This unit covers competencies required to perform electrical and electronic equipment and appliances repair. Competencies include: preparing a list of maintenance tools, equipment and materials, inspecting and testing faulty components, performing maintenance activities and conducting tests on repaired equipment and assemble repaired equipment and appliance

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  *(****Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Prepare a list of maintenance tools, equipment and materials | * 1. Types of ***materials*** are established in line with semiconductor theory   2. Types of diodes are identified as per their functionality.   3. ***Diodes*** characteristics are determined as per their properties   4. Maintenance tools, equipment and materials are identified in regard to maintenance activities to be performed   5. A list of tools, equipment and materials are prepared in line with established procedure   6. Tools and equipment and materials are checked for specifications and functionality as per operating procedures   7. Tools and equipment are calibrated in line with standard operating procedure. |
| 1. Inspect and test faulty components | * 1. Disassembling of ***electrical equipment and appliance*** is performed in line with manufacture’s manuals   2. Sorting of screws is performed in regard to standard operating procedures   3. Appliances are inspected in regard to established procedure   4. Tests to be performed are identified in regard to appliance functionality   5. Appliances are tested as per established procedures   6. Perform troubleshooting in line with established procedure   7. Testing is performed in adherence to safety standards |
| 1. Perform maintenance activities | * 1. System components to be repaired/replaced are identified based on the appliance functionality   2. Cleaning, soldering and tightening of components are performed as per standard operating procedure   3. Defective components/parts are repaired/replaced based on established procedures   4. Maintenance activities are carried out in adherence to OSHA standards   5. Waste materials are disposed in adherence to EHS regulations |
| 1. Perform tests on repaired equipment and appliances | * 1. Specific written communication strategies are identified based on workplace requirements.   2. Type of tests to be carried out are identified in line with maintenance activities   3. Components to be tested are identified based on the system functionality   4. Repaired/replaced components are tested in accordance to manufacturer’s manuals |
| 1. Assemble repaired equipment and appliance | * 1. Tightening of screws is performed in accordance with standard operating procedures   2. Connectors are patched as per manufacture’s manuals   3. Cable ties, silicon glue, super glue and insulating tapes are applied in binding cables as per standard operating procedures   4. Mounting of cooling components is performed in line with manufacture’s manuals |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **VARIABLE** | **RANGE** |
| * + - 1. Materials may include but is not limited to: | * Insulators * Conductors * Semiconductors |
| * + - 1. Diodes may include but is not limited to: | * Photo diode * Zener diodes * Light emitting diode * Schottky diodes |
| * + - 1. Electrical and electronic equipment and appliances may include but is not limited to: | * Radio * Television * Mobile phones * Set top boxes * Iron box * Electric kettles * Instant shower * Refrigerator * Air conditioning systems * Microwave * Washing machine * Blenders |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of

* Troubleshooting techniques
* Repair/replacing of system components techniques
* Causes of system failures
* Knowledge in basic electricity
* Electrical safety and precautious measures
* Electrical shock prevention measures
* Performance monitoring techniques

**FOUNDATION SKILLS**

***The individual needs to demonstrate the following additional skills:***

* Communications (verbal and written);
* Computer literacy
* Electrical principles
* Physics
* Analytical skills
* Planning;
* Decision making;
* Report writing;
* Time management
* Faults troubleshooting
* Problem solving;

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified different semiconductor material   2. Identified special semiconductor devices   3. Identified maintenance tools, equipment and materials in regard to maintenance activities to be performed   4. Checked tools and equipment and materials for specifications and functionality as per operating procedures   5. Performed disassembling of equipment and appliance in line with manufacture’s manuals   6. Inspected appliances are in regard to established procedure   7. Tested appliances in line with established procedures   8. Performed testing in adherence to safety standards   9. Repaired/replaced defective components/parts based on established procedures   10. Identified type of tests to be carried out in line with maintenance activities   11. Tested repaired/replaced components in accordance to manufacturer’s manuals   12. Patched connectors as per manufacture’s manuals   13. Mounting of cooling components is performed in line with manufacture’s manuals   14. Disposed waste materials are adherence to EHS regulations   15. Carried out maintenance activities in adherence to OSHA standards |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied  Included: radio, television, mobile phones, set top boxes, switches, iron boxes, refrigerator etc. |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation   4. Written tests |
| 1. Context of Assessment | Competency may be assessed   * 1. On the job   2. Off the job   3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ELECTRICAL INSTRUMENTATION

**UNIT CODE**: 0713 251 18A

**UNIT DESCRIPTION**

This unit covers the competencies required to apply electrical instrumentation. Competencies include; demonstrating understanding of measurements, applying electrical instruments, measuring electrical quantities and performing maintenance of electrical instruments.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  *(****Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Demonstrate understanding of electrical measurements | * 1. Electrical symbols are identified as per standard operating procedures   2. Electrical units are identified in accordance with engineering practices   3. Conversions of units is performed in line with standard operating procedure |
| 1. Apply electrical instruments | * 1. A range of mathematical and problem-solving processes are selected and used   2. Calculation performed with positive and negative numbers   3. Meters are classified based on their functionality   4. Analogue meters are applied in line with standard operating procedures   5. Digital multimeters are applied in accordance with standard operating procedure   6. Clamp ammeters are applied as per standard operating procedure   7. Megohmmeters are applied as based on their functionality |
| 1. Measure electrical quantities | * 1. Perform measurement of resistance as per standard operating procedures   2. Determine the resistance value for various resistors based on their colour coding.   3. High resistance measurement is performed as per standard operating procedures   4. Perform measurement of voltage based on standard operating procedure   5. Perform measurement of current as per standard operating procedure   6. Measurement of insulation resistance is performed in line with standard operating procedures   7. Safety standards are observed when performing electrical measurements in accordance to OSHA regulations |
| 1. Perform maintenance of electrical instruments | * 1. Instruments to be repaired are identified in line with established procedure   2. Cleaning, soldering and tightening of components are performed as per standard operating procedure   3. Defective parts are repaired/replaced based on standard operating procedure   4. Repaired system components are configured in accordance to the instrument functionality   5. Maintenance activities are carried out in adherence to OSHA standards   6. Waste materials are disposed in adherence to EHS regulations   7. Repaired components are tested in regard to manufacturer’s manuals |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of:

* Analogue instruments
* Digital instruments
* Measurement
* Maintenance activities

**FOUNDATION SKILLS**

The individual needs to demonstrate the following additional skills:

* OSHA, WSHA, EHS standards and industry safety procedures and regulations
* Operate test equipment and interpret results
* Troubleshooting
* Read and understand
* Symbols and schematics

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified electrical units in accordance with engineering practices   2. Performed conversions of units based on standard operating procedure   3. Performed calculation using positive and negative numbers   4. Performed conversions between units of measurement   5. Used problem solving processes to undertake the task   6. Applied analogue ammeters in line with standard operating procedures   7. Applied clamp ammeters as per standard operating procedure   8. Classified meters are based on their functionality   9. Performed measurement of resistance as per standard operating procedures   10. Performed high resistance measurement in line with operating procedures   11. Performed measurement of current as per standard operating procedure   12. Performed cleaning, soldering and tightening of components based on standard operating procedure   13. Configured instruments in accordance to the instrument functionality   14. Tested repaired components are in accordance to manufacturer’s manuals |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied  Included: Digital and analogue instruments etc. |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation   4. Written tests |
| 1. Context of Assessment | Competency may be assessed   * 1. On the job   2. Off the job   3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |