

**THE REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**WELDING AND FABRICATION CRAFTSPERSON**

**LEVEL 5**



**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 blue print 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 to 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 were developed for the purpose of developing a competency-based Curriculum for Welding and Fabrication Level 5. 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 on Reforming Education and Training in Kenya, emphasized the need to reform Curriculum development, assessment and certification. This called for shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Welding Sector Skills Advisory Committee (SSAC), have developed these Occupational Standards for a Welding and Fabrication Craftsman. These Occupational Standards will be the basis for development of competency-based Curriculum for Welding and Fabrication Level 5. These Standards will also be the basis for assessment of an individual for competence certification.

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, Welding SSAC, expert workers and all those who participated in the development of these Occupational Standards.

**CHAIRPERSON, TVET CDACC**

# ACKNOWLEDGEMENT

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 Welding 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 institutions which in one way or another contributed to the development of these Standards.

**CHAIRPERSON**

**WELDING SECTOR SKILLS ADVISORY COMMITTEE**

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# ABBREVIATIONS AND ACRONYMNS

ASME American Society of Mechanical Engineers

BC Basic Competency

BS British Standard

CAD Computer Aided Design

CBET Competency Based Education and Training

CC Common Competency

CDACC Curriculum Development Assessment and Certification Council

CR Core Competency

ISO International Organization for Standardization

KS Kenyan Standard

NEMA National Environmental Management Authority

NGO Non-Governmental Organization

OS Occupational Standards

OSHA Occupation Safety and Health Act

PPE Personal Protective Equipment

SOPs Standard Operating Procedures

SSAC Sector Skills Advisory Committee

WEF Welding and Fabrication

# KEY TO UNIT CODE

ENG /OS /WEF/BC /01/ 5/ A

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Version control

# OVERVIEW

Welding and Fabrication Level 5 qualification consists of competencies that a person must achieve to enable him/her to carry out various welding processes including gas welding, manual metal arc welding, Tungsten Inert Gas (TIG) welding and Gas Metal Arc Welding (GMAW). In addition, it also involves competencies for performing weld testing and fabricating products and structures.

The units of competency comprising this qualification include the following basic, common and core competencies:

**Basic Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/WEF/BC/01/5/A | Demonstrate communication skills |
| ENG/OS/WEF/BC/02/5/A | Demonstrate digital literacy |
| ENG/OS/WEF/BC/03/5/A | Demonstrate entrepreneurial skills |
| ENG/OS/WEF/BC/04/5/A | Demonstrate employability skills |
| ENG/OS/WEF/BC/05/5/A | Demonstrate environmental literacy |
| ENG/OS/WEF/BC/06/5/A | Demonstrate occupational safety and health practices |

**Common Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/WEF/CC/01/5/A | Apply Technical Drawing |
| ENG/OS/WEF/CC/02/5/A | Apply Basic Mathematics |
| ENG/OS/WEF/CC/03/5/A | Perform Science Calculations and Electricity Basics |
| ENG/OS/WEF/CC/04/5/A | [Apply](#_Toc525316851) Estimation and Costing |

**Core Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/WEF/CR/01/5/A | Fabricate products and structures |
| ENG/OS/WEF/CR/02/5/A | Perform soldering and gas welding |
| ENG/OS/WEF/CR/03/5/A | Perform manual metal arc welding |
| ENG/OS/WEF/CR/04/5/A | Perform Gas Metal Arc Welding (GMAW) |
| ENG/OS/WEF/CR/05/5/A | Perform Tungsten Inert Gas (TIG) welding |
| ENG/OS/WEF/CR/06/5/A | Perform Spot and Seam Resistance Welding |
| ENG/OS/WEF/CR/07/5/A | Perform Weld Testing |

**BASIC UNITS OF COMPETENCY**

## DEMONSTRATE COMMUNICATION SKILLS

**UNIT CODE:** ENG/OS/WEF/BC/01/5/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate communication skills. It involves meeting communication needs of clients and colleagues, contributing to the development of communication strategies, conducting workplace interviews, facilitating group discussions and representing the organisation

**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. Meet communication needs of clients and colleagues | 1. Specific communication needs of clients and colleagues are identified and met based on workplace requirements 2. Different communication approaches are identified and applied according to clients’ needs 3. Conflict is identified and addressed as per the standards of the organization |
| 1. Contribute to the development of communication strategies | 1. Strategies for internal and external dissemination of information are developed, promoted, implemented and reviewed as per organizations’ strategic plan 2. Channels of communication are established and reviewed based on the workplace needs 3. Communication training needs are identified and provided according to SOPs 4. Work related network and relationship are maintained based on workplace requirements 5. Negotiation and conflict resolution strategies are maintained as per the workplace procedures |
| 1. Conduct workplace interviews | 1. ***Communication strategies*** are identified and employed in ***interview situations*** based on workplace requirements 2. Records of interviews are made and maintained in accordance with organizational procedures 3. Effective questioning, listening and nonverbal communication techniques are used based on needs |
| 1. Facilitate group discussions | 1. Mechanisms to enhance ***effective group interaction*** are identified and implemented according to workplace requirements 2. Strategies to encourage group participation are identified and used as per organizations’ procedures 3. Meetings objectives and agenda are set and followed based on workplace requirements 4. Relevant information is provided and feedback obtained according to set protocols 5. Evaluation of group communication strategies is undertaken in accordance with workplace guidelines 6. Specific communication needs of individuals are identified and addressed as per individual needs |
| 1. Represent the organization | 1. Relevant presentation are researched and presented based on internal or external communication forums requirements Presentation is delivered in a clear and sequential manner as per the predetermined time 2. Presentation is made as per appropriate media 3. Difference views are respected based on workplace procedures 4. Written communication is done as per organizational standards 5. Inquiries are responded according to organizational standard |

**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. Communication strategies may include but not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrase * Clarification request * Translation * Restructuring * Approximation * Generalization |
| 1. Effective group interaction may include but not limited to: | * Identifying and evaluating what is occurring within an interaction in a non-judgmental way * Using active listening * Making decision about appropriate words, behavior * Putting together response which is culturally appropriate * Expressing an individual perspective * Expressing own philosophy, ideology and background and exploring impact with relevance to communication * Openness and flexibility in communication |
| 1. Interview situations may include but not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * Developing action plans * Diffusing potentially difficult situations |

**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:

* Active listening
* Giving/receiving feedback
* Interpretation of information
* Role boundaries setting
* Negotiation
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups and different styles of group leadership
* Communication skills relevant to client groups
* Flexibility in communication

**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. Met communication needs of clients and colleagues 2. Contributed to the development of communication strategies 3. Conducted interviews 4. Facilitated group discussions 5. Represented the organization |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 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/WEF/BC/02/5/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate digital literacy. It involves identifying appropriate computer software and hardware, applying security measures to data, hardware, software in automated environment, applying computer software in solving tasks, applying internet and email in communication at workplace, applying desktop publishing in official assignment and preparing presentation packages.

**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 appropriate computer software and hardware | 1. Concepts of ICT are determined in accordance with computer equipment 2. Classifications of computers are determined in accordance with manufacturers specification 3. ***Appropriate computer software*** is identified according to manufacturer’s specification 4. ***Appropriate computer hardware*** is identified according to manufacturer’s specification 5. Functions and commands ofoperating system are determined in accordance withmanufacturer’s specification |
| 1. Apply security measures to data, hardware, software in automated environment | 1. ***Data security and privacy are classified*** in accordance with the prevailing technology 2. ***Security threats*** areidentified, **and *control measures*** are applied in accordance with laws governing protection of ICT 3. Computer threats and crimes are detected in accordance with 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. ***Word processing concepts***are applied in resolving workplace tasks, report writing and documentation as per job requirements 2. ***Word processing utilities*** are applied in accordance with workplace procedures 3. Worksheet layout is prepared in accordance with work procedures 4. Worksheet is build and data manipulated in the worksheet in accordance with workplace procedures 5. Continuous data manipulated on worksheet is undertaken in accordance with work requirements 6. Database design and manipulation is undertaken in accordance with office procedures 7. Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures |
| 1. Apply internet and email in communication at workplace | 1. Electronic mail addresses are opened and applied in workplace communication in accordance with office policy 2. Office internet functions are defined and executed in accordance with office procedures 3. ***Network configuration*** is determined in accordance with office operations procedures 4. Official World Wide Web is installed and managed according to workplace procedures |
| 1. Apply desktop publishing in official assignments | 1. Desktop publishing functions and tools are identified in accordance with manufactures specifications 2. Desktop publishing tools are developed in accordance with work requirements 3. Desktop publishing tools are applied in accordance with workplace requirements 4. Typeset work is enhanced in accordance with workplace standards |
| 1. Prepare presentation packages | 1. Types of presentation packages are identified in accordance with office requirements 2. Slides are created and formulated in accordance with workplace procedures 3. Slides are edited and run in accordance with work procedures 4. Slides and handouts are printed according to work requirements |

**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. Appropriate computer hardware may include but not limited to: | * Computer case * Monitor * keyboard * mouse |
| 1. Data security and privacy may include but not limited to: | * Confidentiality of data * Cloud computing * Integrity -but-curious data surfing |
| 1. Security and control measures may include but not limited to: | * Counter measures against cyber terrorism * Risk reduction * Cyber threat issues * Risk management * Pass wording |
| 1. Security threats may include but not limited to: | * Cyber terrorism * Hacking |

**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 skills
* Interpretation
* Typing
* Communication
* Basic ICT skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Software concept
* Functions of computer software and hardware
* Data security and privacy
* Computer security threats and control measures
* Technology underlying cyber-attacks and networks
* Cyber terrorism
* Computer crimes
* Detection and protection of computer crimes
* Laws governing protection of ICT
* Microsoft suite

**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 and controlled security threats 2. Detected and protected computer crimes 3. Applied word processing in office tasks 4. Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures 5. Opened electronic mail for office communication as per workplace procedure 6. Installed internet and World Wide Web for office tasks in accordance with office procedures 7. Integrated emerging issues in computer ICT applications 8. Applied laws governing protection of ICT |
| 1. Resource Implications | The following resources should be provided:   1. Tablets 2. Laptops 3. Desktop computers 4. Calculators 5. Internet 6. Smart phones 7. Operation Manuals |
| 1. Methods of Assessment | Competency may be assessed through:   1. Written Test 2. Observation 3. Practical assignment 4. Interview/Oral Questioning |
| 1. Context of Assessment | Competency may be assessed in:   1. Off the job 2. On the job setting 3. Industrial attachment |
| 5. 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/WEF/BC/03/5/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship, and self-employment, identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation, developing business innovative strategies and developing business plan.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT** | **PERFORMANCE CRITERIA** |
| 1. Demonstrate understanding of an Entrepreneur | 1. Entrepreneurs and Businesspersons are distinguished as per principles of entrepreneurship 2. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 3. Ways of becoming an Entrepreneur are identified as per principles of Entrepreneurship 4. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 5. Factors affecting Entrepreneurship development are explored as per principles of Entrepreneurship |
| 1. Demonstrate understanding of Entrepreneurship and self-employment | 1. Entrepreneurship and self-employment are distinguished as per principles of entrepreneurship 2. Importance of self-employment is analysed based on business procedures and strategies 3. ***Requirements for entry into self-employment*** are identified according to business procedures and strategies 4. Role of an Entrepreneur in business is determined according to business procedures and strategies 5. Contributions of Entrepreneurs to National development are identified as per business procedures and strategies 6. Entrepreneurship culture in Kenya is explored as per business procedures and strategies 7. Born or made Entrepreneurs are distinguished as per entrepreneurial traits |
| 1. Identify Entrepreneurship opportunities | 1. Sources of business ideas are identified as per business procedures and strategies 2. Business ideas and opportunities are generated as per business procedures and strategies 3. Business life cycle is analysed as per business procedures and strategies 4. Legal aspects of business are identified as per procedures and strategies 5. Product demand is assessed as per market strategies 6. Types of ***business environment*** are identified and evaluated as per business procedures 7. Factors to consider when evaluating business environment are explored based on business procedure and strategies 8. Technology in business is incorporated as per best practice |
| 1. Create entrepreneurial awareness | 1. ***Forms of businesses*** are explored as per business procedures and strategies 2. Sources of business finance are identified as per business procedures and strategies 3. Factors in selecting source of business finance are identified as per business procedures and strategies 4. ***Governing policies*** on Small Scale Enterprises (SSEs) are determined as per business procedures and strategies 5. Problems of starting and operating SSEs are explored as per business procedures and strategies |
| 1. Apply entrepreneurial motivation | 1. ***Internal and external motivation*** factors are determined in accordance with motivational theories 2. Self-assessment is carried out as per entrepreneurial orientation 3. Effective communications are carried out in accordance with communication principles 4. Entrepreneurial motivation is applied as per motivational theories |
| 1. Develop innovative business strategies | 1. Business innovation strategies are determined in accordance with the organization strategies 2. Creativity in business development is demonstrated in accordance with business strategies 3. ***Innovative business strategies*** are developed as per business principles 4. Linkages with other entrepreneurs are created as per best practice 5. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Identified Business is described as per business procedures and strategies 2. Marketing plan is developed as per business plan format 3. Organizational/Management plan is prepared in accordance with business plan format 4. Production/operation plan in accordance with business plan format 5. Financial plan is prepared in accordance with the business plan format 6. Executive summary is prepared in accordance with business plan format 7. Business plan is presented as per best practice |

**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.

|  |  |
| --- | --- |
| 1. **Variable** | **Range** |
| 1. Types of entrepreneurs may include but not limited to: | * Innovators * Imitators * Craft * Opportunistic * Speculators |
| 1. Characteristics of Entrepreneurs may include but not limited to: | * Creative * Innovative * Planner * Risk taker * Networker * Confident * Flexible * Persistent * Patient * Independent * Future oriented * Goal oriented |
| 1. Requirements for entry into self-employment may include but not limited to | * Technical skills * Management skills * Entrepreneurial skills * Resources * Infrastructure |
| 1. Internal and external motivation may include but not limited to: | * Interest * Passion * Freedom * Prestige * Rewards * Punishment * Enabling environment * Government policies |
| 1. Business environment may include but not limited to: | * External * Internal * Intermediate |
| 1. Forms of businesses may include but not limited to: | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| 1. Governing policies may include but not limited to: | * Increasing scope for finance * Promoting cooperation between entrepreneurs and private sector * Reducing regulatory burden on entrepreneurs * Developing IT tools for entrepreneurs |
| 1. Innovative business strategies may include but not limited to: | * New products * New methods of production * New markets * New sources of supplies * Change in industrialization |

**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
* Management
* Problem-solving
* Root-cause analysis
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Decision making
* Business communication
* Change management
* Competition
* Risk
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care strategies
* Basic financial management
* Business strategic planning
* Impact of change on individuals, groups and industries
* Government and regulatory processes
* Local and international market trends
* Product promotion strategies
* Market and feasibility studies
* Government and regulatory processes
* Local and international business environment
* Relevant developments in other industries
* Regional/ County business expansion 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. Distinguished entrepreneurs and business persons correctly 2. Identified ways of becoming an entrepreneur appropriately 3. Explored factors affecting entrepreneurship development appropriately 4. Analysed importance of self-employment accurately 5. Identified requirements for entry into self-employment correctly 6. Identified sources of business ideas correctly 7. GeneratedBusiness ideas and opportunities correctly 8. Analysed business life cycle accurately 9. Identified legal aspects of business correctly 10. Assessed product demand accurately 11. Determined Internal and external motivation factors appropriately 12. Carried out communications effectively 13. Identified sources of business finance correctly 14. Determined Governing policy on small scale enterprise appropriately 15. Explored problems of starting and operating SSEs effectively 16. Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 17. Prepared executive summary correctly 18. Determined business innovative strategies appropriately 19. Presented business plan effectively |
| 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. Written tests 2. Oral questions 3. Third party report 4. Interviews 5. Portfolio |
| 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/WEF/BC/04/5/A

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading small teams, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing 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 interpersonal communication | 1. Writing skills are demonstrated as per communication policy 2. Negotiation and persuasion skills are demonstrated as per communication policy 3. Internal and external stakeholders’ needs are identified and interpreted as per the communication policy 4. Communication networks are established based on workplace policy 5. Information is shared as per communication policy |
| 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. Lead small teams | 1. Performance targets for the ***team*** are set based on organization’s objectives 2. Duties are assigned in accordance with the organization policy. 3. ***Forms of communication*** in a team are established according to organization’s policy. 4. Team performance is evaluated based on set targets as per workplace policy. 5. Conflicts are resolved between team members in line with organization policy. 6. Gender related issues are identified and mainstreamed in accordance workplace policy. 7. Human rights and fundamental freedoms are identified and respected as Constitution of Kenya 2010. 8. Healthy relationships are developed and maintained in line with workplace. |
| 1. Plan and organize work | 1. Task requirements are identified as per the workplace objectives 2. Task is interpreted in accordance with safety (OHS ), environmental requirements and quality requirements 3. Work activity is organized with other involved personnel as per the SOPs 4. Resources are mobilized, allocated and utilized to meet project goals and deliverables. 5. Work activities are monitored and evaluated in line with organization procedures. 6. Job planning is documented in accordance with workplace requirements. 7. Time is managed achieve workplace set goals and objectives. |
| 1. Maintain professional growth and development | 1. Personal training needs are identified and assessed in line with the requirements of the job. 2. ***Training and career opportunities*** are identified and utilized based on job requirements. 3. Resources for training are mobilized and allocated based organizations and individual skills needs. 4. Licensees and certifications relevant to job and career are obtained and renewed as per policy. 5. Work priorities and personal commitments are balanced and managed based on requirements of the job and personal objectives. 6. Recognitions are sought as proof of career advancement in line with professional requirements. |
| 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 problem solving skills | 1. Creative, innovative and practical solutions are developed based on the problem 2. Independence and initiative in identifying and solving problems is demonstrated based on requirements of the job. 3. Team problems are solved as per the workplace guidelines 4. Problem solving strategies are applied as per the workplace guidelines 5. Problems are analyzed and assumptions tested as per the context of data and circumstances |
| 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. Drug and substance abuse may include but not limited to: | Commonly abused   * Alcohol * Tobacco * Miraa * Over-the-counter drugs * Cocaine * Bhang * Glue |
| 1. Feedback may include but not limited to: | * Verbal * Written * Informal * Formal |
| 1. Relationships may include but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| 1. Forms of communication may include but not limited to: | * Written * Visual * Verbal * Non verbal * Formal and informal |
| 1. Team may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| 1. Personal growth may include but not limited to: | |  | | --- | | * Growth in the job * Career mobility * Gains and exposure the job gives * Net workings * Benefits that accrue to the individual as a result of noteworthy performance | |
| 1. Personal objectives may include but not limited to: | * Long term * Short term * Broad * Specific |
| 1. Trainings and career opportunities may include but not limited to | * Participation in training programs * Technical * Supervisory * Managerial * Continuing Education * Serving as Resource Persons in conferences and workshops |
| 1. Resource may include but not limited to: | * Human * Financial * Hardware * Software |
| 1. Innovation may include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| 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 |

**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
* Critical thinking
* Observation
* Organizing
* Negotiation
* Monitoring
* Evaluation
* Record keeping
* Problem solving
* Decision Making
* Resource utilization
* Resource mobilization

**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
* Resources and allocating resources
* Organizing work
* Monitoring and evaluation
* Record keeping
* Workplace problems and how to deal with them
* Gender mainstreaming
* HIV and AIDS
* Drug and substance abuse
* Leadership
* 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 interpersonal communication 3. Demonstrated critical safe work habits 4. Led small teams 5. Planned and organized work 6. Maintained professional growth and development 7. Demonstrated workplace learning 8. Demonstrated problem solving skills 9. 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/WEF/BC/05/5/A

**UNIT DESCRIPTION**

This unit describes the competencies required to demonstrate understanding of environmental literacy. It involves controlling environmental hazard, controlling control environmental pollution, complying with workplace sustainable resource use, evaluating current practices in relation to resource usage, identifying environmental legislations/conventions for environmental concerns, implementing specific environmental programs and monitoring activities on environmental protection/programs.

**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 strictly followed according to environmental regulations and OSHS. 2. ***Disposal methods*** of hazardous wastes are followed always according to environmental regulations and OSHS. 3. ***PPE*** is used according to OSHS. |
| 1. Control environmental Pollution control | 1. Environmental pollution ***control measures*** are compiled following standard protocol. 2. Procedures for solid waste management are observed according to Environmental Management and Coordination Act 1999 3. Methods for minimizing ***noise pollution*** is complied with based on Noise and Excessive Vibration Pollution and Control Regulations, 2009 |
| 1. Demonstrate sustainable resource use | 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 and reducing resource consumption are practiced as per the Environmental Management and Coordination Act 1999 |
| 1. Evaluate current practices in relation to resource usage | 1. Information on resource efficiency **systems and procedures** are collected and provided to the work group where appropriate. 2. Current resource usage is measured and recorded by members of the work group. 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. 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 |
| 1. Implement specific environmental programs | 1. Programs/Activities are identified according to organizations policies and guidelines. 2. Individual roles/responsibilities are determined and performed based on the activities identified. 3. Problems/constraints encountered are resolved in accordance with organizations’ policies and guidelines 4. Stakeholders are consulted based on company guidelines |
| 1. Monitor activities on Environmental protection/Programs | 1. Activities are periodically monitored and evaluated according to the objectives of the environmental Program 2. Feedback from stakeholders are gathered and considered in proposing enhancements to the program based on consultations 3. Data gathered are analyzed based on evaluation requirements 4. Recommendations are submitted based on the findings 5. Management support systems are set/established to sustain and enhance the program 6. Environmental incidents are monitored and reported to concerned/proper authorities |

**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 not limited to: | * Mask * Gloves * Goggles * Safety hat * Overall * Hearing protector * Safety boots |
| 1. Environmental pollution control measures may include but not limited to: | * Methods for minimizing or stopping spread and ingestion of airborne particles * Methods for minimizing or stopping spread and ingestion of gases and fumes * Methods for minimizing or stopping spread and ingestion of liquid wastes |
| 1. Waste management procedures may include but not limited to: | * Sorting * Storing of items * Recycling of items * Disposal of items |
| 1. Resources may include but not limited to: | * Electric * Water * Fuel * Telecommunications * Supplies * Materials |
| 1. Workplace environmental hazards may include but not limited to: | * Biological hazards * Chemical and dust hazards * Physical hazards |
| 1. Organizational systems and procedures may include but not limited to: | * Supply chain, procurement and purchasing * Quality assurance * Making recommendations and seeking approvals |

**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:

* Observation
* Measuring
* Writing
* Communication
* Analytical
* Monitoring
* Evaluation

**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
* 3Rs principle
* 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.
* Measurement and recording of current resource usage
* Analysis current work processes to access information and data Analysis of data and information
* Identification of areas for improvement
* Resource consuming processes
* Determination of quantity and nature of resource consumed
* Analysis of resource flow of different parts of the resource flow process
* Use/conversion of resources
* Causes of low efficiency of use
* Increasing the efficiency of resource use
* Inspection of resource use plans
* Regulations/licensing requirements
* Determine benefit/cost for alternative resource sources
* Benefit/costs for different alternatives
* Components of proposals
* Criteria on ranking proposals
* Regulatory requirements
* Proposals for improving resource efficiency
* Implementation of resource efficiency plans
* Procedures in monitor implementation
* Adjustments of implementation plan
* Inspection of new resource usage

**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 hazard 2. Controlled environmental pollution 3. Demonstrated sustainable resource use 4. Evaluated current practices in relation to resource usage 5. Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns. 6. Described industrial standard environmental practices according to the different environmental issues/concerns. 7. Resolved problems/ constraints encountered based on management standard procedures 8. Implemented and monitored environmental practices on a periodic basis as per company guidelines 9. Recommended solutions for the improvement of the Program 10. Monitored and reported to proper authorities any environmental incidents |
| 1. Resource Implications | The following resources should be provided:   1. Workplace with storage facilities 2. Tools, materials and equipment relevant to the tasks (ex. Cleaning tools, cleaning materials, trash bags, etc.) 3. PPE 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 test 4. Interview/Third Party Reports 5. Portfolio of evidence |
| 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 OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENG/OS/WEF/BC/06/5/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to identify workplace hazards and risk, identify and implement appropriate control measures and implement OSH programs, procedures and policies/ guidelines

**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 workplace hazards and risk | 1. ***Hazards*** in the workplace are identified ***based their indicators*** 2. Risks and hazards are evaluated based on legal requirements. 3. ***OSH concerns*** raised by workers are addressed as per legal requirements. |
| 1. Control OSH hazards | 1. Hazard prevention ***and control measures*** are implemented as per legal requirement. 2. Risk assessment is conductedand a risk matrix developed based on likely impact. 3. ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures. |
| 1. Implement OSH programs | 1. Company OSH program are identified, evaluated and reviewed based on legal requirements. 2. Company OSH programs are implemented as per legal requirements. 3. Workers are capacity built on OSH standards and procedures as per legal requirements 4. ***OSH-related records*** are maintained as per legal requirements. |

**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. Hazards may include but are not limited to: | * Physical hazards * Biological hazards * Chemical hazards * Ergonomics * Psychological factors * Physiological factors * Safety hazards * Unsafe workers’ act |
| 1. Indicators may include but are not limited to: | * Increased of incidents of accidents, injuries * Increased occurrence of sickness or health complaints/ symptoms * Common complaints of workers related to OSH * High absenteeism for work-related reasons |
| 1. Evaluation and/or work environment measurements may include but are not limited to: | * Health Audit * Safety Audit * Work Safety and Health Evaluation * Work Environment Measurements of Physical and Chemical Hazards |
| 1. OSH issues and/or concerns may include but are not limited to: | * Workers’ experience/observance on presence of work hazards * Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks) * Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines |
| 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. Appropriate risk controls | * Eliminate the hazard altogether * Isolate the hazard from anyone who could be harmed * 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 |
| 1. Contingency measures may include but are not limited to: | * Evacuation * Isolation * Decontamination * Emergency personnel |
| 1. Emergency procedures may include but are not limited to: | * Fire drill * Earthquake drill * Basic life support/CPR * First aid * Spillage control * Decontamination of chemical and toxic * Disaster preparedness/management * Set of fire-extinguisher |
| 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-related Records may include but are not limited to: | * Medical/Health records * Incident/accident reports * Sickness notifications/sick leave application * OSH-related trainings obtained |

**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
* Presentation
* Risk assessment
* Evaluation
* Critical thinking
* Problem solving
* Negotiation

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* General OSH Principles
* Occupational hazards/risks recognition
* OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM)
* National OSH regulations; company OSH policies and protocols
* Systematic gathering of OSH issues and concerns
* General OSH principles
* National OSH regulations
* Company OSH and recording protocols, procedures and policies/guidelines
* Training and/or counseling methodologies and 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. Identified hazards in the workplace based their indicators 2. Evaluated workplace hazards based on legal requirements. 3. Addressed OSH concerns raised by workers as per legal requirements. 4. Implemented hazard prevention and control measures as per legal requirement. 5. Conducted risk assessment as per legal requirement. 6. Developed risk matrix based on likely impact. 7. Recognized and established contingency measures in accordance with organization procedures. 8. Identified, evaluated and reviewed company OSH program based on legal requirements. 9. Implemented company OSH programs as per legal requirements. 10. Capacity built workers on OSH standards and procedures as per legal requirements 11. Maintained OSH-related records as per legal requirements. |
| 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. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 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 TECHNICAL DRAWING

**UNIT CODE: ENG/OS/WEF/CC/01/5/A**

**UNIT DESCRIPTION**

This unit covers the competencies required to apply technical drawings. It involves competencies to select, use and maintain drawing equipment, materials and application of CAD packages. It also involves competencies of interpreting drawing, applying plain geometry drawings, solid geometry drawings, pictorial, free hand sketching and orthographic drawings of components.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  ***(Bold and italicized 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 requirements  1.2 ***Drawing materials*** are identified and gathered according to task requirements  1.3 Drawing equipment are used and maintained as per manufacturer’s instructions  1.4 Drawing materials are used as per workplace procedures  1.5 Different types of paper-layout and folding are illustrated as per SOPs  1.6 Applied CAD packages as required by task assignment  1.7 Waste materials are disposed in accordance with workplace procedures and environmental legislations |
| 1. Apply plain geometry drawings | * 1. Different types of lines used in drawing and their meanings are identified according to ***standard drawing conventions and symbols.***   2. Different types of lines are drawn as per ISO drawing standard   3. Different types of lines are bisected as per ISO drawing standard   4. Different lettering is applied as per task assignment.   5. Different types of ***geometric forms*** are constructed according to standard drawing conventions.   6. Different types of angles are constructed according to the principles of trigonometry.   7. Different types of angles are bisected according to principles of trigonometry.   8. Different types of angles are measured using measuring tools   9. Different angles are bisected according to standard drawing conventions   10. Different types of angles are constructed according to principles of trigonometry. |
| 1. Apply solid geometry drawings | * 1. Sketches and drawings are applied according to standard conventions   2. Patterns are applied in accordance with standard conventions |
| 1. Develop object surfaces | * 1. Interpreted object patterns as per task assignment   2. Apply surface development principles as per task assignment |
| 1. Apply pictorial and orthographic drawings of components | * 1. Different symbols and abbreviations are identified, and their meaning interpreted according to standard drawing conventions.   2. Isometric sketches and drawings of components are interpreted and produced in accordance with the standard conventions of isometric drawings.   3. First and third angle orthographic sketches and drawings of components are interpreted and produced in accordance with the standard conventions of orthographic drawings. |
| 1. Apply free hand sketching | * 1. Different types of geometric shapes are identified according to standard drawing conventions.   2. Applied freehand sketching of different types of geometrical shapes. |

**RANGE**

| **Variable** | **Range** |
| --- | --- |
| 1. Drawing equipment may include but is not limited to: | * Drawing boards * T-square and set squares * Drawing set * Computers with CAD packages |
| 1. Drawing materials may include but is not limited to: | * Drawing papers * Pencils * Erasers * Masking tapes * Paper clips |
| 1. Geometric forms may include but is not limited to: | * Circles * Triangles * Rectangles * Parallelogram * Polygons * Pyramids * Conic sections * Prisms |
| 1. Standard drawing conventions may include but is not limited to: | * Anatomy of engineering drawing (title block, projection symbols, revision block) * Drawing scale (paper size and drawing symbols) * International drawing standards |

**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
* Communication

**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
* Use of computer applications

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 technical drawing principles, tools and equipment as a specific drawing assignment   2. Produced sketches and drawings as per assignment requirements   3. Applied CAD packages as specific assignment   4. Maintained drawing equipment as per manufacturer’s specifications and work place procedures |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied.   * 1. Fully equipped drawing room   2. Drawing equipment and materials   3. Computers with versatile operating systems   4. CAD packages |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed   1. On job 2. Off 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 BASIC MATHEMATICS

**UNIT CODE: ENG/OS/WEF/CC/02/5/A**

**UNIT DESCRIPTION:**

This unit describes the competencies required by a craft person in order to apply algebra, apply ratio calculations, apply trigonometric functions, carry out mensuration, apply statistics, apply vector and apply commercial calculations.

**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. Apply Algebra | * 1. Conversion of numbers from one base to another   2. Calculations involving indices are performed as per assignment concept.   3. Laws of Indices applied as per assignment concept   4. Laws of logarithms applied as per assignment concept   5. Calculations involving logarithms are performed as per assignment concept   6. Scientific calculator is used in solving mathematical problems as per manufacturer’s manual   7. Algebra expressions applied as per assignment concept   8. Transpose of formulae applied as per assignment concept   9. Simultaneous equations are performed as per the rules   10. Quadratic equations are calculated as per the concept |
| * 1. Apply ratio calculations | * 1. Rational and irrational numbers applied as per assignment concept   2. Expressions of ratios applied as per assignment concept   3. Direct and inverse proportions applied as per assignment concept |
| * 1. Apply Trigonometry | * 1. Linear graphs plotted as per assignment requirements   2. Interpret linear graphs as per the assignment requirements.   3. Calculations are performed using trigonometric rules |
| * 1. Carry out Mensuration | * 1. Perimeter and areas of regular and irregular figures are obtained as per assignment requirements   2. Volume and Surface area of solids are obtained as assignment requirements |
| * 1. Apply Statistics | 1. Grouped and ungrouped data collated as per assignment’s requirements 2. Tabulation of statistical data done as per the assignment’s requirements 3. Mean, median, mode, range and Standard deviation are calculated from given data as per assignment concept 4. Statistical data represented as per assignment task 5. Data interpreted as per representative graph |
| * 1. Apply Vectors | * 1. Manipulated vectors as per assignment concept   2. Resolved vectors as per assignment requirement |
| * 1. Apply commercial calculations | * 1. Exchange rates are calculated as per Nairobi Security Exchange policy   2. Calculated simple and compound interest as per assignment task Prices, profit and loss calculated as per assignment concept   3. Calculated hire purchase as per assignment concept   4. Calculated price appreciation and depreciation as per assignment task |

**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 mathematical operations (addition, subtraction, division, multiplication)
* Using and applying mathematical formulae
* Logical thinking
* Problem solving
* Applying statistics
* Drawing graphs
* Using different measuring tools
* Commercial calculations

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Fundamental operations (addition, subtraction, division, multiplication)
* Calculating area and volume
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Truncation and rounding techniques
* Types of fractions
* Types of tables and graphs
* Presentation of data in tables and graphs
* Vector operations
* Statistical operations

**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 Trigonometry 2. Carried out mensuration 3. Applied number series 4. Applied Vectors 5. Performed commercial calculations 6. Applied statistics |
| * 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. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 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 SCIENCE CALCULATIONS AND ELECTRICITY BASICS

**UNIT CODE: ENG/OS/WEF/CC/03/5/A**

**UNIT DESCRIPTION**

This unit describes the competencies required by a craft person in order to apply electricity basics in their work. It includes competencies in utilizing engineering materials, calculating force, work, energy and power, performing motion calculations, force moments calculations, friction force calculations, density and pressure calculations and applying electricity basics

**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. Utilize engineering materials | * 1. Material types identified as per task assignments   2. Material properties explained as per assignment task   3. Different materials applied as per task assignment. |
| 1. Calculate force, work energy, and power | * 1. Different units of measurements defined as per science principles   2. Different units converted from one form to another as per task requirements   3. Forces, work, energy and power related by simple calculations as per concepts of science.   4. Mechanical advantage and velocity ratio defined and calculated as per scientific principles.   5. Efficiency calculated as per principles of science   6. Simple machines illustrated as per assignment tasks. |
| 1. Perform motion calculations | * 1. Scalar and vector quantities differentiated as per concepts of science   2. Newton’s law of motion stated as per principles of science.   3. Law of momentum stated as per principles of science.   4. Displacement defined as per science concept   5. Displacement applied as per science concept   6. Simple displacement problems solved as per assignment requirements.   7. Forces resolved in two components as per assignment tasks. |
| 1. Perform force moments basic calculations | * 1. Principle of moment stated as per theories of science   2. Force moments calculated as per assignment tasks.   3. Centre of gravity explained as per principles of science   4. Centre of gravity calculated as per assignment requirements.   5. Force moments illustrated as per assignment tasks. |
| 1. Perform friction force calculations | * 1. Friction defined as per concepts of science   2. Advantages and disadvantages of friction discussed as per assignment tasks.   3. Problems in coefficient of friction solved as per assignment tasks. |
| 1. Perform density and pressure calculations | * 1. ***Density terminology*** discussed as per concepts of science   2. Density problems solved as per assignment requirements   3. Density application discussed as per assignment tasks.   4. Pressure concepts discussed in accordance with principles of science   5. Working principles of pressure discussed as per assignment tasks   6. Pressure problems solved as per assignment tasks   7. ***Pressure applications*** identified as per assignment tasks. |
| 1. Apply electricity basics | * 1. ***Electricity terminology*** explained as per electrical concepts   2. Electricity distribution described as per assignment tasks.   3. Electrical power conversion to welding power source explained as per assignment tasks.   4. Transformers explained as per assigned tasks   5. Transformers applied as per assignment tasks   6. Rectifiers explained as per assigned tasks   7. Rectifiers applied as per assignment tasks   8. Electrical hazards explained as per assignment tasks |

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. Density terminology may include but not limited to: | * + Density   + Relative density |
| 1. Pressure applications may include but not limited to: | * + Vacuum pump   + Hydraulic pump   + Hydrometers |
| 1. Electricity terminologies may include but not limited to: | * + Mains supply   + Power socket   + Current   + Alternating current   + Direct current   + Voltage   + Neutral cable   + Live cable   + Earth cable   + Open circuit   + Duty cycle   + Polarity   + Electric socket |

**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 mechanical formulae
  + Use of basic mechanical machines
  + Perform various unit conversions of mechanical quantities
  + Mechanical machine operation
  + Logical thinking
  + Problem solving
  + Using different measuring tools
  + Apply basic electrical principles

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton’s law
* Levers
* Type of forces
* Mechanical advantage, velocity ratio and efficiency calculations
* Properties of materials
* SI units of mechanical energy.
* Mechanical calculation of power, energy, and work done
* Units of measurement, conversions and abbreviations
* Basic electrical quantities and formulae

**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. Determined forces in a system   2. Demonstrated knowledge of moments   3. Applied friction principles   4. Applied motions in engineering   5. Described work, energy and power   6. Performed machine calculations   7. Applied heat knowledge   8. Applied density knowledge   9. Applied pressure principles   10. Applied basic electrical principles |
| 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 tools and equipment   3. Assort relevant electrical equipment. |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 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 ESTIMATION AND COSTING

**UNIT CODE:** ENG/OS/WEF/CC/04/5/A

**UNIT DESCRIPTION**

This unit describes the competencies required by a craft person in order to interpret specifications of a given project, analyse material quantities, prepare bill of quantities and undertake purchase and stock control.

**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. Interpret specifications of a given project | * 1. ***Project*** specifications interpreted as per task assignments   2. Material ***quantities*** analysed as per the assignment tasks.   3. Labour and overheads identified as per workplace procedures. |
| * + 1. Prepare quantities’ information | **2.1 *Information sources*** identified as per task assignments  2.2 Items, unit prices and unit description obtained in accordance with workplace procedures |
| * + 1. Prepare bill of quantities | 3.1 Bill of quantities form prepared as per work place procedures.  3.2 ***Material*** prices, description and quantity prepared in accordance with workplace procedures  3.3 Labour, overhead costs, profit margin and provisional sum calculated as per workplace procedures.  3.4 Material requisition order prepared as per workplace procedures.  3.5 Purchase order prepared as per workplace procedures. |
| * + 1. Undertake purchase and stock control | 4.1 Purchasing functions explained as per workplace procedures  4.2 Factors affecting store inventory explained as per workplace procedures.  4.3 Purchasing methods explained as per task assignments.  4.4 Qualities and knowledge of purchasing officer stated as per workplace procedures  4.5 Functions of stock control stated as per workplace procedures  4.6 Stock taking procedures explained as per workplace policy  4.7 Organization of store discussed as per workplace 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.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Quantities may include but not limited to***:*** | * + Material costs     - Direct     - Indirect   + Labour costs     - Direct     - Indirect   + Overhead cost   + Profit margin   + Provisional sum |
| 1. Material may include but not limited to***:*** | * + Nominal materials   + Actual materials |
| 1. Information Sources may include but not limited to***:*** | * + Local trade   + Quotation from suppliers   + Manufacturers magazines, catalogues and journals   + Relevant government agencies for material specifications   + Price inference from production costs |
| 1. Project may include but not limited to***:*** | * + Working drawings   + Sketches   + Sample items   + Models |

**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:

* Interpretation of specifications
* Logical thinking
* Problem solving
* Quantity analysis
* Use different measuring tools
* Communication

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Material quality and quantities
* Labour and overhead costing
* Units of measurement, conversions and abbreviations
* Commercial calculations
* Purchasing procedures
* Basic procurement procedure

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. Interpreted project specifications.   2. Labour and overheads identified as per workplace procedures   3. Items, unit prices and unit description obtained in accordance with workplace procedures.   4. Analysed quantities as per workplace procedures.   5. Prepared bill of materials as per workplace produces.   6. Purchase order prepared as per workplace procedures.   7. Factors controlling purchasing explained as per workplace procedures   8. Functions of stock control stated as per workplace procedures   9. Store procedures explained as per workplace policy   10. General store layout discussed as per workplace procedures |
| 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 tools and equipment 3. Computer 4. Calculator |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 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

## FABRICATE PRODUCTS AND STRUCTURES.

**UNIT CODE: ENG/OS/WEF/CR/01/5/A**

**UNIT DESCRIPTION**

This unit specifies competencies required to fabricate products and structures. Competencies include: lay out product/ structure, produce products and structures and conducting work place housekeeping.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Lay out product/ structure | * 1. safety and health is observed as per Workplace procedures and OSHA   2. working drawings are interpreted as per the KS, ISO and BS drawing standards   3. ***materials***, ***tools and equipment*** are selectedas per job specifications   4. components are measured and marked out as per job specifications |
| 1. Produce products and structures | * 1. work profiles are cut in accordance with working drawing specifications.   2. Profiles are worked to size as per working drawing specifications.   3. product/ structure is fabricated as per working drawing specifications   4. ***Finishing processes*** are selected as per working drawing specifications   5. finishing processes are applied as per working drawing specifications   6. product/ structure is inspected as per ISO/BS/ASME standards |
| 1. Conducting work place housekeeping | * 1. Workplace is cleaned and prepared before and after the tasks are completed as per work place procedures.   2. tools, equipment and unused materials and consumables are returned to safe area as per work place procedures.   3. Completed work piece is stored based on work place procedures   4. waste is disposed as per work place procedures and NEMA requirements. |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Materials may include but is not limited to: | * Metal tubes * Metal sheets * Metal plates * Metal bars |
| 1. Tools and Equipment may include but is not limited to: | * Hand tools * Powered hand tools * Metal cutting machines |
| 1. Finishing processes may include but is not limited to: | * Deburring * Polishing * Painting * Varnishing * Oil blackening * Bluing * Buffing * Electroplating * Enamelling |

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Material types and properties
* Types and use of:
* Marking out tools
* Measuring and checking tools
* Cutting tools and equipment
* Forming tools
* Finishing tools
* Finishing processes

**Required Skills**

The individual needs to demonstrate the following skills:

* Selecting materials and tools
* Testing materials and equipment
* Cutting and sizing the work pieces
* Applying finishing processes
* Interpreting working drawing

**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. Observed safety procedures as per workplace procedures and OSHA   2. Selected materials, tools and equipment as per working drawing specifications   3. Tested materials as per working drawing specifications   4. Measured and marked out work pieces   5. Sized work pieces as per working drawing specifications   6. Assembled the work pieces to produce the products   7. Fabricated the product as per the working drawing specifications   8. Applied finishing processes as per the working drawing specifications   9. Applied housekeeping as per workplace procedures |
| 1. Resource implications | The following resources must be provided:   * 1. Fabrication workplace meeting OSHA standards   2. Tools and equipment relevant to the task   3. Personal Protective Equipment |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practical tests |
| 1. Context of assessment | Candidate will be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within  this occupational sector. |

## PERFORM SOLDERING AND GAS WELDING

**UNIT CODE: ENG/OS/WEF/CR/02/5/A**

**UNIT DESCRIPTION**

This unit specifies competencies required for setting up equipment and materials, carrying out soldering process, setting up gas welding equipment and materials, carrying gas welding, setting gas cutting equipment and materials and carrying out gas cutting operation,

**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. Set up soldering equipment and materials | * 1. Safety and health practices are observed as per Workplace procedures and OSHA   2. Working drawings are interpreted as per ISO/KS/BS drawing standards.   3. Materials, tools and equipment are selected as per working drawing specifications   4. Joints are prepared as per working drawings specifications   5. ***Soldering equipment*** is set up as per job specifications |
| 1. Carry out soldering process | * 1. Work pieces are soldered as per job specifications   2. Soldered joints are examined as per ISO standards   3. Recorded soldered-joint quality results as per ISO Soldering procedure record   4. Housekeeping is conducted as per workplace procedures |
| 1. Set up gas welding equipment and materials | * 1. Safety and health practices are observed as per Workplace procedures and OSHA   2. Working drawings are interpreted as per ISO/KS/BS drawing standards.   3. Materials, tools and equipment are selected as per working drawing specifications   4. Joints are prepared as per job specifications   5. ***Gas welding equipment*** is set up as per job specifications |
| 1. Carry out gas welding process | * 1. Safety and health practices are observed as per workplace procedures and OSHA.   2. Work pieces are gas welded as per working drawing specifications and ISO standards   3. Post weld treatment is performed according to job specifications   4. Welded joints as examined per ISO standards standard   5. Recorded weld-joint quality results as per ISO welding procedure record   6. Housekeeping is conducted in accordance with workplace procedures |
| 1. Set up gas cutting equipment and materials | * 1. Safety and health practices are observed as per Workplace procedures and OSHA   2. Working drawings are interpreted as per ISO/KS/BS drawing standards   3. ***Materials***, tools and equipment are selected as per working drawing specifications   4. Gas cutting torch is set up as per job specifications |
| 1. Carry out gas cutting operation | * 1. Safety and health practices are observed as per workplace procedures and OSHA   2. Work pieces are gas cut as per job specifications and ISO standards   3. Kerf is examined as per standard operating procedures and ISO standards   4. Housekeeping is conducted in accordance with workplace 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.

| **Variable** | **Range** |
| --- | --- |
| 1. Soldering equipment include but not limited to: | * + - Soldering safety gear     - Soldering bits/ iron     - Solder     - Heat source     - Soldering fluxes     - Brazing fluxes     - Brazing rods (Spelter) |
| 1. Gas welding equipment include but not limited to: | * + - Gas welding PPE     - Gas cylinders     - Gas welding torch     - Gas cutting torch     - Regulators     - Hoses     - Spark lighter/ gas lighter |
| 1. Materials include but not limited to: | * + - Metal tubes     - Metal sheets     - Metal plates     - Metal bars |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures and OSHA
* Gas welding equipment
* Joint preparation techniques
* Welding positions
* Soldering techniques and specification procedure
* Gas welding techniques and specification procedure
* BS and ISO welded joint standards
* Workplace housekeeping procedures
* Gas cutting techniques
* Gas cutting equipment
* Gas cutting safety
* Filler metal classifications
* Welding nozzle classifications

**Required skills**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Preparing joints
  + Soldering
  + Gas welding
  + Gas cutting
  + Product assessment
  + Workplace housekeeping procedures

**EVIDENCE GUIDE**

This section 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. Observed safety and health as per Workplace procedures and OSHA   2. Selected materials, tools and equipment as per working drawing specifications   3. Prepared joints as per working drawings   4. Set up soldering equipment in accordance with job specifications   5. Soldered work as per job specifications and ISO standard   6. Set up gas welding equipment in accordance with job specifications   7. Gas welded work pieces as per job specifications and ISO standard   8. Gas welded work pieces are examined as per ISO standard   9. Set up gas cutting equipment as per job specifications   10. Gas cut work pieces as per job specifications |
| 1. Resource implications | The following resources must be provided:   * 1. Fully equipped soldering and gas welding workshop meeting OSHA standards   2. Soldering, gas welding and gas cutting consumables and equipment   3. Personal Protective Equipment |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practical tests |
| 1. Context of assessment | Candidate will be assessed   1. On job 2. Off 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 MANUAL METAL ARC WELDING

**UNIT CODE: ENG/OS/WEF/CR/03/5/A**

**UNIT DESCRIPTION**

This unit specifies competencies required to prepare materials, set up Manual Metal Arc (MMA) equipment and apply safety in MMA welding. It involves competencies to weld in all positions using manual metal arc welding process. It is also known as Shielded Metal Arc Welding (SMAW).

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Set up MMA equipment and materials | * 1. Safety and health practices are observed as per Workplace procedures and OSHA   2. Working drawings are interpreted as per ISO/BS/KS drawing standards   3. ***Materials***, tools and equipment are selected as per working drawing specifications   4. Joints are prepared as per working drawing specifications   5. Set up ***MMA welding equipment*** as per job specifications and ISO standard |
| 1. Carry out MMA welding process | * 1. Safety and health are observed as per workplace procedures and OSHA   2. Welded work pieces using manual metal arc welding process as per working drawing specifications and ISO standard   3. Weld joint is examined as per ISO standards   4. Recorded weld-joint quality results as per ISO welding procedure record   5. Housekeeping is conducted as per workplace 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.

| **Variable** | **Range** |
| --- | --- |
| 1. MMA welding equipment may include but is not limited to: | * + MMA welding PPE   + Welding machine   + Welding accessories e.g. driers, welding containers   + Electrodes |
| 1. Materials may include but is not limited to: | * + Metal tubes   + Metal sheets   + Metal plates   + Metal bars |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Workplace procedures and OSHA
* MMA welding equipment
* Joint preparation
* Types of electrodes
* MMA welding techniques and specification procedure
* Setting current on MMA equipment
* BS and ISO welding standards
* Applications of MMA
* MMA cutting techniques
* MMA welding safety procedures
* Workplace housekeeping procedures

**REQUIRED SKILLS**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Preparing joints
  + MMA welding
  + Manipulation of electrodes
  + MMA cutting
  + Product assessment
  + Observation of safety
  + Workplace housekeeping procedures

**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. Observed safety and health as per Workplace procedures and OSHA   2. Selected materials, tools and equipment   3. Prepared joints as per working drawing   4. Set up MMA welding equipment in accordance with job specifications   5. Welded work piece using MMA process as per job specifications and ISO standard   6. Welded Work pieces are examined as per ISO standard   7. Dressed welded joint as per standard operating procedures and ISO standards and client’s specifications |
| 1. Resource implications | The following resources must be provided:   * 1. Fully equipped welding workshop meeting OSHA standards   2. Welding consumables and equipment   3. Personal Protective Equipment |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practical tests |
| 1. Context of assessment | Candidate will be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within  this occupational sector. |

## PERFORM GAS METAL ARC WELDING (GMAW)

**UNIT CODE: ENG/OS/WEF/CR/04/5/A**

**UNIT DESCRIPTION**

This unit specifies competencies required for material preparation, setting up of GMAW welding equipment and application of safety in GMAW welding. It involves competencies in thermal joining of metals using consumable electrodes. GMAW encompasses MIG and MAG welding processes.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Set up GMAW welding equipment and materials | * 1. Interpreted working drawings as per BS/ISO/ KS drawing standards   2. ***Materials***, tools and equipment are selected as per working drawing specifications   3. Joints are prepared as per working drawings specifications   4. Set up ***GMAW* *welding equipment*** as per job specifications |
| 1. Carry out GMAW welding | * 1. Observed safety as per workplace procedures and OSHA   2. Welded work pieces using GMAW process as per job specifications and ISO standard   3. Examined the weld joint as per ISO standards   4. Recorded weld-joint quality results as per welding specification record.   5. Housekeeping is conducted as per workplace 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.

| **Variable** | **Range** |
| --- | --- |
| * GMAW welding equipment may include but is not limited to: | * + Welding PPE   + Welding machine   + Welding accessories   + Feed wire |
| * Materials may include but is not limited to: | * Metal tubes * Metal sheets * Metal plates * Metal bars |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Workplace procedures and OSHA
* GMA welding equipment
* Joint preparation
* GMA welding techniques and specification procedure
* Setting of wire feed rate
* BS and ISO standards
* GMA welding safety procedures
* Applications of GMAW
* Workplace housekeeping procedures
* Electrodes classification

**REQUIRED SKILLS**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Preparing joints
  + GMA welding techniques
  + Product quality assessment
  + Manipulation of GMAW feed rate
  + Observation of safety
  + Workplace housekeeping procedures

**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. Observed safety as per workplace procedures and OSHA   2. Selected materials, tools and equipment   3. Prepared joints as per working drawings specifications   4. Set up GMAW welding equipment in accordance with job specifications   5. Welded work pieces using GMAW process as per job specifications and ISO standard   6. Welded work pieces are examined as per ISO standard   7. Conducted housekeeping as per workplace procedures |
| 1. Resource implications | The following resources must be provided:   * 1. Fully equipped welding workshop meeting OSHA standards   2. GMAW welding consumables and equipment   3. Personal Protective Equipment |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practical tests |
| 1. Context of Assessment | Candidate will be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment | This unit may be assessed on an integrated basis with others within  this occupational sector. |

## PERFORM TUNGSTEN INERT GAS (TIG) WELDING

**UNIT CODE: ENG/OS/WEF/CR/05/5/A**

**UNIT DESCRIPTION**

This unit specifies competencies required for material preparation, setting up of Tungsten Inert Gas (TIG) welding equipment and application of safety in TIG welding. It also includes competencies in thermal joining of metals using non-consumable electrodes. It is also known as Gas Tungsten Arc Welding (GTAW).

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Set up TIG welding equipment and materials | * 1. Safety and health practices are observed as per Workplace procedures and OSHA   2. Working drawings are interpreted as per ISO/BS/KS drawing standards   3. ***Materials***, tools and equipment are selected as per working drawing specifications.   4. Joint designs are prepared as per job specifications.   5. ***TIG welding equipment*** are set up as per job specifications. |
| 1. Carry out TIG welding | * 1. Safety and health are observed as per workplace procedures and OSHA   2. Welded work pieces using TIG process as per working drawings specifications and ISO standard   3. Examined weld joint as per ISO standards   4. Recorded weld-joint quality results as per ISO welding procedure record.   5. Housekeeping is conducted as per workplace 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.

| **Variable** | **Range** |
| --- | --- |
| 1. TIG welding equipment may include but is not limited to: | * + TIG welding PPE   + TIG Welding machine   + TIG welding accessories   + Electrodes |
| 1. Materials may include but is not limited to: | * + Metal tubes   + Metal sheets   + Metal plates   + Metal bars |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Workplace procedures and OSHA
* TIG welding equipment
* Joint preparation
* TIG welding techniques and specification procedure
* Setting of wire feed rate
* BS and ISO standards
* TIG welding safety procedures
* Applications of TIG
* Workplace housekeeping procedures

**REQUIRED SKILLS**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Preparing joints
  + TIG welding techniques and specification procedure
  + Product assessment
  + TIG electrode manipulation
  + Observation of safety
  + Workplace housekeeping procedures

**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. Observed safety as per Workplace procedures and OSHA   2. Selected materials, tools and equipment   3. Prepared joints as per working drawings   4. Set up TIG welding equipment in accordance with job specifications   5. Welded work pieces using TIG process as per job specifications and ISO standard   6. Welded work pieces are examined as per ISO standard   7. Conducted housekeeping as per workplace procedures |
| 1. Resource implications | The following resources must be provided:   * 1. Fully equipped welding workshop meeting OSHA standards   2. TIG welding consumables, non-consumables and equipment   3. Personal Protective Equipment |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practical tests |
| 1. Context of Assessment. | Candidate will be assessed   1. On job 2. Off job 3. During Industrial Attachment. |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within  this occupational sector. |

## PERFORM SPOT AND SEAM RESISTANCE WELDING

**UNIT CODE: ENG/OS/WEF/CR/06/5/A**

**UNIT DESCRIPTION**

This unit of competency specifies competencies required for setting up spot equipment and materials, carrying out spot welding, setting up seam equipment and materials and carrying out seam welding

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Set up spot welding equipment and materials | * 1. Working drawings are interpreted as per BS/ISO/ KS drawing standards.   2. Materials, tools and equipment are selected as per working drawing specifications.   3. Prepared surface joint as per the working drawing specification   4. Set up ***spot welding equipment*** as per job specifications |
| 1. Carry out spot welding | * 1. Safety and health practices are observed as per workplace procedures and OSHA   2. Welded work pieces using spot process as per job specifications and ISO standard   3. Examined weld joint as per ISO standards   4. Recorded weld-joint quality results as per welding specification record.   5. Housekeeping is conducted in accordance with workplace procedures as workplace procedures |
| 1. Set up seam welding equipment and materials | * 1. Interpreted working drawings as per BS/ISO/ KS drawing standards   2. ***Materials***, tools and equipment are selected as per working drawing specifications   3. Joints are prepared as per working drawings   4. Set up ***seam welding equipment*** as per job specifications |
| 1. Carry out seam welding | * 1. Observed safety as per workplace procedures and OSHA.   2. Performed seam weld process as per job specification and ISO standard.   3. Examined the weld joint as per ISO standards.   4. Recorded weld-joint quality results as per welding specification record.   5. Housekeeping is conducted as per workplace 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.

| **Variable** | **Range** |
| --- | --- |
| 1. Spot welding equipment may include but is not limited to: | * + - Spot welding PPE     - Spot welding machine     - Spot welding accessories |
| 1. Seam welding equipment may include but is not limited to: | * + Seam welding PPE   + Seam welding machine   + Seam welding accessories |
| 1. Materials may include but is not limited to: | * Sheet metals made of:   + Mild steel   + Aluminium and alloys   + Stainless steel   + Copper and alloys |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Workplace procedures and OSHA
* Spot and seam welding equipment
* Surface preparation
* Spot and seam welding operation and specification procedure
* BS and ISO welding standards
* Spot and seam welding safety procedures
* Application of spot and seam welding
* Spot and seam welding workplace housekeeping procedures

**REQUIRED SKILLS**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Preparing surfaces for welding
  + Spot and seam welding techniques
  + Product assessment
  + Workplace housekeeping procedures

**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. Observed safety and health as per Workplace procedures and OSHA   2. Selected materials, tools and equipment as per working drawing specifications   3. Prepared surfaces as per working drawing specifications   4. Set up spot welding equipment in accordance with job specifications   5. Set up seam welding equipment in accordance with job specifications   6. Welded work pieces using spot process as per job specification and ISO standard   7. Welded work pieces using seam process as per working drawing specification and ISO standard   8. Welded work pieces are examined as per ISO standards   9. Conducted housekeeping according to work place procedures |
| 1. Resource Implications | The following resources must be provided:   * 1. Fully equipped welding workshop meeting OSHA standards   2. Spot welding equipment and accessories   3. Seam welding equipment and accessories   4. Personal Protective Equipment |
| 1. Methods of Assessment. | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practical tests |
| 1. Context of Assessment. | Candidate will be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within  this occupational sector. |

## PERFORM WELD TESTING

**UNIT CODE: ENG/OS/WEF/CR/07/5/A**

**UNIT DESCRIPTION**

This unit of competency specifies competencies required while observing safety to set up testing equipment and Accessories and perform welding Testing

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Set up testing equipment and accessories | * 1. Safety and health practices are observed as per workplace procedures and OSHA   2. Sample work is prepared pieces as per standard operating procedures   3. Testing materials are prepared, tools and equipment as per the standard operating procedures   4. Set up testing equipment as per standard testing procedures   5. Calibrate testing equipment as per standard operating procedures |
| 1. Perform weld testing | * 1. Carry out the ***non-destructive tests*** as per the ISO standards   2. Carry out the ***destructive test*s** as per the ISO standards   3. Record test results as per workplace procedures/ welding procedure record   4. Conduct housekeeping before and after tasks as per workplace 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.

| **Variable** | **Range** |
| --- | --- |
| 1. Destructive tests may include but is not limited to: | * + Tensile test   + Bend test   + Fracture test |
| 1. Non-destructive tests may include but is not limited to: | * + Visual inspection   + Ultrasonic   + Radiographic test   + Magnetic particle test   + Dye penetrant |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Safety procedures in carrying out weld tests
* Welding defects
* Qualities of good weld
* BS and ISO welding standards
* Destructive test techniques
* Non-destructive test techniques
* Weld test recording procedures

**REQUIRED SKILLS**

The individual needs to demonstrate the following skills:

* Identifying weld defects/imperfections
* Conducting destructive tests
* Conducting non-destructives tests
* Recording of weld test results

**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. Observed safety and health as per workplace procedures and OSHA   2. Prepared the work pieces as per standard operating procedures   3. Prepared testing materials, tools and equipment as per SOPs/ ISO quality requirements for welding.   4. Set up testing equipment as per standard operating procedures   5. Calibrate testing equipment as per standard operating procedures   6. Carried out the destructive tests as per the standard operating procedures   7. Carried out the non-destructive tests as per the standard operating procedures   8. Recorded weld test results as per workplace procedures/ welding procedure record   9. Housekeeping is conducted as per workplace procedures |
| 1. Resource implications | The following resources must be provided:   * 1. Testing equipment   2. PPE   3. Weld samples |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practical tests |
| 1. Context of assessment | Candidate will be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within  this occupational sector. |