

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**INSTRUMENTATION AND CONTROL LEVEL 4**

**(SIMPLE AUTOMATION CONTROL INSPECTOR)**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

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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 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 and this resulted in the formulation of the Policy Framework for Reforming Education and Training. 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 be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these Occupational Standards was developed for the purpose of developing a competency-based curriculum for Instrumentation and Control (Simple Automation and Control Inspection) Level 4. 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 great role towards development of competent human resource for the Engineering Sector’s growth and sustainable development.

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING MINISTRY OF EDUCATION**

# PREFACE

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

The Technical and Vocational Education and Training Act No. 29 of 2013 and Sessional Paper No. 14 of 2012 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan Labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Instrumentation and Control Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for Instrumentation and Control (Simple Automation Control Inspector) Level 4 .These standards will be the basis for development of competency-based curriculum for Instrumentation and Control (Simple Automation Control Inspection ) Level 4 .

The occupational standards are designed and organized with clear performance criteria for each element of a unit of competency. These standards also outline the required knowledge and skills as well as evidence guide.

I am grateful to the Council Members, Council Secretariat, Instrumentation and Control SSAC, expert workers and all those who participated in the development of these Occupational Standards.

**CHAIRPERSON, TVET CDACC**

# ACKNOWLEDGMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am sincerely thankful to the management of these organizations for allowing their staff to participate in this course. I wish to acknowledge the invaluable contribution of industry players who provided inputs towards the development of these Standards.

I thank TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) for providing guidance on the development of these Standards. My gratitude goes to the Instrumentation and Control Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the validation of these Standards.

I acknowledge all other institutions which in one way or another contributed to the development of these Standards.

**CHAIRPERSON**

 **INSTRUMENTATION AND CONTROL SECTOR SKILLS ADVISORY COMMITTEE**

TABLE OF CONTENTS

[FOREWORD iii](#_Toc65390338)

[PREFACE iv](#_Toc65390339)

[ACKNOWLEDGMENT v](#_Toc65390340)

[KEY TO UNIT CODE viii](#_Toc65390341)

[OVERVIEW ix](#_Toc65390342)

[BASIC UNITS OF COMPETENCY 1](#_Toc65390343)

[DEMONSTRATE COMMUNICATION SKILLS 2](#_Toc65390344)

[DEMONSTRATE DIGITAL LITERACY 6](#_Toc65390345)

[DEMONSTRATE ENTREPRENEURIAL SKILLS 10](#_Toc65390346)

[DEMONSTRATE ENVIRONMENTAL LITERACY 20](#_Toc65390347)

[COMMON UNITS OF COMPETENCY 28](#_Toc65390348)

[APPLY NUMERACY SKILLS 29](#_Toc65390349)

[PERFORM WORKSHOP PROCESSES 33](#_Toc65390350)

[APPLY ELECTRICALAND ELECTRONICS PRINCIPLES 37](#_Toc65390351)

[PREPARE AND INTERPRET TECHNICAL DRAWINGS 41](#_Toc65390352)

[CORE UNITS OF COMPETENCY 45](#_Toc65390353)

[INSTALL AND SERVICE STAND-ALONE CONTROLLERS (SACs) 46](#_Toc65390354)

[PERFORM ELECTRICAL INSTALLATION 51](#_Toc65390355)

[MEASURE PROCESS CONTROL PARAMETERS 55](#_Toc65390356)

[INSTALL AND MAINTAIN TRANSMISSION SYSTEM COMPONENTS 59](#_Toc65390357)

**ACRONYMNS AND ABBREVIATIONS**

A Control Version

AC Alternate Current

AIDS Acquired Immunodeficiency Syndrome

BC Basic Competencies

CAD Computer-Aided Design

CBET Competency Based Education and Training

CC Common Competencies

DC Direct Current

CDACC Curriculum Development, Assessment and Certification Council

CEO Council Secretary

CPU Central Processing Unit

CR Core Competencies

EHS Environment, Health and Safety

ENG Engineering

HIV Human Immunodeficiency Virus

IAC Instrumentation and Control

ICT Information Communication Technology

IEE Institute of Electrical engineers

LED Light Emitting Diode

NPN Negative Positive Negative

OS Occupational Standards

OSH Occupational Safety and Health

OSHA Occupational Safety and Health Act

PESTEL Political Environmental Social Technological Economical Legal

PNP Positive Negative Positive

PPE Personal Protective Equipment

SAC Simple Automation Control

SOP Standard Operating Procedure

SSAC Sector Skill Advisory Committee

SWOT Strength Weakness Opportunity and Threat

TVET Technical and Vocational Education and Training

# KEY TO UNIT CODE

ENG/OS/IAC/BC/01/4/A

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

 Control Version

# OVERVIEW

Instrumentation and control (simple automation control inspection) level 4 qualification consists of competencies that a person must achieve to enable him/her install and service stand-alone controllers, perform electrical installation, measure process control parameters and install and maintain transmission system components

**Units of Competency**

This course consists of basic, common and core units of competency as indicated below:

**BASIC COMPETENCIES**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/IAC/BC/01/4/A | Demonstrate Communication Skills |
| ENG/OS/IAC/BC/02/4/A | Demonstrate Digital Literacy |
| ENG/OS/IAC/BC/03/4/A | Demonstrate Entrepreneurial Skills |
| ENG/OS/IAC/BC/04/4/A | Demonstrate Employability Skills |
| ENG/OS/IAC/BC/05/4/A | Demonstrate Environmental Literacy |
| ENG/OS/IAC/CC/06/4/A | Demonstrate Occupational Safety and Health Practices |

**COMMON COMPETENCIES**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/IAC/CC/01/4/A | Apply Numerical Skills |
| ENG/OS/IAC/CC/02/4/A | Perform Workshop Processes |
| ENG/OS/IAC/CC/03/4/A | Apply Electrical and Electronics Principles |
| ENG/OS/IAC/CC/04/4/A | Prepare and Interpret Technical Drawings |

**CORE COMPETENCIES**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/IAC/CR/01/4/A | Install and Service Stand-Alone Controllers |
| ENG/OS/IAC/CR/02/4/A | Perform Electrical Installation  |
| ENG/OS/IAC/CR/03/4/A | Measure Process Control Parameters |
| ENG/OS/IAC/CR/04/4/A | Install and Maintain Transmission System Components |

# BASIC UNITS OF COMPETENCY

#

# DEMONSTRATE COMMUNICATION SKILLS

**UNIT CODE: ENG/OS/IAC/BC/01/4/A**

**UNIT DESCRIPTION**

This unit covers the competencies required demonstrate communication skills. It involvesobtaining and conveying workplace information, completing relevant work-related documents, communicating information about workplace processes, leading workplace discussion and communicating workplace issues.

**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 italicized terms*** ***are elaborated in the Range*** |
| 1. Obtain and convey workplace information
 | 1. Specific and relevant information is accessed from ***appropriate sources*** based on standard procedures
2. Effective questioning, active listening and speaking skills are used to gather and convey information based on communication needs
3. Appropriate ***medium*** is used to transfer information and ideas in accordance with workplace guidelines
4. Appropriate non- verbal communication is used as per the communication needs
5. Appropriate lines of communicationwith supervisors and colleagues are identified and followed based on workplace requirements
6. Location and storage of information is undertaken according to workplace procedures
	1. Personal interaction is carried out clearly and concisely according to workplace requirements
 |
| 1. Complete relevant work-related documents
 | * 1. Range of forms relating to conditions of employment are completed according to workplace procedures
	2. Workplace data is recorded based on workplace requirements
	3. Errors in recording information are identified and acted upon in accordance with workplace policies
	4. Reporting requirements are completed according to organizational guidelines
 |
| 1. Communicate information about workplace processes
 | 1. Information sources are identified according to workplace procedures
2. ***Methods of communication*** are selected based on workplace guidelines
3. Multiple operations are communicated according to workplace structure
4. Work-related questions are asked and responded based on set protocols
5. Information is selected and organized according to workplace requirements
6. Verbal and written reporting is undertaken as per workplace requirements
7. Communication is maintained according to workplace standards
 |
| 1. Lead workplace discussions
 | 1. Response to workplace issues are sought and provided as per workplace protocol
2. Constructive contributions are made based on ***workplace discussions***
3. Workplace objectives and action plan are communicated according to workplace requirements
 |
| 1. Identify and communicate issues arising in the workplace
 | 1. Issues and problems are identified as per workplace guidelines
2. Problems and issues in the workplace are organized according to workplace operations
3. Dialogue is initiated with appropriate personnel as per workplace structure
4. Problems and issues raised are communicated as per the workplace reporting procedures
 |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Methods of communication mayinclude but not limited to:
 | * Non-verbal gestures
* Verbal
* Face to face
* Two-way radio
* Speaking to groups
* Using telephone
* Written
* Internet
 |
| 1. Workplace discussion may include but not limited to:
 | * Coordination meetings
* Toolbox discussion
* Peer-to-peer discussion
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Active listening
* Interpretation
* Negotiation
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Organization requirements for written and electronic communication methods
* Effective verbal communication methods
* Report writing
* Effective questioning techniques (clarifying and probing)
* Workplace etiquette

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency
 | Assessment requires evidence that the candidate: 1. Dealt with a range of communication/information at one time
2. Made constructive contributions in workplace issues
3. Sought workplace issues effectively
4. Responded to workplace issues promptly
5. Presented information clearly and effectively in written form
6. Used appropriate sources of information
7. Asked appropriate questions
8. Provided accurate information
 |
| 1. Resource Implications
 | 1. Access to relevant workplace where assessment can take place
2. Appropriately simulated environment where assessment can take place
3. Materials relevant to the proposed activity or tasks
 |
| 1. Methods of Assessment
 | 1. Third-party reports
2. Portfolio
3. Interview
4. Written tests
5. Observation
6. Oral questioning
 |
| 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. |

# DEMONSTRATE DIGITAL LITERACY

**UNIT CODE: ENG/OS/IAC/BC/02/4/A**

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate digital literacy in a working environment. It entails identifying computer software and hardware, applying security measures to data, hardware, software, applying computer software in solving task sand applying internet and email in communication at workplace.

**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 italicized terms*** ***are elaborated in the Range*** |
| 1. Identify computer software and hardware
 | * 1. ***Appropriate computer software*** is identified according to manufacturer’s specification
	2. ***Appropriate computer hardware*** is identified according to manufacturer’s specification
 |
| 1. Apply security measures to data, hardware, software
 | * 1. ***Data security and privacy are classified*** in accordance with the technological situation
	2. ***Security and control measures*** are applied in accordance with laws governing protection of ICT
	3. Computer threats and crimes are detected as per information security management guidelines.
	4. Protection against computer crimes is undertaken in accordance with laws governing protection of ICT
 |
| 1. Apply computer software in solving tasks
 | * 1. Basic word processing concepts are applied in resolving workplace tasks
	2. Word processing utilities are applied in accordance with workplace procedures
	3. Data is manipulated on worksheet in accordance with office procedures
 |
| 1. Apply internet and email in communication at workplace
 | * 1. Electronic mail is applied in workplace communication in accordance with office procedures
	2. Office internet functions are defined and executed in accordance with office procedures
	3. Network configuration and uses are determined in accordance with office operations procedures
 |

**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.

|  |  |
| --- | --- |
| **Range** | **Variable** |
| 1. Appropriate computer software may include but not limited to:
 | * Operating system
* MS office
* Web browser
* Media players
 |
| 1. Appropriate computer hardware may include but not limited to:
 | * Computer Case
* Monitor
* Keyboard
* Mouse
* Hard Disk Drive
* Motherboard
* Video Card
 |
| 1. Data security and privacy may include but not limited to:
 | * Confidentiality
* Cloud computing
* Confidentiality
* Cyber terrorism
* Integrity -but-curious data serving
 |
| 1. Security and control measures may include but not limited to:
 | * Countermeasures and risk reduction
* Cyber threat issues
* Risk management
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical
* Interpretation
* Typing
* Communication
* Computing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Input and output devices
* Central processing Unit (CPU)
* Peripherals
* Storage Media
* Software concept
* Types of concept
* Function of computer software
* Data security and privacy
* Security threats and control measures
* Computer crimes
* Detection and protection of computer crimes
* Laws governing protection of ICT
* Word processing;
* Functions and concepts of word processing.
* Documents and tables creation and manipulations
* Mail merging
* Word processing utilities
* Spread sheet;
* Meaning, formulae, function and charts, uses, layout, data manipulation and application to cell
* Networking and Internet;
* Meaning, functions and uses of networking and internet.
* Electronic mail and world wide web
* Emerging trends and issues in ICT;
* Identify and apply emerging trends and issues in ICT
* Challenges posed by emerging trends and issues

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency
 | Assessment requires evidence that the candidate:* 1. Identified input, output, CPU and storage media devices of computers in accordance to computer specification
	2. Identified concepts, types and functions of computer software according to operation manual
	3. Identified and controlled security threats
	4. Detected and protected computer crimes
	5. Applied word processing in office tasks
	6. Prepared work sheet and applied data to the cells in accordance to workplace procedures
	7. Used Electronic Mail for office communication as per workplace procedure
	8. Applied internet and World Wide Web for office tasks in accordance with office procedures
	9. Applied laws governing protection of ICT
 |
| 1. Resource Implications
 | * 1. Access to relevant workplace where assessment can take place
	2. Appropriately simulated environment where assessment can take place
	3. Materials relevant to the proposed activity or tasks
 |
| 1. Methods of Assessment
 | Competency may be assessed through:* 1. Written tests
	2. Practical assignment
	3. Interview
	4. Oral Questioning
	5. Observation
 |
| 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. |

#

# DEMONSTRATE ENTREPRENEURIAL SKILLS

**UNIT CODE: ENG/OS/IAC/BC/03/4/A**

**UNIT DESCRIPTION**

This unit covers the competencies required demonstrate entrepreneurial skills. It involvescreating and maintaining small scale business, establishing small scale business customer base, managing small scale business and growing/ expanding small scale business.

**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 italicized terms are elaborated in the Range*** |
| 1. Create and maintain small scale business
 | 1. Generation and evaluation of business ideas is undertaken in accordance with the existing procedure
2. Competencies are matched with business opportunities in accordance with business practices.
3. Procedure for starting a small business is identified as per the legal requirements
4. SWOT/ PESTEL analysis and or industrial survey is carried out according to office procedures
5. ***Business operations*** are monitored and controlled following established procedures.
6. Quality assurance measures are implemented in accordance with the business practices.
7. Good relations are maintained with staff/workers as per the workplace policies.
8. Policies and procedures on occupational safety and health and environmental concerns are constantly observed as per the workplace policies
 |
| 1. Establish small scale business customer base
 | 1. Good customer relations are maintained in accordance with office procedures
2. New customers and markets are identified, explored and reached out to according to the marketing plan
3. Promotions/Incentives are offered to loyal customers in accordance with office procedures
4. Additional products and services are evaluated and tried in accordance with marketing strategy
5. Customer record is maintained in accordance with office procedures
 |
| 1. Manage small scale business
 | 1. Enterprise is built up and sustained in line with judicious control of cash flows.
2. Profitability of enterprise is ensured as per the internal controls.
3. Unnecessary or lower-priority expenses and purchases are avoided as per the marketing strategy
4. Basic cost-benefit analysis are undertaken in accordance with office procedures
5. Basic financial management are undertaken in accordance with office procedures
6. Basic financial accounting in undertaken in accordance with office procedures
7. Business ***internal controls*** are implemented in accordance with office procedure
8. Setting business priorities and strategies is carried out according to office procedures
9. Preparation and interpretation of basic financial statements is undertaken in accordance with set procedures
10. Preparation of business plansfor small business is undertaken in accordance with ***business strategy***
11. Business Social Responsibility is maintained in accordance with Standard Operations Procedures (SOP)
 |
| 1. Grow/ expand small scale business
 | 1. Prepared business growth strategy for small sale business in accordance with office procedures
2. Incorporated technology in small scale business growth in accordance with technological trends
3. Emerging issues and trends are considered in accordance with business growth strategy
4. Built audience interest in product/service according to growth strategy
5. Boosted cooperate communication according to business ***communication strategy***
 |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range**  |
| 1. Business operations may include but not limited to:
 | * Purchasing
* Accounting/administrative
* Work production/operations/sales
* Marketing
 |
| 1. Internal control may include but not limited to:
 | * Accounting systems
* Financial statements/reports
* Cash management
* Human resource management
 |
| 1. Business Strategy may include but not limited to:
 | * Management of wastages
* Environmental Conservation
 |
| 1. Communication strategy may include but not limited to:
 | * Blue print of exchange of information
* Technology and exchange of information
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Marketing
* Advertising
* Basic bookkeeping
* Accounting
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Generation and evaluation of business ideas
* Legal requirements for starting a small business
* SWOT/ PESTEL analysis
* Occupational Safety and Health
* Public relations concepts
* Business plan
* Business financing
* Marketing strategies
* Business management and control
* Production/ operation process
* Product promotion strategies
* Market and feasibility studies
* Business ethics
* Building customer relations
* Business models and strategies
* Types and categories of businesses
* Business internal controls
* Relevant national and local legislation and regulations
* Basic quality control and assurance concepts
* Building relations with customer and employees
* Building competitive advantage of the enterprise
* Business growth strategies

**EVIDENCE GUIDE**

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

|  |  |  |
| --- | --- | --- |
| 1. Critical aspects of Competency
 | Assessment requires evidence that the candidate:

|  |
| --- |
| 1. Demonstrated entrepreneurial skills
2. Demonstrate competencies to create a small-scale business
3. Demonstrated ability to conceptualize and plan a micro/small business
4. Grew customer base for the small-scale business
5. Demonstrated ability to manage/operate a micro/small-scale business
6. Demonstrated competencies to grow a micro/small-scale business
 |

 |
| 1. Resource Implications
 |

|  |
| --- |
| The following resources should be provided:  |

1. Assessment location
2. Case studies on micro/small-scale enterprises
3. Assessment materials
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through:

|  |  |
| --- | --- |
| 1. Written tests
2. Observation
3. Oral questioning
4. Portfolio
5. Projects
 |  |

 |
| 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. |

**DEMONSTRATE EMPLOYABILITY SKILLS**

**UNIT CODE:** ENG/OS/IAC/BC/04/4/A

**UNIT DESCRIPTON**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating critical safe work habits, demonstrating workplace learning and workplace ethics.

**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 italicized terms are elaborated in the Range*** |
| 1. Conduct self-management
 | 1. Personal vision, mission and goals are formulated based on potential and in relation to organization objectives
2. Emotional intelligence is demonstrated as per workplace requirements.
3. Individual performance is evaluated and monitored according to the agreed targets.
4. Assertiveness is developed and maintained based on the requirements of the job.
5. Accountability and responsibility for own actions are demonstrated based on workplace instructions.
6. Self-esteem and a positive self-image are developed and maintained based on values.
7. Time management, attendance and punctuality are observed as per the organization policy.
8. Goals are managed as per the organization’s objective
9. Self-strengths and weaknesses are identified based on personal objectives
 |
| 1. Demonstrate critical safe work habits
 | 1. Stress is managed in accordance with workplace policy.
2. Punctuality and time consciousness is demonstrated in line with workplace policy.
3. Personal objectives are integrated with organization goals based on organization’s strategic plan.
4. ***Resources*** are utilized in accordance with workplace policy.
5. Work priorities are set in accordance to workplace goals and objectives.
6. Leisure time is recognized and utilized in line with personal objectives.
7. ***Drugs and substances of abuse*** are identified and avoided based on workplace policy.
8. HIV and AIDS prevention awareness is demonstrated in line with workplace policy.
9. Safety consciousness is demonstrated in the workplace based on organization safety policy.
10. ***Emerging issues*** are identified and dealt with in accordance with organization policy.
 |
| 1. Demonstrate workplace learning
 | * 1. Learning opportunities are sought and managed based on job requirement and organization policy.
	2. Improvement in performance is demonstrated based on courses attended.
	3. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job
	4. Time and effort is invested in learning new skills based on job requirements
	5. Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy.
	6. New systems are developed and maintained in accordance with the requirements of the job.
	7. Awareness of personal role in workplace ***innovation*** is demonstrated based on requirements of the job.
 |
| 1. Demonstrate workplace ethics
 | 1. Policies and guidelines are observed as per the workplace requirements
2. Self-worth and professionalism is exercised in line with personal goals and organizational policies
3. Code of conduct is observed as per the workplace requirements
4. Integrity is demonstrated as per legal requirement
 |

**RANGE**

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

|  |  |
| --- | --- |
| **Range** | **Variable** |
| 1. Personal objectives may include but not limited to:
 | * Long term
* Short term
* Broad
* Specific
 |
| 1. Feedback may include but not limited to:
 | * Verbal
* Written
* Informal
* Formal
 |
| 1. Team may include but not limited to:
 | * Small work group
* Staff in a section/department
* Inter-agency group
 |
| 1. Drug and substance abuse may include but not limited to:
 | * Alcohol
* Tobacco
* Miraa
* Over-the-counter drugs
* Cocaine
* Bhang
* Glue
 |
| 1. Emerging issues may include but not limited to:
 | * Terrorism
* Social media
* National cohesion
* Open offices
 |
| 1. Range of media for learning may include but not limited to:
 | * Mentoring
* peer support and networking
* IT and courses
 |
| 1. Innovation may include but not limited to:
 | * New ideas
* Original ideas
* Different ideas
* Methods/procedures
* Processes
* New tools
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Interpersonal
* Critical thinking
* Observation
* Organizing
* Record keeping
* Problem solving
* Decision Making
* Resource utilization

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Work values and ethics
* Company policies
* Company operations, procedures and standards
* Occupational Health and safety procedures
* Fundamental rights at work
* Personal hygiene practices
* Workplace communication
* Concept of time
* Time management
* Decision making
* Types of resources
* Work planning
* Record keeping
* Workplace problems and how to deal with them
* Assertiveness
* Team work
* HIV and AIDS
* Drug and substance abuse
* Safe work habits
* Professional growth and development
* Technology in the workplace
* Emerging issues
	+ Social media
	+ Terrorism
	+ National cohesion

###### **EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency
 | Assessment requires evidence that the candidate:* 1. Conducted self-management
	2. Demonstrated critical safe work habits
	3. Demonstrated workplace learning
	4. Demonstrated workplace ethics
 |
| 1. Resource Implications
 | The following resources should be provided:1. Access to relevant workplace where assessment can take place
2. Appropriately simulated environment where assessment can take place
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through: 1. Oral questioning
2. Portfolio of evidence
3. Third Party Reports
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. |

# DEMONSTRATE ENVIRONMENTAL LITERACY

**UNIT CODE:** **ENG/OS/IAC/BC/05/4/A**

**UNIT DESCRIPTION**

This unit specifies the competencies required to demonstrate environmental literacy. It involves controlling environmental hazard, controlling environmental pollution, demonstrating sustainable resource use and evaluating current practices in relation to resource usage.

**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 italicized terms*** ***are elaborated in the Range*** |
| 1. Control environmental hazard
 | * 1. Storage methods for environmentally hazardous materials are followed according to environmental regulations and OSHS.
	2. Disposal methods of hazardous wastes are followed according to environmental regulations and OSHS.
	3. ***PPE*** is used according to OSHS.
 |
| 1. Control environmental pollution
 | * 1. ***Environmental pollution*** ***control measures*** are compiled following standard protocol.
	2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999
	3. Methods for minimizing noise pollution complied following environmental regulations.
 |
| 1. Demonstrate sustainable use of resource s
 | * 1. Methods for minimizing wastage are complied with.
	2. ***Waste management procedures*** are employed following principles of 3Rs (Reduce, Reuse, Recycle)
	3. Methods for economizing or reducing resource consumption are practiced.
 |
| 1. Evaluate current practices in relation to resource usage
 | * 1. Information on resource efficiency ***systems and procedures*** are collected and provided as per work groups/sector
	2. ***Current resource usage*** is measured and recorded as per work group/sector
	3. Current purchasing strategies are analyzed and recorded according to industry procedures.
	4. Current work processes to access information and data is analyzed following enterprise protocol.
 |
| 1. 5. Identify environmental legislations/conventions for environmental concerns
 | 1. Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact
2. Industrial standard/environmental practices are described according to the different environmental concerns
 |

**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. PPE may include but are not limited to:
 | * Masks
* Gloves
* Goggles
* Safety hat
* Overall
* Hearing protector
* Safety boots
 |
| 1. Environmental pollution control measures may include but are not limited to:
 | * Methods for minimizing or stopping spread and ingestion of airborne particles
* Methods for minimizing or stopping spread and inhaling gases and fumes
* Methods for minimizing or stopping spread and ingestion of liquid wastes
 |
| 1. Waste management procedures may include but are not limited to:
 | * Sorting
* Storing of items
* Recycling of items
* Disposal of items
* Handling
* Transport
 |
| 1. Current resources usage may include but are not limited to:
 | * Electric
* Water
* Fuel
* Telecommunications
* Supplies
* Materials
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Measuring
* Recording
* Analytical
* Monitoring
* Writing
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Storage methods of environmentally hazardous materials
* Disposal methods of hazardous wastes
* Usage of PPE Environmental regulations
* OSHS
* Types of pollution
* Environmental pollution control measures
* Different solid wastes
* Solid waste management
* Different noise pollution
* Methods of minimizing noise pollution
* Solid Waste Act
* Methods of minimizing wastage
* Waste management procedures
* Economizing of resource consumption
* Principle of 3Rs
* Types of resources
* Techniques in measuring current usage of resources
* Calculating current usage of resources
* Types of workplace environmental hazards
* Environmental regulations
* Environmental regulations applying to the enterprise.
* Procedures for assessing compliance with environmental regulations.
* Collection of information on environmental and resource efficiency systems and procedures,
* Measurement and recording of current resource usage
* Analysis and recording of current purchasing strategies.
* Analysis current work processes to access information and data Analysis of data and information

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency
 | Assessment requires evidence that the candidate:1. Controlled environmental hazards
2. Controlled environmental pollution
3. Demonstrated sustainable resource use
4. Evaluated current practices in relation to resource usage
 |
| 1. Resource Implications
 | The following resources should be provided:* 1. Workplace with storage facilities
	2. Tools, materials and equipment relevant to the tasks (e.g. cleaning tools, cleaning materials, trash bags, etc.)
	3. PPEs
	4. Manuals and references
	5. Legislation, policies, procedures, protocols and local ordinances relating to environmental protection
	6. Case studies/scenarios relating to environmental Protection
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through:1. Observation
2. Oral questioning
3. Written tests
4. Third party reports
5. Portfolio
 |
| 1. Context of Assessment
 | Competency may be assessed1. 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. |

**DEMONSTRATE OCUPATIONAL SAFETY AND HEALTH PRACTICES**

**UNIT CODE:** ENG/OS/IAC/BC/06/4/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to practice safety and health and comply with OSH requirements relevant to work. It involves observing workplace procedures for hazards and risk prevention and participating in arrangements for workplace safety and health maintenance.

**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 italicized terms*** ***are elaborated in the Range*** |
| 1. Adhere to workplace procedures for hazards and risk prevention
 | 1. Arrangement of work area and items in accordance with

workplace procedures requirements 1. Work standards and procedures are followed based on instructions
2. ***Prevention and control measures*** are applied based on instructions
 |
| 1. Participate in arrangements for workplace safety and health maintenance
 | 1. Orientations on ***OSH requirements and regulations*** is undertaken in line with policy.
2. Feedback on occupational health and safety are provided as per workplace instructions.
3. Workplace procedures for reporting hazards, incidents, injuries and sickness are adhered to as per workplace policy.
4. ***OSH-related training needs*** are identified and proposed as per workplace policy.
 |

**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. Prevention and control measures may include but are not limited to:
 | * Eliminate the hazard
* Isolate the hazard
* Substitute the hazard with a safer alternative
* Use administrative controls to reduce the risk
* Use engineering controls to reduce the risk
* Use personal protective equipment
* Safety, Health and Work Environment Evaluation
* Periodic and/or special medical examinations of workers
 |
| 1. Safety gears /PPE (Personal Protective Equipment’s) may include but are not limited to:
 | * Arm/Hand guard, gloves
* Eye protection (goggles, shield)
* Hearing protection (ear muffs, ear plugs)
* Hair Net/cap/bonnet
* Hard hat
* Face protection (mask, shield)
* Apron/Gown/coverall/jump suit
* Anti-static suits
* High-visibility reflective vest
 |
| 1. Incidents and emergencies may include but are not limited to:
 | * Chemical spills
* Equipment/vehicle accidents
* Explosion
* Fire
* Gas leak
* Injury to personnel
* Structural collapse
* Toxic and/or flammable vapors emission.
 |
| 1. OSH requirements / regulations may include but are not limited to:
 | * Building code
* Permit to Operate
 |
| 1. OSH-related trainings may include but are not limited to:
 | * Safety Orientations relevant to tasks
* Safe and Correct Operation of Tools and Equipment
* Health Orientations/trainings
* Prevention and Control of OSH Hazards in the workplace
* Chemical Handling
* Safety Trainings
* Prevention and Control of Work-related Injuries and Illness
* Basic First-aid Trainings
* Emergency Response Trainings
* Trainings on use of fire-extinguisher
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Knowledge management
* Collaborating
* Interpersonal
* Troubleshooting
* Critical thinking
* Observation

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* General OSH principles and legislations
* Principles of good housekeeping (5S)
* Company/workplace policies/ guidelines
* Standards and safety requirements of work process and procedures
* Standard Workplace emergency plan and procedures
* Safety and health requirements of tasks
* Workplace guidelines on providing feedback on OSH and security concerns
* OSH regulations
* Hazard control procedures
* OSH trainings relevant to work

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency
 | 1. Assessment requires evidence that the candidate:
2. Arranged work area and items in accordance with
3. workplace procedures requirements
4. Followed work standards and procedures based on instructions
5. Applied ***Prevention and control measures*** based on instructions
6. Undertook orientations on ***OSH requirements and regulations*** in line with policy.
7. Provided feedback on occupational health and safety as per workplace instructions.
8. Adhered to workplace procedures for reporting hazards, incidents, injuries and sickness to as per workplace policy.
9. Identified and proposed ***OSH-related training needs*** as per workplace policy.
 |
| 1. Resource Implications
 | The following resources should be provided:1. Access to relevant workplace where assessment can take place
2. Appropriately simulated environment where assessment can take place
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through: 1. Oral questioning
2. Portfolio of evidence
3. Third Party Reports
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. |

# COMMON UNITS OF COMPETENCY

# APPLY NUMERACY SKILLS

**UNIT CODE:** ENG/OS/IAC/CC/01/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate numeracy skills. Competencies include applying algebra, trigonometric and hyperbolic functions, applying coordinate geometry, carrying out mensuration, applying matrix and vectors

 **ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** These describe the key outcomes which make up workplace functions. | **PERFORMANCE CRITERIA**These are assessable statements which specify the required level of performance for each of the elements.***Bold and italicized terms are elaborated in the Range*** |
| --- | --- |
| 1. Apply algebra
 | 1. Calculations involving Indices are performed as per the concept
2. Calculations involving Logarithms are performed as per the concept
3. Scientific calculator is used in solving mathematical problems in line with manufacturer’s manual
4. Simultaneous equations are performed based on the rules
5. Quadratic equations are calculated as per the concept
 |
| 1. Apply Trigonometry and hyperbolic function
 | 1. Calculations are performed using trigonometric rules
2. Calculations involving ***hyperbolic functions*** are performed
 |
| 1. Apply coordinate geometryy
 | * 1. Polar equations are calculated using coordinate geometry
	2. Graphs of given polar equations are drawn using the Cartesian plane
	3. Normal and tangents are determined using coordinate geometry
 |
| 1. Carry out mensuration
 | * 1. Units of measurement are identified
	2. Perimeter and are of regular ***figures*** are determined
	3. Volume of regular objects are determined
	4. Surface area of solids are calculated
	5. Area and volume of irregular figures are determined
 |
| 1. Apply Matrix
 | * 1. Matrix operations are carried out as per the rules
	2. Determinant of a 2x2 matrices are solved
	3. Inverse of 2x2 matrices are solved
	4. Solutions of linear simultaneous equations with 2 unknowns are determined using matrices
 |
| 1. Apply vectors
 | * 1. Vectors and scalars are identified
	2. Vector operations are performed
 |

 **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. Hyperbolic functions may include but not limited to:
 | * + Sinh x
	+ Cosh x
	+ Cosec x
	+ Coth x
	+ Tanh x
	+ Sech x
 |
| 1. Figures may include but not limited to:
 | * + Triangles
	+ Squares
	+ Rectangles
	+ Circles
	+ Spheres
	+ Cylinders
	+ Cubes
	+ Polygons
	+ Cuboids
	+ Pyramids
 |

**REQUIRED SKILLS AND KNOWLEDGE**

 This section describes the skills and knowledge required for this unit of competency.

 Required Skills

 The individual needs to demonstrate the following skills:

* Applying fundamental operations (addition, subtraction, division, multiplication)
* Using and applying mathematical formulas
* Logical thinking
* Problem solving
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Using a scientific calculator in solving mathematical problems
* Calculating area and volume
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Rounding techniques
* Types of fractions
* Types of tables and graphs
* Presentation of data in tables and graphs
* Vector operations
* Matrix operations

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency
 | Assessment requires evidence that the candidate: * 1. Applied Trigonometry and hyperbolic functions
	2. Determined angles and length in triangles
	3. Determined area and volume of regular and irregular figures
	4. Determined surface area and volume of regular and irregular objects
	5. Applied Matrix in solving simultaneous equations
	6. Identified and selected measuring equipment
 |
| 1. Resource Implications
 | The following resources should be provided:1. Access to relevant workplace where assessment can take place
2. Appropriately simulated environment where assessment can take place
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through: * 1. Direct Observation
	2. Demonstration with Oral Questioning
	3. 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 WORKSHOP PROCESSES

**UNIT CODE**: ENG/OS/IAC/CC/02/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required to perform workshop processes.it involves applying workshop safety, using workshop tools, equipment and materials, storing tools, equipment and materials, troubleshooting and repairing/replacing workshop tools and equipment.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  | **PERFORMANCE CRITERIA*****(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Apply workshop safety | 1. Proper use of PPE is adhered to in line with manufacturer’s recommendations
2. Workshop rules are followed as per standard operating procedure
3. Proper use of safety equipment are followed as per the manufacturers recommendations
4. First Aid procedures are adhered to in accordance to standard operating procedure
 |
| 1. Use workshop tools, equipment, and materials
 | * 1. ***Workshop tools*,** Instruments and equipment are Identified
	2. Tools, Instruments, and equipment are used as per the manufacture’smanuals
	3. Calibration of workshop instruments are performed as per work requirements
	4. Workshop tools, equipment and materials are handled in line with standard operating procedures
 |
| 1. Store tools equipment and material.
 | * 1. Tools are checked against the issuing list after practical
	2. Tools are stored according to manufacturer’s recommendations
	3. Tools are cleaned as per the workshop standard operating procedure
	4. Waste materials are disposed as per the EHS
	5. Tools are stored in their respective sections as per the workshop procedures
 |
| 1. Troubleshoot and repair/replace workshop tools and equipment
 | * 1. Faulty tools are identified as per their expected functioning
	2. Faulty component are diagnosed as per the fault diagnosis procedures
	3. Repair/Replace faulty components as per the expected functioning
	4. Repaired/Replaced tool are tested as per the expected functioning.
 |

**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. Workshop tools may include but not limited to:
 | * + Pliers
	+ Hacksaws
	+ Hammer
	+ Spirit levels
	+ Multimeters
	+ Phase Tester
	+ Side cutters
 |

**REQUIRED SKILLS AND KNOWLEDGE**

 This section describes the skills and knowledge required for this unit of competency.

 Required Skills

 The individual needs to demonstrate the following skills:

* Communications (verbal and written)
* Proficient in ICT
* Time management
* Analytical
* Faults troubleshooting
* Problem solving
* Planning
* Decision making
* First aid
* Report writing

**Required knowledge**

The individual needs to demonstrate knowledge of:

* The manufacturer's manual about the operation of various workshop tools and instruments
* The legal and statutory requirements relating to electrical Workshop operation activities.
* workplace procedures relevant to:
* health and safety
* the environment (including waste disposal)
* appropriate personal and protective equipment
* appropriate use of service manuals
* Workplace procedures for fault identification and diagnosis
* Appropriate use of tools and equipment
* Repairing, modifying or replacing defective parts or components.
* Reporting of technical challenges
* The importance of documenting workshop practical activities and information.
* The importance of working within agreed timelines and sharing progress reports.
* The importance of reporting anticipated delays to relevant parties promptly
* The use of technical information on how to find, interpret and use sources of technical information for workshop practical activities
* The importance of using the correct sources of technical information.
* The purpose of and how to use identification codes.

**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. Adhered to the proper use of PPE
	2. Observed the workshop rules
	3. Performed the First Aid procedures in the workshop
	4. Observed workshop procedures in the storage of tools
	5. Safely used testing equipment and tools
	6. Observed EHS in the waste disposal
	7. Properly demonstrated care and maintenance of workshop tools
	8. Obtained, recorded and interpreted test results
	9. Identified faulty tools and instruments
	10. Repaired/Replaced faulty tools
 |
| 1. Resource Implications
 | The following resources should be provided:1. Access to relevant workplace where assessment can take place
2. Appropriately simulated environment where assessment can take place
 |
| 1. Methods of Assessment
 | Competency may be assessed through:* 1. Oral test
	2. Observation
	3. Practical demonstration
 |
| 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 ELECTRICALAND ELECTRONICS PRINCIPLES**

**UNIT CODE**: ENG/OS/IAC/CC/03/4/A

**UNIT DESCRIPTION**

This unit describes the competencies required to apply electrical principles in their work. It involves using the concept of basic electrical quantities, using the concepts of D.C and A.C circuits in electrical installation, using basic electrical machine, applying semiconductor theory, applying semiconductor diodes, using earthing in electrical installations and demonstrating understanding of transistors

**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 italicized terms are elaborated in the Range.* |
| --- | --- |
| 1. Use the concept of basic Electrical quantities
 | * 1. Basic ***SI unit*s** in Electrical are identified
	2. ***Quantitie*s** of Charge, force, work and power are identified
	3. Perform calculations involving Ohm’s law i.e Current, Resistance and voltage
	4. Calculations involving various electrical quantities are performed
 |
| 1. Use the concepts of D.C and A.C circuits in electrical installation
 | * 1. Calculations involving parallel and series circuits are performed
	2. Calculations involving DC and AC Network theorems are performed. E.g. Kirchhoff’s laws, Superposition, Thevenin’s, Norton’s
 |
| 1. Use of basic electrical machines
 | * 1. Types of various electrical machines are identified
	2. Single phase and three phase motor starting methods are performed
	3. DC motor starting methods are performed
 |
| 1. Apply semiconductor theory
 | * 1. Types of semiconductor ***materials*** are established in line with semiconductor theory
	2. Semiconductor materials are identified as per their electrical conductivity properties
 |
| 1. Apply semiconductor diodes
 | * 1. Types of diodes are identified as per their functionalityy
	2. ***Diodes*** characteristics are determined as per their properties
	3. Forward and reverse bias characteristics are established as per the properties of the semiconductor material
 |
| 1. Use of earthing in Electrical installations
 | * 1. Earthing types are identified
	2. Earthing points on Electrical installation are identified
	3. Calculation involved in determining the earthing type is performed
	4. Test on an earthing system is performed in line with the IEE regulations
 |
| 1. Demonstrate understanding of transistors
 | * 1. ***Transistors*** are identified as per their characteristics
	2. NPN and PNP are determined as per their operation
	3. P and N channels are identified as per their operation
	4. Biasing and determination of gain of transistors is performed as per their standard operating procedure
	5. Transistor configuration is performed as per their application
 |

**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. SI unit may include but not limited to:
 | * Power – Watts (W)
* Current – Amperes (A)
* Resistance – Ohms(Ω)
* Voltage – Volts (V)
 |
| 1. Quantities may include but not limited to:
 | * Charge
* Force
* Work
* Power
 |
| 1. Materials may include but not limited to:
 | * Silicon
* Germanium
 |
| 1. Transistors may include but not limited
 | * PNP
* NPN
 |
| 1. Diodes may include but not limited to
 | * Zener diode
* LED
* Photodiode
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Apply basic Electrical formulas
* Use of basic Electrical instruments
* Perform various unit conversions of Electrical quantities
* Electrical earthing
* logical thinking
* problem solving
* applying statistics
* drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Electrical power calculations
* Various laws in Electrical engineering
* Electrical formulas
* Power triangle
* SI units of various electrical parameters
* Earthing testing
* Selecting the correct type of electrical machines for various uses
* Types and purpose of measuring instruments
* Electrical Units of measurement and abbreviations

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency
 | Assessment requires evidence that the candidate: * 1. Applied the correct SI units of Electrical quantities
	2. Stated, Calculate and relates the quantities in Ohm’s law
	3. Identified the components of an earthing system
	4. Stated and apply various laws in Electrical system
	5. Differentiated between AC and DC network
	6. Applied correct formulas in the calculation of AC and DC machines
 |
| 1. Resource Implications
 | The following resources should be provided: * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place
	2. Measuring equipment
	3. Materials relevant to the proposed activity or tasks
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through: * 1. Direct Observation
	2. Demonstration with Oral Questioning
	3. 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. |

**PREPARE AND INTERPRET TECHNICAL DRAWINGS**

**UNIT CODE**: ENG/OS/IAC/CC/04/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required to prepare and interpret technical drawings. It involves using and maintaining drawing equipment and materials, producing plain geometry drawings, solid geometry drawings and electrical drawings

**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. Use and maintain drawing equipment and materials
 | 1.1 ***Drawing equipment*** are identified and gathered according to task requirements1.2 ***Drawing materials*** are identified and gathered according to task requirements 1.3 Drawing equipment are used and maintained as per manufacturer’s instructions1.4 Drawing materials are used as per workplace procedures1.5 Waste materials are disposed in accordance with workplace procedures and environmental legislation1.6***Personal Protective Equipment*** is used according to occupational safety and health regulations |
| 1. Produce plane geometry drawings
 | * 1. Different types of lines used in drawing and their meanings are identified according to standard drawing conventions
	2. Different types of ***geometric forms*** are constructed according to standard conventions
	3. Different types of angles are constructed according to principles of trigonometry
	4. Different types of angles are measured using appropriate measuring tools
	5. Angles are bisected according to standard conventions
	6. Freehand sketching of different types of geometric forms, tools, equipment, diagrams is conducted
 |
| 1. Produce solid geometry drawings
 | * 1. Drawings of patterns are interpreted according to standard conventions
	2. Patterns are developed in accordance with standard conventions
 |
| 1. Produce electrical drawings
 | * 1. Electrical symbols and abbreviations are identified and their meaning interpreted according to BS 3939
	2. ***Electrical drawings*** are produced in accordance with BS 3939
 |

**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. Drawing equipment
 | * Drawing boards
* T and set squares
* drawing sets
* computers with CAD packages
 |
| 1. Drawing materials
 | * Drawing papers
* Pencils
* Erasers
* masking tapes
* paper clips
 |
| 1. Personal Protective Equipment
 | * Dust coats
* closed leather shoes
 |
| 1. Geometric forms
 | * Circles
* Triangles
* Rectangles
* Parallelogram
* Polygons
* Pyramids
* conic sections
* prisms, loci
 |
| 1. Electrical drawings
 | * Block
* Schematic
* Circuit
* line
* wiring diagrams
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Critical thinking
* Drawing
* Interpretation
* Drawing equipment handling
* Analysis and synthesis
* Communication
* Inter personal

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Drawing equipment and materials
* Freehand sketching
* Lettering
* Geometrical constructions
* Types of drawings
* Types of lines
* Isometric drawing conventions, features, characteristics, components
* Orthographic drawing conventions, features, characteristics, components
* Sketches and drawings of simple patterns

**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. Applied and adhered to safety procedures
	2. Cared and maintained drawing equipment
	3. Interpreted circuit, assembly and lay out diagrams
	4. Applied appropriate technical standards, used proper tools and equipment for a given task
	5. Produced sketches and drawings
	6. Applied CAD packages in production of drawings
 |
| 1. Resource Implications
 | The following resources should be provided: 1. Access to relevant workplace or appropriately simulated environment where assessment can take place
2. Measuring equipment
3. Materials relevant to the proposed activity or tasks
 |
| 1. Methods of Assessment
 | Competency may be assessed through:* 1. Practical tests
	2. Observation
 |
| 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. |

# CORE UNITS OF COMPETENCY

# INSTALL AND SERVICE STAND-ALONE CONTROLLERS (SACs)

**UNIT CODE**: ENG/OS/IAC/CR/01/4/A

**UNIT DESCRIPTION**

This unit specifies the competencies required in installing and servicing stand-alone controllers. it involves preparing a list of tool, equipment and materials, performing marking and laying of conduits and cables, installing stand-alone controller components, configuring stand-alone controller components, terminating controller installation, inspecting and testing controller installation, documenting stand alone control installation and maintaining stand alone controllers.

**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 tools equipment and materials
 | * 1. Tools, equipment, and materials are identified, and list prepared in accordance to workshop regulations and guidelines
	2. Tools, equipment, and materials are checked for ***specifications*** as per their functionality
	3. Tools, equipment, and materials are assembled and stored as per established workplace procedures
 |
| 1. Perform marking and laying of conduits and cables.
 | * 1. Safety procedures are adherence to in accordance with the OSHA standards
	2. Marking is performed in line with the design and working drawing
	3. Piping is performed as per working drawing
	4. Piping is performed in line with standard operating procedure
	5. Number and size of cables are laid in accordance with IEE regulations.
	6. Cables, conduits, enclosures, and support systems are installed as per the working drawing
	7. Cables are drawn-in in line with standard operating procedures
 |
| 1. Install stand-alone controller components
 | * 1. Components are installed in line with the design and working drawings
	2. Components to be installed are identified as per installation requirements
	3. Components are installed in adherence to IEE regulations
	4. Components are installed in line with the instrumentation and electrical industry best practices
 |
| 1. Configure stand-alone controller components
 | * 1. Components are configured in accordance with the design and system functionality
	2. Components are configured as per the program’s codes requirement and compatibility.
	3. Configuration techniques are applied as per the system operation
	4. Configuration software are applied as per the systems requirements
	5. Components are configured as per manufactures’ manuals
 |
| 1. Terminate Controller Installation
 | * 1. Cable are terminated as per the industry best practices and procedures
	2. Cable lugging 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 job.
 |
| 1. Inspect and test controller installation
 | * 1. Types of tests are identified as per the system functionality
	2. Test parameters are recorded in line with the workplace procedures
	3. Testing in conducted according to the IEE regulations
	4. Testing instruments are identified as per the type of testing expected to be carried out
 |
| 1. Document Stand Alone Control Installation
 | * 1. Report is prepared in accordance with the industry best practices
	2. Report is shared with the relevant parties as per the installation contract and the organization structure
	3. Report is filed in adherence to the organization filing system
 |
| 1. Maintain stan alone controllers
 | * 1. Types of maintenance are identified as per the controller functionality
	2. Troubleshooting is performed as per controller operation
	3. Maintenance schedule is prepared as per the types of activities to be carried out
 |

**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. Specifications
 | * Make / model
* Size
* Class
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* + Instrumentation components configuration
	+ Computer software coding
	+ Instrumentation components installation
	+ Communications (verbal and written)
	+ Time management
	+ Problem solving
	+ Decision making
	+ First aid
	+ Planning
	+ Negotiation

**Required knowledge**

The individual needs to demonstrate knowledge 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:
	+ - Workplace 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

**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. Determined and prepared a list of tools, equipment and materials
	2. Checked tools, equipment and materials for specifications and functionality
	3. Installed controller components as per the working drawings
	4. Performed marking as per the design and working drawing
	5. Laid number and size of cables in a conduit as per the IEE regulations
	6. Adhered to safety regulation in the stand-alone controller installation and OSHA regulations
	7. Mounted components in accordance to the working drawings
	8. Terminated cables as per the IEE regulations
	9. Performed labelling of the cables as per the complexity of the job.
	10. Checked firmness of the installation as per established procedures
	11. Performed insulation resistance test as per the IEE regulations
	12. Performed short circuit test in adherence to IEE regulation
	13. Documented the installation
 |
| 1. Resource Implications
 | The following resources must be provided:1. Access to relevant workplace or appropriately simulated environment where assessment can take place
2. Measuring equipment
3. Materials relevant to the proposed activity or tasks
 |
| 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 INSTALLATION

**UNIT CODE**: ENG/OS/IAC/CR/02/4/A

**UNIT DESCRIPTION**

This unit specifies the competencies required for performing electrical installation. It involves preparing a list of tools equipment and materials, performing piping, and laying of cables, installing of electrical components, terminating of electrical installation, and inspecting and testing the installation and documenting an 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 a list of tools equipment and materials
 | * 1. Tools, equipment and materials are identified, and list prepared as per established procedure
	2. Tools, equipment and materials are checked for ***specifications*** as per their functionality
	3. 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. Piping is performed as per working drawing
	3. Piping is performed in line with standard operating procedure
	4. Number and size of cables are laid in a conduit as per the IEE regulations
	5. Cables, conduits, enclosures and support systems are installed as per the working drawing
	6. Cables are drawn-in in line with standard operating procedures
 |
| 1. Install electrical components
 | * 1. Components are installed in line with the design
	2. Components to be installed are identified as per installation requirements
	3. Components are installed in adherence to IEE regulations
	4. Components are installed in accordance with the electrical best practices
 |
| 1. Terminate Electrical Installation
 | * 1. Cable lugging is performed as per the standards operating procedure.
	2. Cables are terminated as per the IEE regulations
	3. Labelling of the cables is performed as per the complexity of the job.
 |
| 1. Inspect and test installation
 | * 1. Types of tests are identified according to the nature of the installation
	2. Testing in conducted according to the IEE regulations
	3. Test parameters are recorded in line with the workplace procedures
	4. Testing instruments are identified as per the type of testing expected to be carried out
 |
| 1. Document an Electrical installation
 | * 1. Report is prepared in accordance with the industry best practices
	2. Report is shared with the relevant parties as per the installation contract
	3. Report is filed in adherence to the organization filing system
 |

**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. Specifications may include but not limited to
 | * Make / model
* Size
* Class
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge 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:
	+ - Workplace 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

**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. Determined and prepared a list of tools, equipment and materials as per established procedure
	2. Checked tools, equipment and materials for specifications and functionality as per the standard operating procedure
	3. Laid number and size of cables in a conduit as per the IEE regulations
	4. Drawn-in cables line with standard operating procedures
	5. Mounted components in accordance to the working drawings
	6. Terminated cables as per the IEE regulations
	7. Performed labelling of the cables as per the complexity of the job.
	8. Checked firmness of the installation as per established procedures
	9. Performed insulation resistance test as per the IEE regulations
	10. Performed short circuit test in adherence to IEE regulation
	11. Documented the installation
 |
| 1. Resource Implications
 | The following resources must be provided:1. Access to relevant workplace or appropriately simulated environment where assessment can take place
2. Measuring equipment
3. Materials relevant to the proposed activity or tasks
 |
| 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. |

# MEASURE PROCESS CONTROL PARAMETERS

UNIT CODE: ENG/OS/IAC/CR/03/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required to measure process control parameters. It involves identifying process control strategies, components, and instruments on the process control strategy, measuring process control parameters, calibrating instruments on the process control strategy and documenting instrument calibrations.

**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. Identify process control strategies
 | * 1. Process control strategies are defined
	2. Types of process control strategies are identified based on their functionality
	3. Block diagrams of control strategies are developed
 |
| 1. Identify components of the process control strategy
 | 2.1 Components of a control process strategy are identified2.2 Types of***plant layout***are identified2.3 Types of process control strategies are identified |
| 1. Measure process control parameters
 | * 1. ***Process control parameters*** are identified
	2. Temperature measuring instruments are identified based on their functionality
	3. Pressure measuring instruments are identified as per system requirements
	4. Level measuring instruments are identified in line with system requirements
	5. Flow rate instruments are identified based on their functionality
	6. Automation instruments are identified based on the scope of the system
	7. Communication instruments are identified in accordance with system configuration
	8. Gas analyzing instruments are identified as per system requirements
	9. ***Process control parameters measuring instruments***are mounted in line with manufacturer’s recommendations
 |
| 1. Calibrate instruments on the process control
 | * 1. Process control parameter measuring instruments are calibrated in line with system requirements
	2. Process control parameters measuring instruments are calibrated as per manufacturer’s recommendations
 |
| 1. Document instrument calibration
 | * 1. Report on instrument calibration is prepared in adherence to the industry guidelines
	2. Report is share in accordance to the organization structure
	3. Reports are filed in accordance with the organization filing system
 |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Plant layout may include but not limited to:
 | * Process layout
* Product layout
* Combined layout
* Fixed position layout
 |
| 1. Process control parameters may include but not limited to:
 | * Temperature
* Pressure
* Fluid level
* Flow rate
* Humidity
 |
| 1. Process control measuring instruments may includes but not limited to:
 | * Pressure gauges
* Pressure switches
* Pressure regulators
* Continuous level instruments
* Differential pressure flow meter
* Ultrasonic flow meters
* Electromagnetic flow meters
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Mounting of pressure gauges
* Calibrating pressure switches
* Mounting differential pressure flow meters
* Interpreting block diagrams
* Operate test equipment and interpret results
* Parameters for normal/abnormal operation of equipment for climate
* Metric conversions
* Math: geometry, trigonometry, algebra
* Communication: speaking, listening, writing
* Problem solving & decision making
* Analytical
* Troubleshooting
* Measurement
* Read and understand plans and symbols

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Electrical wiring
* Use of workshop tools and equipment
* Network Components and devices
* Process control parameters
* Process control parameters measuring instruments
* Safety standards
* Basic networking
* Calibrating process instruments
* Basic construction
* Troubleshooting
* Electrical power distribution
* Measurement
* Electrical standards
* Knowledge of “normal” electricity usage
* Project management
* Environmental regulations
* Construction standards

**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. Developed block diagrams of control strategies
	2. Identified types of process control strategies based on their functionality
	3. Identified components of process control strategies
	4. Developed block diagrams of control strategies
	5. Identified temperature measuring instruments
	6. Identified pressure measuring instruments
	7. Identified level measuring instruments
	8. Mounted process control parameters as per manufacturer’s recommendations
	9. Measuring instruments are calibrated in line with system requirements
 |
| 1. Resource Implications
 | The following resources must be provided:1. Access to relevant workplace or appropriately simulated environment where assessment can take place
2. Measuring equipment
3. Materials relevant to the proposed activity or tasks
 |
| 1. Methods of Assessment
 | Competency may be assessed through:3.1 Observation 3.2 Oral questioning3.3 Practical demonstration |
| 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. |

# INSTALL AND MAINTAIN TRANSMISSION SYSTEM COMPONENTS

**UNIT CODE:** ENG/OS/IAC/CR/04/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required to install and maintain transmission system components transmission system. It involves preparing working drawings, assembling tools, equipment and materials, mounting transmission components, performing wiring, tubing and fitting of transmission system components, testing installed transmission system components and documenting installation and maintenance of transmission components

**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 working drawings
 | * 1. ***Symbols and nomenclatures***are applied in accordance with British Standards [BS 3939]
	2. Drawing tools are applied as per the expected task
	3. Components and their ratings are identified as per their applications
	4. Cable and tubing sizes and lengths are shown as per the working drawings
	5. Cable routes are clearly indicated in line with working drawings
 |
| 1. Assemble tools, equipment, and material
 | * 1. *Tools,* ***equipment and materials*** are identified as per the tasks to be carried out
	2. Tools, equipment and materials are assembled basing on their functionality
	3. Tools, equipment and materials are configured in consideration of system’s installation requirements
	4. Tools, equipment and materials are assembled in consideration of work requirements.
 |
| 1. Mount transmission system components
 | * 1. Types of plant ***layouts*** are identified
	2. Classification of transmission systems are identified
	3. Types of transmission system are identified
	4. Components of transmission system are identified as per their application
 |
| 1. Perform wiring, tubing and fitting of transmission system components
 | * 1. Cable ratings and sizes are established based on electrical power
	2. ***Wiring system*s** are identified based on the transmission requirements
	3. Types of cables are identified based on application
	4. ***Motor control circuits***are identified
	5. ***Tubing*** are classified based on their applications
	6. Fittingsare classified based on their applications
	7. Tubing, cables and fittings are fixed in line with system requirements.
 |
| 1. Test the installed transmission system components
 | * 1. System components are tested in line with their power ratings
	2. System components are tested based on their functionality
	3. System components are tested in line with manufacturer’s manuals
	4. Tubing, cables and fittings are tested for firmness as per system requirements.
 |
| 1. Document system installation and maintenance
 | * 1. Report are prepared as per the organization approved format
	2. Report is shared best on the organization guidelines
	3. Filing is performed in adherence to the organization filing system
 |

**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. Symbols and nomenclatures may include but not limited to:
 | * For power
* Voltage
* Valves
* Tubes
 |
| 1. Tools, equipment and materials may include but not limited to:
 | * Cutting tools
* Measuring tools
* Measuring equipment
* Cables and conductors
* Crimping tool
* Conduits
* Cables
* Fittings
* Tubes
* Accessories
* Thread seal
 |
| 1. Layouts may include but not limited to:
 | * Process layout
* Product layout
* Combined layout
* Fixed position layout
 |
| 1. Motor control circuits may include but not limited to
 | * Motor starters
* Interlocking
 |
| 1. Tubing may include but not limited to:
 | * Structural tubing
* Mechanical tubing
* Pressure tubing
 |
| 1. Wiring systems may include but not limited to:
 | * Surface wiring
* Batten wiring
* Conduit wiring
* Concealed wiring
 |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Soldering
* Tightening of nuts
* Operate test equipment and interpret results
* Teamwork
* Troubleshooting
* Building codes
* Read and understand
* Plans and symbols
* Dynamics, air-to-air heat exchangers
* Communication
* Problem solving & decision making
* Measurements

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Basics of global warming
* Preparing working diagrams
* Motor starting methods
* Types of fittings
* Types of motors
* Types of wiring systems
* Classifications of tubing
* Electrical wiring
* Power protection
* Types of cables
* Sensors
* Transmitters
* Pressure gauges
* Valves
* Electrical standards
* Measurement
* Use of electrical & mechanical tools
* Troubleshooting
* Engineering principles
* OSHA, WSHA, and industry safety procedures and regulations
* Mathematics
* Research effectively on the internet (including old equipment)
* Depth of knowledge of the solar industry
* Work Ethics

**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. Applied Symbols and nomenclatures in accordance with British Standards [BS 3939]
	2. Identified Cable and tubing sizes and lengths as per the working drawings
	3. Iidentified Tools, equipment and material*s* as per the tasks to be carried outt
	4. Identified types of plant layouts
	5. Identified components of transmission system as per their application
	6. Established cable ratings and sizes based on electrical power
	7. Identified *wiring systems* based on the transmission requirements
	8. Classified tubing based on their applications
	9. Classified fittings based on their applications
	10. Tested System components in line with their power ratings
	11. Tested tubings, cables and fittings for firmness as per system requirements.
	12. Documented the report
 |
| 1. Resource Implications
 | The following resources must be provided:1. Access to relevant workplace or appropriately simulated environment where assessment can take place
2. Measuring equipment
3. Materials relevant to the proposed activity or tasks
 |
| 1. Methods of Assessment
 | Competency may be assessed through:* 1. Oral questioning
	2. Practical demonstration
	3. Observation
 |
| 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. |