

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**INDUSTRIAL PLANT OPERATOR**

**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 blueprint, Vision 2030 and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010. 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 shall be competency based, curriculum development shall be industry led, certification shall be based on demonstration of competence and mode of delivery shall allow 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 Industrial Plant Operations. These Occupational Standards will also be the bases 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 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 a shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Engineering Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for Industrial Plant Operations Technician. These standards will be the bases for development of competency-based curriculum for Industrial Plant Operations.

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

**Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. EngTech.**

**CHAIRMAN, TVET CDACC**

# ACKNOWLEDGMENT

These occupational standards have been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support was received from various organisations.

I appreciate the funding of the Government of Canada and its implementing partner Colleges and Institutes Canada (CICan) which enabled the development of these standards through the Kenya Education for Employment Program (KEFEP).

I also appreciate the Kisumu National Polytechnic and its Canadian technical partners from Humber College who collaborated to identify industry skills gaps and develop these standards.

I recognize with appreciation the role of industry partners including the National Polytechnic’s Industry Advisory Committee and the Engineering Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in these standards. I also thank all stakeholders in the sector for their valuable input and all those who participated in the process of developing these standards.

I am convinced that occupational standards will go a long way in ensuring that workers in this sector acquire competencies that will enable them to perform their work more efficiently.

**CHAIRPERSON ENGINEERING SECTOR SKILLS ADVISORY COMMITTEE**

# ACRONYMNS

CBET Competency Based Education and Training

CDACC Curriculum Development Assessment and Certification Council

CU Curriculum

EMCA Environmental Management and Conservation Act

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualifications Authority

MOE Ministry of Education Science and Technology

NGO Non-Governmental Organization

NOS National Occupation Standard

OS Occupational Standard

OSHA Occupation Safety and Health Act

PPE Personal Protective Equipment

RPL Recognition of Prior Learning

SSAC Sector Skills Advisory Committee

TVET Technical and Vocational Education and Training

MHE Material Handling Equipment

# KEY TO UNIT CODE

ENG/OS/IPO/BC/01/5/A

Industry or sector

Occupational standards

Occupational area

Type of competency

Competency number

Competency level

Version control

# COURSE OVERVIEW

This course is designed to equip an Industrial Plant Operator technician with the competencies required to perform various duties aligned to this sector**.**

The course consists of basic ,common and core units of learning as indicated below

**BASIC COMPETENCIES**

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

**COMMON COMPETENCIES**

|  |  |
| --- | --- |
| **Unit of Competency Code** | **Unit of Competency Title** |
| ENG/OS/IPO/CC/01/5/A | Perform Workshop Practice |
| ENG/OS/IPO/CC/02/5/A | Apply Engineering Mathematics |
| ENG/OS/IPO/CC/03/5/A | Apply Electrical Principles |
| ENG/OS/IPO/CC/04/5/A | Prepare and Interpret Technical drawing |

**CORE COMPETENCIES**

|  |  |
| --- | --- |
| **Unit of Competency Code** | **Unit of Competency Title** |
| ENG/OS/IPO/CR/01/5/A | Maintain Industrial Boilers |
| ENG/OS/IPO/CR/02/5/A | Maintain Industrial Steam Turbines |
| ENG/OS/IPO/CR/03/5/A | Maintain Industrial Pneumatic Systems |
| ENG/OS/IPO/CR/04/5/A | Maintain Industrial Hydraulic Systems Material Handling |
| ENG/OS/IPO/CR/05/5/A | Maintain Industrial Material Handling Equipment |
| ENG/OS/IPO/CR/06/5/A | Service and Maintain Industrial Pumps |

# BASIC UNITS OF COMPETENCIES

**DEMONSTRATE COMMUNICATION SKILLS**

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

**UNIT DESCRIPTION**

This unit covers the competencies required to use specialized communication skills to meet specific needs of internal and external clients, conduct interviews, facilitate discussion with groups and contribute to the development of communication strategies.

**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 2. Different approaches are used to meet communication needs of clients and colleagues 3. Conflict is addressed promptly and in a timely way and in a manner which does not compromise the standing 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 required   2. Channels of communication are established and reviewed regularly   3. Coaching ineffective communication is provided   4. Work related network and relationship are maintained as necessary   5. Negotiation and conflict resolution strategies are used where required   6. Communication with clients and colleagues is appropriate to individual needs and organizational objectives |
| 1. Conduct interviews | 1. A range of appropriate communication strategies are employed in ***interview situations*** 2. Records of interviews are made and maintained in accordance with organizational procedures 3. Effective questioning, listening and nonverbal communication techniques are used to ensure that required message is communicated |
| 1. Facilitate group discussions | 1. Mechanisms which enhance effective group interaction is defined and implemented 2. Strategies which encourage all group members to participate are used routinely 3. Objectives and agenda for meetings and discussions are routinely set and followed 4. Relevant information is provided to group to facilitate outcomes 5. Evaluation of group communication strategies is undertaken to promote participation of all parties 6. Specific communication needs of individuals are identified and addressed |
| 1. Represent the organization | 1. When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization 2. Presentation is clear and sequential and delivered within a predetermined time 3. Utilize appropriate media to enhance presentation 4. Differences in views are respected 5. Written communication is consistent with organizational standards 6. Inquiries are responded in a manner consistent with 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** |
| * Communication strategies include but not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrase * Clarification request * Translation * Restructuring * Approximation * Generalization |
| * Effective group interaction includes 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 |
| * Situations 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:

* Effective communication process
* Active listening
* Giving/receiving feedback
* Interpretation of information
* Role boundaries setting
* Negotiation
* Establishing empathy
* Openness and flexibility in communication
* Communication skills required to fulfill job roles as specified by the organization

**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
* Communication skills relevant to client groups

**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. Direct Observation/Demonstration with Oral Questioning 2. Written Examination |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 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/IPO/BC/03/5/A

**UNIT DESCRIPTION**

This unit covers the competencies required to effectively use digital devices such as smartphones, tablets, laptops and desktop PCs. It entails identifying and using digital devices such as smartphones, tablets, laptops and desktop computers for purposes of communication, work performance and management at the work place.

**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.   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   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** |
| * Appropriate computer software may include but not limited to: | A collection of instructions or computer tools that enable the user to interact with a *computer*, its hardware, or perform tasks. |
| * Appropriate computer hardware may include but not limited to: | Collection of physical parts of a computer system such as;   * Computer case, monitor, keyboard, and mouse * All the parts inside the computer case, such as the hard disk drive, motherboard and video card |
| * Data security and privacy may include but not limited to: | * Confidentiality of data * Cloud computing * Integrity -but-curious data surfing |
| * Security and control measures may include but not limited to: | * Counter measures against cyber terrorism * Risk reduction * Cyber threat issues * Risk management * Pass wording |
| * Security threats may include but not limited to: | * Cyber terrorism * Hacking |
| * Word processing concepts may include but not limited to: | Using a special program to create, edit and print documents |
| * Network configuration may include but not limited to: | Organizing and maintaining information on the components of a computer network |

**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
* Computing (applying fundamental operations such as addition, subtraction, division and multiplication)
* Using calculator
* 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
* Word processing;
* Functions and concepts of word processing.
* Documents and tables creation and manipulations
* Mail merging
* Word processing utilities
* Spread sheets;
* Meaning, formulae, function and charts, uses and layout
* Data formulation, manipulation and application to cells
* Database;
* Database design, data manipulation, sorting, indexing, storage retrieval and security
* Desktop publishing;
* Designing and developing desktop publishing tools
* Manipulation of desktop publishing tools
* Enhancement of typeset work and printing documents
* Presentation Packages;
* Types of presentation Packages
* Creating, formulating, running, editing, printing and presenting slides and handouts
* Networking and Internet;
* Computer networking and internet.
* Electronic mail and world wide web
* Emerging trends and issues in ICT;
* Identify and integrate emerging trends and issues in ICT
* Challenges posed by emerging trends and issues

EVIDENCE GUIDE

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified 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 | * 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. Demonstration   3. Practical assignment   4. Interview/Oral Questioning   5. Demonstration |
| 1. Context of Assessment | Competency may be assessed in an off and on the job setting |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE ENTREPRENEURIAL SKILLS

**UNIT CODE :** ENG/OS/IPO/BC/04/5/A

**UNIT DESCRIPTION**

This unit covers the outcomes required to build and develop the enterprise to be more competitive within a changing business environment, specifically responding to consumer demands while maintaining product quality and accessibility, building a customer base and employee motivation.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT** | **PERFORMANCE CRITERIA** |
| 1. Develop business Innovative strategies | 1. Business innovation strategies are determined in accordance with the organization strategies 2. Business innovative strategies are implemented for the purpose of business growth 3. Track record and normative capability profile of enterprise and similar businesses are reviewed and considered in setting ***strategic directions***. 4. Strengths, weaknesses, opportunities and threats are considered when developing new ideas, approaches, goals and directions 5. Decisions about enterprise strategies/directions are made after careful consideration of all relevant information 6. ***Business/corporate plan*** is developed that sets out tactics, resource implications, timeframes, production and sales target |
| 1. Develop new products/ markets | 2.1 Alternative product/service offerings are canvassed and studied for feasibility  2.2 Potential and new sources/sellers of supplies and raw materials are identified and canvassed.  2.3 Target markets and buyers are identified and surveyed as to their preferences and brand loyalties. |
| 1. Expand customers and product lines | 3.1 Enterprise is built up and sustained through responsiveness to market demands and the regulatory environment.  3.2 Competitive advantage of existing products and services is maintained/enhanced through responsive advocacies and strategies.  3.3 Constant listening to stakeholder/client feedback is ensured to maintain loyal client base. |
| 1. Motivate staff/workers | 4.1 Regular dialogue is established and maintained in all levels and relevant sections of the enterprise  4.2 Flow of communications in both directions is encouraged  4.3 Helpful mechanisms and benefits are implemented  4.4 Issues/problems are proactively resolved through win-win solutions wherever practicable |
| 1. Expand employed capital base | 5.1 Capital employed in business is continuously reviewed as per the strategic plan  5.2 Business share holdings are reviewed in accordance with the type of business  5.3 Capital employed is expanded according to organization procedures  5.3 Types of shares are determined according to strategic plan  5.4 Shares diversification process is undertaken as per office procedures  5.5 Role of shareholders is determined and implemented in accordance organization procedures |
| 1. Undertake county/ regional business expansion | 6.1 Regions for expansion are continuously reviewed in accordance with strategic plan and company’s expansion plan  6.2 County business regulations are reviewed and adhered to in accordance with set procedures  6.3 Regional laws and regulations are adhered to in accordance with set procedures  6.4 County/regional business expansion is undertaken in accordance with organization’s growth/ expansion plan |

**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** |
| * Strategic directions include but not limited to: | * Business continuity and succession * Resource access security * Core competencies development * New developments e.g. technological change, new products |
| * Business/Corporate plan * include but not limited to: | * Action steps and responsibilities of departments and individual workers * Resource requirements and budget * Tactics and strategies to achieve objectives |
| * Helpful mechanisms include but not limited to: | * Wage and non-wage benefits * Employee awards and recognition systems * Employee rights and welfare policies * Full-disclosure/transparency policies |

**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:

* Assessing a range of alternative products and strategies
* Critically analyzing information, summarizing and making sense of previous and current market trends
* Identifying changing consumer preferences and demographics
* Thinking “outside the box”
* Ensuring quality consistency
* Reducing lead time to product/service delivery
* Managing operations/ production
* Using formal problem-solving procedures, e. g., root-cause analysis, six sigmas
* Communication skills
* Applying motivational principles, e. g., positive stroking, behavior modification
* Assessing range of alternatives rather than choosing the easiest option
* Achieving ownership and credibility for the enterprise vision
* Critically analyzing information, summarizing and making sense of previous and current market trends
* Developing solutions and practical strategies which are “outside the box”

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Public-relations strategies
* Basic cost-benefit analysis
* Basic financial management
* Business strategic planning
* Impact of change on individuals, groups and industries
* Employee assistance
* Government and regulatory processes
* Local and international market trends
* Product promotion strategies
* Mechanisms in the enterprise
* Market and feasibility studies
* Local and global supply chains Business models and strategies
* Government and regulatory processes
* Local and international business environment
* Concepts of change management
* Relevant developments in other industries
* Capital employed
* Regional/ County business expansion
* Innovation in business

**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:  1.1 Demonstrated ability to maintain a profitable and stable enterprise as shown by stakeholder feedback, employee testimonies and company financial statements  1.2 Demonstrated ability to conceptualize and plan a micro/small enterprise  1.3 Demonstrated ability to manage/operate a micro/small-scale business  1.4 Demonstrated basic marketing skills |
| 2. Resource Implications | The following resources should be provided:  2.1 Interview guide for entrepreneurs  2.2 Enterprise workers and third parties  2.3 Materials and location relevant to the proposed activity and tasks |
| 3. Methods of Assessment | 3.1 Case problems  3.2 Interview  3.3 Portfolio  3.4 Third part reports |
| 4. Context of Assessment | 4.1 Competency may be assessed in workplace or in a simulated workplace setting  4.2 Assessment shall be observed while tasks are being undertaken whether individually or in-group |
| 5. 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/IPO/BC/04/5/A

**UNIT DESCRIPTON**

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 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. Emotions are managed 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. 6. Self-esteem and a positive self-image are developed and maintained. 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 as per ***personal objectives*** 10. Critics are managed as per personal objectives |
| 1. Demonstrate interpersonal communication | 1. Listening and understanding is demonstrated as per communication policy 2. Writing to the needs of the audience is demonstrated as per communication policy 3. Speaking, reading and writing is demonstrated as per communication policy 4. Empathising is demonstrated as per the communication policy 5. Internal and external customers’ needs are identified and interpreted as per the communication policy 6. Persuasion is demonstrated as per the communication policy 7. Communication networks are established as per the SOPs 8. Information is shared as per communication structure |
| 1. Demonstrate critical safe work habits | * 1. Stress is managed in accordance with workplace procedures.   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. Work priorities are set in accordance to workplace procedures.   5. Leisure time is recognized in line with organization policy.   6. Abstinence from ***drug and substance abuse*** is observed as per workplace policy.   7. Awareness of HIV and AIDS is demonstrated in line with workplace requirements.   8. Safety consciousness is demonstrated in the workplace based on organization safety policy.   9. ***Emerging issues*** are dealt with in accordance with organization policy. |
| 1. Lead small teams | 1. Performance expectations for the ***team*** are set as per the organization objectives 2. Tasks are assigned in accordance with the organization policy. 3. Team performance indicators are identified according to set rules and regulations. 4. ***Forms of communication*** in a team are established according to office policy. 5. Communication is carried out as per workplace place policy and requirements of the job. 6. ***Feedback*** on performance is collected and analyzed based on established team learning process 7. ***Gender mainstreaming*** is undertaken in accordance with set regulations. |
| 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 availed based on job requirements.   3. Licensees and certifications relevant to job and career are obtained and renewed.   4. ***Personal growth*** is pursued towards improving the qualifications set for the profession.   5. Work priorities are identified based on requirement of the job and workplace policy.   6. Recognitions are sought as proof of career advancement in line with professional requirements. |
| 1. Demonstrate workplace learning | * 1. Own learning is managed as per workplace policy.   2. Learning opportunities are sought and allocated based on job requirement and in line with organization policy.   3. Contribution to the learning community at the workplace is carried out.   4. ***Range of media for learning*** are identified as per the training need   5. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job   6. Enthusiasm for ongoing learning is demonstrated   7. Time and effort is invested in learning new skills-based job requirements   8. Willingness to learn in different context is demonstrated based on available learning opportunities arising in the workplace.   9. Opportunities for performance improvement are identified proactively in area of work.   10. Awareness of personal role in workplace ***innovation*** is demonstrated. |
| 1. Demonstrate problem solving skills | * 1. Problems are identified as per the context of data and circumstances   2. Problem solutions are sought based on the problem   3. Independence and initiative in identifying and solving problems is demonstrated.   4. Team problems are solved as per the workplace guidelines   5. Problem solving strategies are applied as per the workplace guidelines |
| 1. Demonstrate workplace ethics | * 1. Policies and guidelines are observed as per the workplace requirements   2. Self-worth and profession is exercised in line with personal goals and organizational policies   3. Code of conduct is observed as per the workplace requirements   4. Personal and professional integrity is demonstrated as per the personal goals   5. Commitment to jurisdictional laws is demonstrated as per the workplace requirements |

**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** |
| * Drug and substance abuse include but not limited to: | Commonly abused   * Alcohol * Tobacco * Miraa * Over-the-counter drugs * Cocaine * Bhang * Glue |
| * Feedback includes but not limited to: | * Verbal * Written * Informal * Formal |
| * Relationships includes but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| * Forms of communication include but not limited to: | * Written * Visual * Verbal * Non verbal * Formal and informal |
| * Team includes but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| * Personal growth includes 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 | |
| * Personal objectives include but not limited to: | * Long term * Short term * Broad * Specific |
| * Trainings and career opportunities includes but not limited to | * Participation in training programs * Technical * Supervisory * Managerial * Continuing Education * Serving as Resource Persons in conferences and workshops |
| * Resource include but not limited to: | * Human * Financial * Technology * Hardware * Software |
| * Innovation include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| * Emerging issues include but not limited to: | * Terrorism * Social media * National cohesion * Open offices |
| * Range of media for learning 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:

* Personal hygiene practices
* Intra and Interpersonal skills
* Communication skills
* Knowledge management
* Interpersonal skills
* Critical thinking skills
* Observation skills
* Organizing skills
* Negotiation skills
* Monitoring skills
* Evaluation skills
* Record keeping skills
* Problem solving skills
* Decision Making skills
* Resource utilization skills
* Resource mobilization skills

**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
* Negotiation
* Assertiveness
* Team work
* Gender mainstreaming
* HIV and AIDS
* Drug and substance abuse
* Leadership
* Safe work habits
* Professional growth and development
* Technology in the workplace
* Learning
* Creativity
* Innovation
* 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. Case studies/scenarios |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * Oral Interview * Observation * Third Party Reports * Written |
| 1. Context of Assessment | * 1. Competency may be assessed in workplace or in a simulated workplace setting   2. Assessment shall be observed while tasks are being undertaken whether individually or in-group |
| 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/IPO/BC/05/5/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to follow procedures for environmental hazard control, follow procedures for environmental pollution control, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, develop and adhere to environmental protection principles/strategies/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. 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*** complied following environmental regulations. |
| 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 or reducing resource consumption are practiced. |
| 1. Evaluate current practices in relation to resource usage | * 1. Information on resource efficiency **systems and procedures** are collected and provided 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** |
| * PPE may include but are not limited to: | * Mask * Gloves * Goggles * Safety hat * Overall * Hearing protector * Safety boots |
| * Environmental pollution control measures may include but are not limited to: | * Methods for minimizing or stopping spread and ingestion of airborne particles * Methods for minimizing or stopping spread and ingestion of gases and fumes * Methods for minimizing or stopping spread and ingestion of liquid wastes |
| * Waste management procedures may include but are not limited to: | * Sorting * Storing of items * Recycling of items * Disposal of items |
| * Resources may include but are not limited to: | * Electric * Water * Fuel * Telecommunications * Supplies * Materials |
| * Workplace environmental hazards may include but are not limited to: | * Biological hazards * Chemical and dust hazards * Physical hazards |
| * Organizational systems and procedures may include but are 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:

* Following storage methods of environmentally hazardous materials
* Following disposal methods of hazardous wastes
* Using PPE
* Practicing OSHS
* Complying environmental pollution control
* Observing solid waste management
* Complying methods of minimizing noise Pollution
* Complying methods of minimizing wastage
* Employing waste management procedures
* Economizing resource consumption
* Listing of resources used
* Measuring current usage of resources
* Identifying and reporting workplace environmental hazards
* Conveying all environmental issues
* Following environmental regulations
* Identifying environmental regulations
* Assessing procedures for assessing compliance
* Collecting information on environmental and resource efficiency systems and procedures, and Providing information to the work group
* Measuring and recording current resource usage
* Analysing and recording current purchasing strategies.
* Analysing current work processes to access information and data and Assisting identifying areas for improvement
* Analysing resource flow
* Determining efficiency of use/conversion of resources
* Determining causes of low efficiency of use
* Developing plans for increasing the efficiency of resource use
* Checking resource use plans
* Complying to regulations/licensing requirements
* Determining benefit/cost of plans
* Ranking proposals based on benefit/cost compared to limited resources
* Checking proposals meet regulatory requirements
* Monitoring implementation
* Adjusting plan and implementation
* checking new resource usage

**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.
* Procedures for assessing compliance with environmental regulations.
* Collection of information on environmental and resource efficiency systems and procedures,
* Measurement and recording of current resource usage
* Analysis and recording of current purchasing strategies.
* Analysis current work processes to access information and data Analysis of data and information
* 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. Demonstration   2. Oral questioning   3. Written examination   4. Interview/Third Party Reports   5. Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad)   6. Simulations and role-plays |
| 1. Context of Assessment | Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment. |
| 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/IPO/BC/06/5/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to lead the implementation of workplace’s safety and health program, procedures and policies/guidelines.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| --- | --- |
| **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 | 1.1 ***Hazards*** in the workplace and/or its ***indicators*** of its presence, are identified  1.2 ***Evaluation and/or work environment*** measurements of OSH hazards/risk existing in the workplace is conducted by  Authorized personnel or agency  1.3 ***OSH issues and/or concerns*** raised by workers are  Gathered |
| 1. Identify and implement appropriate control measures | 2.1 Prevention ***and control measures***, including use of  s***afety gears / PPE (personal protective equipment)*** for specific hazards  identified and implemented  2.2 Appropriate ***risk controls*** based on result of OSH hazard evaluation is recommended.  2.3 ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures. |
| 1. Implement OSH programs, procedures and policies/ guidelines | 3.1 Information to work team about company OSH program, procedures and policies/guidelines are provided  3.2 Implementation of OSH procedures and policies/ guidelines are participated  3.3 Team members are trained and advised on OSH standards and procedures  3.4 Procedures for maintaining ***OSH-related records*** are implemented |

**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** |
| * Hazards may include but are not limited to: | * Physical hazards – impact, illumination, pressure, noise, vibration, extreme temperature, radiation * Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects * Chemical hazards – dusts, fibers, mists, fumes, smoke,   gases, vapors  Ergonomics   * Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles * Physiological factors – monotony, personal, relationship, work out cycle * Safety hazards (unsafe workplace condition) –confined space, excavations, falling objects, gas, leaks, electrical, poor storage of materials and waste, spillage, waste and debris * Unsafe workers’ act (Smoking in off-limited areas, Substance and alcohol abuse at work) |
| * 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 |
| * 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 |
| * 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 |
| * Prevention and control measures may include but are not limited to: | * Eliminate the hazard (i.e., get rid of the dangerous machine * Isolate the hazard (i.e. keep the machine in a closed room and operate it remotely; barricade an unsafe area off) * Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) * Use administrative controls to reduce the risk (i.e. give trainings on how to use equipment safely; OSH-related topics, issue warning signages, rotation/shifting work schedule) * Use engineering controls to reduce the risk (i.e. use safety guards to machine) * Use personal protective equipment * Safety, Health and Work Environment Evaluation * Periodic and/or special medical examinations of workers |
| * 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 |
| * Appropriate risk controls | Appropriate risk controls in order of impact are as follows:   * Eliminate the hazard altogether (i.e., get rid of the dangerous machine) * Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off) * Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) * Use administrative controls to reduce the risk (i.e., train workers how to use equipment safely; train workers about the risks of harassment; issue signage) * Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users) * Use personal protective equipment (i.e., wear * gloves and goggles when using the machine) |
| * Contingency measures may include but are not limited to: | * Evacuation * Isolation * Decontamination * (Calling designed) emergency personnel |
| * 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 of fire-extinguisher |
| * 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. |
| * 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:

* Skills on preliminary identification of workplace hazards/risks
* Knowledge management
* Critical thinking skills
* Observation skills
* Coordinating skills
* Communication skills
* Interpersonal skills
* Troubleshooting skills
* Presentation skills
* Training skills

**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. Identifies hazards/risks in the workplace and/or its indicators 2. Requests for evaluation and/or work environment measurements of OSH hazards/risk in the workplace 3. Gathers OSH issues and/or concerns raised by workers 4. Identifies and implements prevention and control measures, including use of PPE (personal protective equipment) for specific hazards 5. Recommends appropriate risk controls based on result of OSH hazard evaluation and OSH issues gathered 6. Establish contingency measures, including emergency procedures in accordance with organization procedures 7. Provides information to work team about company OSH program, procedures and policies/guidelines 8. Participates in the implementation of OSH procedures and policies/guidelines 9. Trains and advises team members on OSH standards and procedures 10. Implements procedures for maintaining OSH-related records |
| 1. Resource Implications | The following resources should be provided:  2.1 Workplace or assessment location  2.2 OSH personal records  2.3 PPE  2.4 Health records |
| 1. Methods of Assessment | Competency may be assessed through:  3.1 Portfolio Assessment  3.2 Interview  3.3 Case Study/Situation  3.4 Observation/Demonstration and oral questioning |
| 1. Context of Assessment | Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# COMMON COMPETENCIES

# PERFORM WORKSHOP PRACTICE

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

**UNIT DESCRIPTION**

This unit covers the competencies for preparing materials, tools and equipment, and performing basic metal works based on the required performance standards.

**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. Prepare materials, tools and equipment | 1. Working drawings are interpreted to determine job requirements 2. ***Tools, equipment*** and materials are identified and prepared according to job requirements 3. Materials are checked according to the required specifications 4. Tools and equipment conditions are checked following the standard operating procedures (SOPs) |
| 2. Perform required basic metal works | 1. Appropriate ***PPE*** and safety procedures are applied 2. ***Work instructions*** are followed to ensure work safety requirements 3. ***Basic metal works*** are performed applying knowledge on safety procedures and according to job requirements 4. ***Dimensions*** are marked out according to job requirements 5. Dimensions are checked against the actual drawings 6. Work pieces are clamped in ***work holding device*** to avoid damage and accidents 7. Work pieces are cut, chipped or filed according to required measurements, tolerance specified in the working drawings and free from burrs and sharp edges 8. Drilling is performed according to recommended sequence and specifications 9. Joining is performed as per job requirements 10. Proper usage of materials is observed 11. Tools, equipment and recyclable materials are stored in accordance to work place procedures. 12. Worksite is cleaned and cleared in accordance with OSH regulations |

**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.

|  |  |
| --- | --- |
| * *Materials* may include but not limited to: | * + Steel brackets   + Grinding disc   + Drill bit   + Flat/angle bars   + Fastening screws   + Sheet metal   + Mild steel tubes   + Rivets |
| * *Tools and equipment* may include but not limited to: | * May include but not limited to: * Portable grinder   + Hacksaw   + File   + Scribers   + Screw drivers   + Ballpein hammers   + Measuring tapes   + Steel rule   + PPE   + Portable electric drill   + Brush wire   + Tri-square   + Chisels   + Snips   + Mallets |
| * *Dimensions* may include but not limited to: | * Measurements * Tolerances |
| * *Work instructions* may include but not limited to: | * Work plans * Drawings * Manufacturer’s specifications |
| * *Personal Protective Equipment (PPE)* may include but not limited to: | * Safety shoes * Gloves * Goggles |
| * *Basic metal works* may include but not limited to: | * + Cutting   + Filing   + Drilling   + Measuring |
| * *Work holding device* may include but not limited to: | * Pliers * Vice grip |
| * *Manual* may include but not limited to: | * Procedures manual * Instructional manual |

**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:

* Cutting
* Filing
* Drilling
* Folding
* Joining
* Communicating effectively
* Work safety
* Preparing materials
* Proper handling of tools and equipment
* Decision making

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Measurements
* Dimensioning
* Unit conversion
* Basic Benchwork
* Usage of PPE
* Handling of tools, materials and equipment
* Good housekeeping

**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:  1.1 Interpreted drawings to determine job requirements  1.2 Identified and prepared materials, tools and equipment in accordance with job requirements  1.3 Selected and used appropriate processes, tools and equipment to carry out task  1.4 Marked out and checked dimensions in accordance with job requirements and within the tolerances  1.5 Followed work instructions  1.6 Performed benchworks in accordance with job requirements  1.7 Cleaned worksite in accordance with OSH regulations |
| 1. Resource Implications | The following resources must be provided:  2.1 Workplace  2.2 Drawings  2.3 Materials, tools and equipment relevant to the proposed activity |
| 1. Methods of Assessment | Competency may be assessed through:  3.1 Demonstration  3.2 Direct observation with oral questioning  3.3 Written tests  3.4 Portfolios  3.5 Third party reports |
| 1. Context of Assessment | Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# 

# APPLY ENGINEERING MATHEMATICS

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

**UNIT DESCRIPTION**

This unit describes the competencies required by a technician in order to apply algebra, carry out binomial expansion, apply coordinate geometry, trigonometric functions, carry out mensuration, apply statistics, matrix methods and vectors

**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. Calculations involving Indices are performed as per the concept   2. Calculations involving Logarithms are performed as per the concept   3. Scientific calculator is used in solving mathematical problems in line with manufacturer’s manual   4. Simultaneous equations are performed as per the rules   5. Quadratic equations are calculated as per the concept   6. Ratios and proportions are worked out |
| 2. Apply Coordinate Geometry | * 1. Graphs of given polar equations are drawn using the Cartesian plane   2. Polar equations are calculated using coordinate geometry   3. Normal and tangents are determined using coordinate geometry |
| 3. Apply trigonometric functions | 3.1 Trigonometric rules are stated and derived  3.2 Calculations are performed using trigonometric rules |
| 4. Carry out mensuration | 4.1 Perimeter and areas of figures are obtained  4.2 Volume and surface area are obtained  4.3 Area of irregular figures are obtained |
| 5. Apply Statistics | 5.1 Mean, median, mode and Standard deviation are obtained from given data  5.2 Sampling methods are applied in data collection |
| 6. Apply Matrix | 6.1 Determinant and inverse of 2x2 matrix are obtained  6.2 Solutions of simultaneous equations are obtained |
| 7. Apply Vectors | 7.1 Vectors and scalar quantities are obtained in two dimensions  7.2 ***Operations*** on vectors are performed  7.3 Position of vectors is obtained |

**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** |
| * *Operations*may include but not limited to***:*** | * + Addition   + Subtraction |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**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
* Rounding techniques
* Types of fractions
* Types of tables and graphs
* Presentation of data in tables and graphs
* Vector operations
* Matrix operations

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Applied Trigonometry functions 2. Applied algebraic equations 3. Carried out mensuration 4. Applied Vector theory 5. Applied Matrix |
| 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 instruments and equipment   3. Scientific calculator   4. Materials relevant to the tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Direct Observation 2. Demonstration with Oral Questioning 3. Written tests |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or  through accredited institution |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY ELECTRICAL PRINCIPLES

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

**UNIT DESCRIPTION**

This unit describes the competencies required by a technician in order to apply a wide range of Electrical principles in their work: Competencies include; use the concept of basic quantities, concepts of D.C and A.C circuits in installation, use of basic machine, use of power factor in installation, use of earthing in installations, apply Electrostatics, magnetism and Electromagnetism and finally transient in analysis.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| 1. Use the concept of basic quantities | * 1. Basic ***SI unit***s in are identified   2. ***Quantitie***s of Charge, force, work and power are identified   3. Perform calculations involving Ohm’s law i.e. Current, Resistance and voltage |
| 2. Apply concepts of D.C and A.C circuits in installation | * 1. Calculations involving parallel and series circuits are performed   2. Calculations involving DC and AC are performed using Kirchhoff’s laws |
| 3. Perform earthing in installations | 3.1 Earthing types are identified  3.2 Earthing points on Industrial plant operations and Maintenance are identified  3.3 Test on an earthing system is performed in line with the IEE regulations |
| 4. Apply Electrostatics | 4.1 Sources of Electrostatic fields are identified  4.2 Types of capacitors are identified  4.3 Concept of charge and electrostatic field is established |

**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** |
| * SI unit may include but not limited to: | * Power – Watts (W) * Current – Amperes (A) * Resistance – Ohms(Ω) * Voltage – Volts (V) |
| * Quantities may include but not limited to: | * Charge * Force * Work * Power |

**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 formulae
* Use of basic instruments
* Perform unit conversions of quantities
* Performing earthing
* Logical thinking
* Problem solving
* Using different measuring tools

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Power calculations
* Ohm’s law and Kirchhoff’s laws
* Formulae
* SI units of various parameters
* Earthing testing
* Types and purpose of measuring instruments
* Units of measurement and abbreviations

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied the correct SI units of quantities   2. Stated, Calculated and related the quantities in Ohm’s law   3. Identified the components of an earthing system   4. Stated and applied Ohms and Kirchhoff’s laws in system   5. Differentiated between AC and DC   6. Adhered to safety procedures   7. Observed good housekeeping |
| 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 and instruments   3. Materials relevant to the tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Written tests |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or  through accredited institution |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PREPARE AND INTERPRET TECHNICAL DRAWINGS

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

**UNIT DESCRIPTION**

This unit covers the competencies required to draw and interpret technical drawings. It involves competencies to select, use and maintain drawing equipment and materials. It also involves competencies for producing plain geometry drawings, solid geometry drawings, orthographic drawings and plant drawings.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function**.** | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| 1. Use and maintain drawing equipment and materials | 1.1 ***Drawing equipment*** and ***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 Waste materials are disposed in accordance with workplace procedures and ***environmental legislations***  1.6 ***Personal Protective Equipment*** are used according to occupational safety and health regulations |
| 1. Produce plane geometry drawings | 2.1 Different types of lines used in drawing and their meanings are identified according to standard drawing conventions  2.2 Different types of ***geometric forms*** are constructed according to standard conventions  2.3 Different types of angles are constructed according to principles of trigonometry  2.4 Different types of angles are measured using appropriate measuring tools  2.5 Angles are bisected according to standard conventions  2.6 Freehand sketching of different types of geometric forms, tools, equipment, diagrams is conducted |
| 1. Produce solid geometry drawings | 3.1 Drawings of patterns are interpreted according to standard conventions  3.2 Patterns are developed in accordance with standard conventions |
| 1. Produce drawings | 4.1 symbols and abbreviations are identified, and their meaning interpreted according to BS 3939  4.2 ***drawings*** are produced in accordance with BS 3939 |

**RANGE**

| **Variable** | **Range** |
| --- | --- |
| * *Drawing equipment* may include but is not limited to: | * Drawing boards, T and set squares, drawing sets |
| * *Drawing materials* may include but is not limited to: | * Drawing papers, pencils, erasers, masking tapes, paper clips |
| * *Environmental legislations* may include but is not limited to: | * EMCA 1999 |
| * *Personal Protective Equipment* may include but is not limited to: | * Dust coats, closed leather shoes |
| * *Geometric forms* may include but is not limited to: | * Circles, triangles, rectangles, parallelogram, polygons, pyramids, conic sections, prisms, loci |
| * *Standard conventions* may include but is not limited to: | * Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends) * Drawing scale (paper size and drawing symbols) * International drawing standards |
| * *Plant drawings* may include but is not limited to: | * Block, schematic, circuit and line diagrams |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Critical thinking
* Drawing
* Interpretation
* Drawing equipment handling
* Communication
* Inter personal

**Required Knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Applied and adhered to safety procedures   2. Cared and maintained drawing equipment   3. Interpreted circuit, assembly and lay out diagrams   4. Applied appropriate technical standards, used proper tools and equipment for a given task   5. Produced sketches and drawings |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied.   * 1. Drawing room   2. Drawing equipment and materials |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Practical tests   2. Observation |
| 1. Context of assessment | Competency may be assessed individually in the actual workplace or a simulated work place setting |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# CORE COMPETENCIES

## MAINTAIN INDUSTRIAL BOILERS

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

**UNIT DESCRIPTION**

This unit covers competencies required to maintaining industrial boilers. It involves applying industrial boiler maintenance safety procedures, conducting routine/preventative industrial boiler maintenance, troubleshooting equipment/ component faults, conducting industrial boiler maintenance-commissioning industrial boiler operations and preparing industrial boiler maintenance report.

**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 Industrial boiler maintenance safety Procedures | * 1. Personal safety gear is prescribed observed as per rules and regulations of the ***Occupational Safety Act***   2. Safety measures for the operation of the boiler are prescribed as the rules and regulations of the ***Occupational Safety Act***   3. Work environment safety is adhered to as per the **Occupational Safety Act**   4. Industrial boiler alarm systems are tested for functionality as per SOPs |
| 1. Conduct routine/preventative industrial boiler maintenance | * 1. Water gauges are checked according to manufacturer’s specifications   2. Water gauges are cleaned according to manufacturer’s recommendations   3. Piping and float chamber are clean according to SOPs   4. Fuel cut-off feature is tested according to manufacturer specifications   5. Water treatment system is checked according to manufacturer instruction   6. Condensate recovery system is checked according to manufacturer recommendations   7. Corrosion and leakages are checked according to manufacturer recommendations   8. Stack gauge temperature is checked according manufacturer instructions   9. Analysis of air to fuel ratio is done according to manufacturer recommendations   10. Heat transfer surfaces are cleaned according to manufacturer recommendations   11. Economizer is checked and maintained according to manufacturer recommendations |
| 1. Troubleshoot equipment/ component faults | * 1. Boiler is troubleshot for no heat and poor heat according to manufacturer instructions   2. Boiler is checked for frozen condensate pipes according to manufacturer instructions   3. Boiler is checked for strange noises according to manufacturer instructions   4. Boiler is troubleshot for the causes of water leakages according to manufacturer instructions |
| 1. Conduct industrial boiler maintenance | * 1. Logs charts, daily check charts and boiler reports are implemented   2. Meantime to repair time is adhered to as per laid down procedures and standards   3. Faulty boiler auxiliary/ component isolated and overhauled for service   4. Inventory of spares records are updated and maintained according to SOPs   5. Lubrication levels for moving parts are checked and addressed as per SOPs   6. All manholes are closed properly as per the SOPs   7. Return plant to required operational status upon completion of test |
| 1. Re-commissioning industrial boiler Operations | * 1. The laid down start-up procedures are followed depending on the status of the boilers, either warm or cold start-up as per manufacturer’s specification   2. Industrial boiler is tested for functionality as per manufacturer’s specification   3. The industrial boiler is re-commissioned for operation |
| 1. Prepare Industrial boiler maintenance report | * 1. Standard maintenance procedures are followed as recorded in maintenance manuals   2. Maintenance scheduling is documented according to manufacturer specifications   3. Maintenance report is developed and stored as per workplace procedure |

**RANGE**

This section provides work environment and condition to which the performance criteria (PC) apply. It allows for different work environment and situation that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| * *Occupational Safety and Health Act 2007* may include but not limited to: | * + Personal safety equipment   + Responsibility of the employee   + Responsibility of the employer   + Work area safety   + Work area hazards   + Accident reporting procedure |
| * *Boiler* may include but not limited to: | * Fixed and modulating combustion controls and a single heat source. Operation includes a battery of boilers and boilers that have a single thermal or solar heat source. |
| * *Types of boiler* may include but not limited to: | * + Fire tube boilers   + Water tube boilers   + Once through boilers   + Waste heat boilers   + Ly heated boilers |
| * *Hazards* may include but not limited to: | * + Asbestos lagging   + Chemical hazards   + Thermal hazards   + Manual handling hazards   + Machinery guard requirements   + Hot exposed steam pipe   + Leakage of steam   + Leakage of fuel   + Odour of gas   + Fumes from a liquid chemical spill   + Faulty/broken ladder or hand rail   + Working at heights   + Flammable liquids   + Fire and explosion   + Hazards   + Work area, including:     - Illumination     - Excessive noise from machinery     - Spillage of oil     - Rubbish and combustibles     - Obstruction |
| * *Risk control methods* may include but not limited to: | * Risk control methods refer to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls. * It includes the application of the hierarchy of control:   + Elimination   + Substitution   + Isolation   + Engineering controls   + Administrative controls   + Personal protective equipment (PPE) |
| * *Appropriate standards* may include but not limited to: | * Legislation * Codes of practice * Manufacturer specifications * Technical standards (International) * Industry standards (where applicable) |
| * *Procedures* may include but not limited to: | * + Manufacturer guidelines (e.g. Instructions, specifications or checklists)   + Industry operating procedures   + Workplace procedures (e.g. Work instructions, operating procedures or checklists) |
| * *Equipment* may include but not limited to: | * + Gas monitoring equipment   + Water testing equipment   + Fire-fighting equipment   + Workplace first aid equipment   + Work platform and associated gear, including walkways   + Temperature monitoring equipment |
| * *Communication methods* may include but not limited to: | * + Verbal and non-verbal language written instructions signage   + Hand signals   + Listening   + Questioning to confirm understanding   + Appropriate worksite protocol |
| * *Appropriate/Relevant personnel* may include but not limited to: | * + Production personnel   + Maintenance personnel   + Supervisors and managers   + Boiler operators   + Suppliers   + Colleagues |
| * *Records* may include but not limited to: | * + Operating log books   + Maintenance records   + Records of faults and potential faults   + Isolation procedures   + Safe operating procedures   + Daily operating inspections   + Repairs carried out according to manufacturer recommendations and operating procedures   + Workplace record keeping requirements   + Details of any daily or periodic maintenance work   + Details of yearly programmed or additional maintenance work |
| * *Risk control measures* may include but not limited to: | * + Barricades and controls   + Machine guarding   + Fall prevention   + Pedestrian controls   + Adequate illumination   + Noise controls   + Signage   + PPE |
| * *Personal Protective Equipment (PPE)* may include but not limited to: | * + Thermally insulated gloves   + Helmet   + Ear protection (muffs or plugs)   + Chemical resistant gloves and apron   + Respiratory devices eye protection   + Working protective gloves   + Whole body fire-resistant clothing   + Safety boots |
| * *Communication equipment* may include but not limited to: | * Two-way radios * Mobile phones * Intercoms * Satellite phones * Local Area Networks |
| * *Maintenance* may include but not limited to: | * + Leaking steam pipe   + Pressure gauge accuracy   + Exposed wiring   + Defective illumination in the workplace   + Leaking fuel pump gland   + Leaks in high pressure feed line   + Leaking gauge glass mounting   + Leaking safety valve   + Isolation procedures, hardware and equipment |
| * *Faults* may include but not limited to: | * + Abnormal operating conditions   + Boiler tube failure   + Feedwater supply and/or other major auxiliary loss   + Wet steam   + High dissolved oxygen   + Ph of water   + High conductivity   + Actuator or valve mechanical or fault/failure   + Instruments failure   + Steam leak   + Insulation failure   + Draft failure |
| * *Diagnose* may include but not limited to: | * Senses, including:   + - Audio     - Smell     - Touch     - Visual * Remote or local indicators and recorders * Computers and alarms, including:   + - Visible     - Audible |
| * *Operating logs* may include but not limited to: | * + Date and time of checking   + Each check, examination and results   + Printed and signed name of person who performed the checks   + Date and time of any lockout or equipment malfunction   + Results of tests on boiler or feed-water   + Changes in operation |
| * *Valves and fittings* may include but not limited to: | * + Safety valves   + Gauge glasses   + Main Steam stop valve   + Feedwater stop valve   + Feed check valve   + Blow-down valve   + Steam side/line drain valves   + Flame failure detection device   + Water level controller   + Boiler steam pressure gauge |
| * *Monitor* may include but not limited to: | * + Water supply system   + Checks of steam reticulation line   + Pressure usage and supply of steam   + Quality of steam   + Combustion/heat source system and management   + Feedwater system   + Fuel system   + Combustion air supply   + Water level   + Boiler steam pressure   + Boiler and steam manifold valves (where fitted)   + Soot blowers (where fitted)   + Operation of control/safety devices, including control panels |
| * *Tests* may include but not limited to: | * + Response checks   + Standby plant ‘cut in’ tests   + Instruments tests   + Valve operating checks   + Hydrostatic tests   + Performance tests   + Alarm and protection test   + Ph levels   + Conductivity   + Oxygen   + Total dissolved solids (TDS)   + Water hardness   + Other contaminants |
| * *Chemicals* may include but not limited to: | * + Oxygen scavenger   + Feedwater additives   + Other chemicals |
| * *Handover* may include but not limited to: | * + Previous load requirements   + Maintenance issue, including equipment isolated for maintenance   + Operational incidences   + Read operating log   + General inspection of boiler to detect any defects   + Accept responsibility of boiler noted defects   + Required equipment tests |
| * *Emergencies* may include but not limited to: | * + Tube failure   + Loss of water level   + Power failure   + Inadequate housekeeping   + Explosion   + Fire   + Personal accidents   + Chemical spills   + Major steam leaks   + Major water leaks and flooding   + Natural disasters   + Oil spills   + Fans and pumps failure |
| * *Appropriate emergency response* may include but not limited to: | * + Identification of emergency   + Isolation of heat source   + Selection and application of appropriate fire-fighting equipment and PPE   + Notification of downstream users   + Operation of boiler only when safe to do so   + Notification of appropriate regulatory authorities |
| * *Storage mode* may include but not limited to: | * + Wet and dry storing   + Open or closed position |

**REQUIRED KNOWLEDGE SKILLS**

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

**Required Knowledge**

The trainee needs to demonstrate knowledge of:

|  |
| --- |
| * Occupational Safety and Health Act of Kenya laws 2007 with focus on personal safety, equipment safety and workplace |
| * Types of boiler |
| * Boiler auxiliaries and mountings |
| * Preventative maintenance |
| * Steam generation process |
| * Fuels |
| * Start-up and shut-down procedure of the boiler |
| * First Aid |
|  |

**Required Skills**

|  |  |
| --- | --- |
| The trainee needs to demonstrate the following fundamental skills | |
| * Communication skills | * Environmental Literacy |
| * Numeracy skills | * Employability skills |
| * Digital literacy skills | * Entrepreneurship skills |
| * Occupational health safety and Practices |  |

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | * 1. Observed safety at workplace   2. Identified different types of boiler   3. Conducted routine maintenance   4. Conducted Preventative/ Condition-based maintenance |
| 1. Resource Implications | * 1. Boiler/model boiler   2. Boiler manuals   3. OSHA   4. Workshop tools |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observed behavior of the candidate   2. Inspection of written operation procedures   3. Inspection of log books |
| 1. Context of Assessment | Competency will be assessed individually in the actual workplace or through accredited institution |
| 1. Guidance information for Assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended |

# MAINTAIN INDUSTRIALSTEAM TURBINE

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

**UNIT DESCRIPTION**

This unit covers competencies required to maintaining industrial steam turbine. It involves applying industrial steam turbine maintenance safety procedures, conducting routine/ preventative industrial steam turbine maintenance, troubleshooting industrial steam turbine equipment/ component faults, conducting industrial steam turbine maintenance-commissioning industrial steam turbine and perform operation test

and preparing industrial steam turbine maintenance report.

**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 Industrial steam turbine maintenance safety Procedures | * 1. Personal safety gear is prescribed as per rules and regulations of the ***Occupational Safety Act***   2. Safety measures for the maintenance of the steam turbines are defined as the rules and regulations of the ***Occupational Safety Act***   3. Industrial steam alarm systems are tested for functionality as per SOPs |
| 1. Conduct routine/ preventative industrial steam Turbine maintenance | * 1. Logs charts, daily check charts and steam turbine reports are implemented   2. Tools and equipment for maintenance are identified as per manufactures manual and SOPs   3. Tube / pipe leaks are fixed according to SOPs   4. Oil leaks are addressed according to SOPs |
| 1. Troubleshoot industrial steam Turbine equipment/ component faults | * 1. Causes of rotor vibration are diagnosed according manufacturer instructions   2. Increased bearing drain oil temperature is diagnosed according manufacturer instructions   3. Decreased turbine performance is diagnosed according manufacturer instructions   4. Changes in stage pressure are checked according manufacturer instructions   5. Steam leakages from the casing are diagnosed according manufacturer instructions   6. Water induction is checked according manufacturer instructions   7. Labyrinth packaging damage is diagnosed according manufacturer instructions   8. Cracking of the turbine parts are checked according manufacturer instructions   9. Blade problems are checked according manufacturer instructions |
| 1. Conduct industrial steam turbine maintenance | * 1. Logs charts, daily check charts and steam turbine reports are implemented   2. Tools and equipment for maintenance are identified as per manufactures manual and SOPs   3. Speed governors are serviced according to SOPs   4. Tube / pipe leaks are fixed according to SOPs   5. Oil leaks are addressed according to SOPs   6. Vacuum cleaning is carried out on the steam turbine panels according to SOP   7. Tools and material inventory updated |
| 1. Re-commission industrial steam turbine and perform operation test | * 1. The laid down start-up procedures are followed as per manufacturer’s specification   2. Industrial steam turbine is tested for functionality as per manufacturer’s specification   3. The industrial steam turbine is re-commissioned for operation |
| 1. Prepare industrial steam turbine maintenance report | * 1. Standard maintenance procedures are followed as recorded in maintenance manuals   2. Maintenance scheduling is documented according to manufacturer specifications   3. Maintenance report is developed and stored as per workplace procedure |

**RANGE**

This section provides work environment and condition to which the performance criteria (PC) apply. It allows for different work environment and situation that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| * *Occupational Safety and Health Act* 2007may include but not limited to: | * Personal safety equipment * Responsibility of the employee * Responsibility of the employer * Work area safety * Work area hazards * Accident reporting procedure |
| * *Types of turbines*may include but not limited to***:*** | * + Impulse turbine   + Reaction turbine |
| * *Plant/Equipment* may include but not limited to: | * + Turbine and auxiliary plant   + Turbine lubrication and power/control oil systems   + Turbine by-pass system plant   + Condensate and feed water system plant to boiler economizer inlet NRV   + Condensate polishing plant   + High- and low-pressure heating systems   + Steam condensing and cooling systems   + Condenser vacuum raising equipment   + Turbine gland sealing equipment   + Cooling water systems plant   + Boiler feed water desecrating equipment   + Condensate and feed water chemical treatment equipment   + Electricity generation and distribution systems A.C and D.C   + Station water distribution systems   + Hydraulic oil system   + Pumps   + Computers with equipment control functions   + Supervisory, alarm, protection and control equipment |
| * *Hazards*may include but not limited to: | * + Asbestos lagging   + Chemical hazards   + Thermal hazards   + Manual handling hazards   + Machinery guard requirements   + Leakage of steam   + Fumes from a liquid chemical spill   + Faulty/broken ladder or hand rail   + Flammable liquids   + Fire and explosion   + hazards   + Work area, including:     - illumination     - excessive noise from machinery     - spillage of oil     - rubbish and combustibles     - obstruction |
| * *Risk control methods* may include but not limited to: | * Risk control methods refer to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls. * It includes the application of the hierarchy of control:   + elimination   + substitution   + isolation   + engineering controls   + administrative controls   + personal protective equipment (PPE) |
| * *Safety Standards*may include but not limited to: | * + Relevant sections of Occupational Health and Safety legislation   + Industry standards   + Manufacturers’ recommendations   + National standards for plant and relevant state legislation. |
| * *Procedures*may include but not limited to: | * + Manufacturer guidelines (e.g. instructions, specifications or checklists)   + Industry operating procedures   + workplace procedures (e.g. work instructions, operating procedures or checklists) |
| * *Information and Documentation*may include but not limited to: | * + Verbal or written communications   + Industry safety rules documentation   + Industry operating instructions   + Manufacturer operational and maintenance manuals   + Equipment and alarm manuals   + Industry log books   + Dedicated computer equipment   + Plant notes. |
| * *Communication*may include but not limited to: | * + Telephone and/or mobile phones   + Two-way radio   + Computer (electronic mail)   + Operating log (written or verbal). |
| * *Appropriate/Relevant personnel*may include but not limited to: | * + Production personnel   + Maintenance personnel   + Supervisors/Team leaders and managers or equivalent   + Technical and engineering officers or equivalent   + Operating staff and contractor staff.   + Other coordinators of energy production or equivalent |
| * *Technical and operational indicators* may include but not limited to: | * + Stimuli (audio, smell, touch, visual)   + Remote or local indicators and recorders   + Computers and alarms (visible and or audible). |
| * *Tests* may include but not limited to: | * + Loss of a major auxiliary controls’ response checks   + Stand-by plant “cut-in” tests   + Valves operating checks   + On-load turbine valve and emergency governor operation test   + Performance tests   + Condenser pressure test   + Heater leak checks   + Alarm and protection tests. |
| * *Personal Protective Equipment (PPE)*may include but not limited to: | * + Thermally insulated gloves   + Helmet   + Ear protection (muffs or plugs)   + Working protective gloves   + Whole body heat-resistant clothing   + Safety boots |
| * *Faults/ abnormal operating conditions* may include but not limited to: | * + Loss of a major auxiliary   + Loss of Generation to auxiliaries   + Turbine water ingress   + Excessively high turbine and turbine valves heating/cooling rates/differentials   + High condenser vacuum   + Condenser tube leak   + High dissolved oxygen, conductivity   + High turbine bearing temperatures/vibration   + High/low bearing oil temperature   + Loss of turbine bearing oil flow/pressure   + Low/high pressure heaters malfunctions   + Actuator/valve mechanical/ faults/failure   + Failed field devices   + Turbine protection |
| * *Appropriate emergency response*may include but not limited to: | * + Identification of emergency   + Isolation of heat source   + Selection and application of appropriate fire-fighting equipment and PPE   + Notification of downstream users   + Operation of boiler only when safe to do so   + Notification of appropriate regulatory authorities |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Skills**

**The trainee needs to demonstrate knowledge of:**

|  |
| --- |
| * Relevant environmental, occupational health and safety legislation and regulations |
| * Classification of turbines |
| * Turbine construction and operating principles |
| * Plant drawings |
| * Steam Turbine Preventative maintenance |
| * Introduction to and typical arrangements of power production plant |
| * Relevant plant and equipment, its location and operating parameters |
| * Pump types and characteristics |
| * Recording procedures |
| * Turbine speed control equipment |
| * The system components and their interaction with other plant and equipment external to that covered by this competency |
| * Steam distribution systems |
| * Turbine by-pass system |
| * Vacuum raising and turbine gland sealing systems |
| * Lubrication and bearings |
| * Turbine lubrication and oil systems, types and characteristics |
| * Condensate and feed water systems |
| * Fire protection control systems |
| * First aid |

**Skills Required**

|  |  |  |
| --- | --- | --- |
| **The trainee needs to demonstrate the following fundamental skills;** | | |
| * Communication skills | * Environmental Literacy | |
| * Numeracy skills | | * Employability skills |
| * Digital literacy skills | | * Entrepreneurship skills |
| * Occupational health safety and Practices | |  |

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | * 1. Observed safety at workplace and sound housekeeping   2. Identified different types of steam turbine   3. Identified turbine components   4. Operated and monitored steam turbine performance   5. Conducted basic preventative maintenance   6. Conducted basic First Aid and Emergency evacuation |
| 1. Resource Implications | * 1. Steam Turbine/model of Steam Turbine   2. Steam Turbine manuals   3. Relevant legislations, e.g. OSHA, Environmental Act; and regulations   4. Workshop tools |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observed behavior of the learners   2. Inspection of written operation procedures   3. Inspection of log books |
| 1. Context of Assessment | Competency will be assessed individually in the actual workplace or through accredited institution |
| 1. Guidance information for Assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended |

## MAINTAIN INDUSTRIAL HYDRAULICS SYSTEMS

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

**UNIT DESCRIPTION**

This unit covers competencies required maintain Industrial Hydraulics Systems. It involves applying industrial hydraulic maintenance safety procedures, conducting routine/preventative maintenance industrial hydraulic system, conducting industrial hydraulic system maintenance-commissioning industrial hydraulic system and perform operation test and preparing industrial hydraulic system maintenance report.

**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 Industrial hydraulic maintenance safety Procedures | * 1. Personal safety gear is prescribed as per rules and regulations of the ***Occupational Safety Act***   2. Safety measures for the maintenance of the hydraulic system is defined as per OSHA and SOPs   3. Work place safety measures are adhered to according to SOPs |
| 1. Conduct routine/ preventative maintenance industrial hydraulic system | * 1. Fluid ounce prevention is done according to manufacturer’s instructions   2. Pump components wear and damage is checked and repaired manufacturer’s instructions   3. Cylinders and motors are checked regularly for damages due excess pressure and contamination manufacturer’s instructions   4. Hoses and lines are inspected regularly for damages as per SOPs   5. Inspection for restricted flow is done as per SOPs |
| 1. Troubleshoot hydraulic systems for fault | * 1. Testing of Industrial Steam turbine alarm systems   2. Carry out Periodic noise levels tests   3. Conduct Pre-operational checks   4. Check Exhaust steam discharge valves for function ability   5. Check Non-drive end and drive-end bearing temperatures using infra-red thermometer and recorded in the log book |
| 1. Conduct industrial hydraulic system maintenance | * 1. Logs books, daily check charts and hydraulic system reports are implemented   2. Tools and equipment for maintenance are identified as per manufactures manual and SOPs   3. O-rings, seals, Circlip rings, gaskets and Cotter pins are serviced and or replaced according to SOPs   4. Filters are serviced and or replaced as per the manufacture’s recommendation and SOPs   5. Hydraulic fittings and auxiliaries are serviced and or replaced according to SOPs   6. Control valves and non-return valves are serviced and or replaced according to SOPs   7. Tools and material inventory updated |
| 1. Recommission industrial hydraulic system and perform operation test | * 1. The laid down start-up procedures are followed per manufacturer’s specification   2. Industrial hydraulic system is tested for functionality as per manufacturer’s specification   3. The industrial hydraulic system is re-commissioned for operation |
| 1. Prepare industrial hydraulic system maintenance report | * 1. Standard maintenance procedures are followed as recorded in maintenance manuals   2. Maintenance scheduling is documented according to manufacturer specifications   3. Maintenance report is developed and stored as per workplace procedure |

**RANGE**

This section provides work environment and condition to which the performance criteria (PC) apply. It allows for different work environment and situation that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| * *Hydraulic components* may include but not limited to: | * + Rams   + Actuators   + Relays   + Hydraulic operated tools   + Governors and relays   + Pumps   + Directional valves   + Piping   + Seals   + Manifolds |
| * *Maintenance* may include but not limited to: | * + Repair   + Inspection and modification   + Overhaul   + Lubrication   + Servicing   + Test running |
| * *Work completion details* may include but not limited to: | * + Plant and maintenance records   + Job cards   + Check sheets   + On device labeling updates   + Reporting and/or documenting equipment defects. |
| * *Isolations* may include but not limited to: | * mechanical or other associated processes |
| * *Regulations, Polices and Standards* may include but not limited to: | * + Occupational Safety and Health Act   + Company policies   + Manufacturers’ specifications |
| * *Potential failures /Indication of failures* may include but not limited to: | * + Noise   + Vibration   + Odour   + Cracks   + Leaks   + Loss of performance   + Unintended motion |
| * *Safety equipment* may include but not limited to: | * + Pressure relief valve   + Safety valve   + Non return valve |
| * *PPE* may include but not limited to: | * + Gloves   + Safety boots |
| * *Hazards* may include but not limited to: | * + Burns from hot, high-pressure fluid   + Injection of fluid into the skin   + Fire Hazards   + Bruises, cuts or abrasions from flailing hydraulic lines   + Injury of people due to unexpected movement of equipment   + During maintenance of equipment and their parts.   + Injury due to sudden release of residual pressurized oil.   + Slippage due to oily floor area.   + Electric shock from motors/ A.C. Solenoids |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Skills**

**The trainee needs to demonstrate knowledge of:**

|  |
| --- |
| * Relevant environmental, occupational health and safety legislation and regulations |
| * Personal protective equipment (PPE) and safety equipment. |
| * Hand and portable power tools |
| * Assess potential hazards. |
| * Scheduled and preventative maintenance on the system. |
| * Technical Drawing, Hydraulic circuit diagrams and data |
| * Uses documentation. |
| * Hydraulic principles |
| * Pre- and post-operational inspections. |
| * Completes daily equipment logbook. |
| * Troubleshooting and basic repairs on equipment |
| * Emergency procedures. |
| * Identification and selection of tools and materials |
| * Identify and use relevant test equipment |
| * Testing techniques |
| * Dismantle and assemble components to specified tolerances |
| * Communicate effectively |
| * Basic First aid |

**Required Skills**

|  |  |
| --- | --- |
| **The trainee needs to demonstrate the following fundamental skills** | |
| * Communication skills | * Environmental Literacy |
| * Numeracy skills | * Employability skills |
| * Digital literacy skills | * Entrepreneurship skills |
| * Occupational health safety and Practices |  |

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | * 1. Observed safety at workplace and sound housekeeping   2. Identified different types of oil used in hydraulic systems   3. Identified hydraulic components and attachments   4. Selected and correctly use tools and equipment   5. Operated and monitor hydraulic system   6. Conducted scheduled and basic preventative maintenance   7. Performed pre- and post-operational tests   8. Conducted basic First Aid and Emergency evacuation |
| 1. Resource Implications | * 1. Hydraulic system/model   2. Hydraulic simulation   3. Relevant legislations, e.g. OSHA, Environmental Act; and regulations   4. Workshop tools and equipment   5. Hydraulic manuals |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observed behavior of the learners at workplace   2. Inspection of written operation procedures   3. Inspection of log books |
| 1. Context of Assessment | Competency will be assessed individually in the actual workplace or through accredited institution |
| 1. Guidance information for Assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended |

# MAINTAIN INDUSTRIAL PNEUMATIC SYSTEMS

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

**UNIT DESCRIPTION**

This unit covers competencies required to maintain industrial pneumatic system. It involves applying industrial pneumatic maintenance safety procedures, conducting routine/ preventative maintenance pneumatic system, troubleshooting industrial pneumatic systems for faults, conducting industrial pneumatic system maintenance-commissioning industrial pneumatic system and perform operation test, preparing industrial pneumatic system maintenance report.

**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 Industrial pneumatic maintenance safety Procedures | * 1. Personal safety gear is prescribed as per rules and regulations of the ***Occupational Safety Act***   2. Safety measures for the maintenance of the pneumatic system is defined as per OSHA and SOPs   3. Work place safety measures are adhered to according to SOPs |
| 1. Conduct routine/ preventative maintenance pneumatic system | * 1. Draining of airline filters and checking for water traps is done regularly as per manufacturers recommendations   2. Lubrication of moving components is done as per SOPs   3. Adjustments of the moving parts is done regularly according to manufacturer specification   4. Cleaning of components is done regularly as per manufacturers recommendations   5. Compressed air leaks are checked per manufacturers recommendations |
| 1. Troubleshoot industrial pneumatic systems for faults | * 1. Pre-operational checks are conducted on the industrial pneumatic system in accordance to the manufacturers’ recommendations and SOPs   2. The functionality of the components for the pneumatic system is checked as per manufacturer’s specifications   3. Troubleshooting is done to identify faults on the pneumatic system components |
| 1. Conduct industrial pneumatic system maintenance | * 1. Logs books, daily check charts and Pneumatic system reports are implemented   2. Tools and equipment for maintenance are identified as per manufactures manual and SOPs   3. O-rings, seals, Circlip rings, gaskets and Cotter pins are serviced and or replaced according to SOPs   4. Filters are serviced and or replaced as per the manufacture’s recommendation and SOPs   5. Pneumatic fittings and auxiliaries are serviced and or replaced according to SOPs   6. Control valves and non-return valves are serviced and or replaced according to SOPs   7. Tools and material inventory updated   8. Housekeeping is performed as per the SOPs   9. Pneumatic maintenance report is prepared and shared with appropriate personnel as per workplace procedure |
| 1. Re-commission industrial pneumatic system and perform operation test | * 1. The laid down start-up procedures are followed per manufacturer’s specification   2. Industrial hydraulic system is tested for functionality as per manufacturer’s specification   3. The industrial hydraulic system is re-commissioned for operation |
| 1. Prepare industrial pneumatic system maintenance report | * 1. Standard maintenance procedures are followed as recorded in maintenance manuals   2. Maintenance scheduling is documented according to manufacturer specifications   3. Maintenance report is developed and stored as per workplace procedure |

**RANGE**

This section provides work environment and condition to which the performance criteria (PC) apply. It allows for different work environment and situation that will affect performance

| **Variable** | **Range** |
| --- | --- |
| * *Pneumatic components* may include but not limited to: | * + Rams   + Linear and Rotary Actuators   + Relays   + Pneumatic operated tools   + Directional/Control valves   + Seals   + Piping   + Manifold |
| * *Types of Compressors* may include but not limited to: | * + Positive displacement   + Reciprocating Compressors   + Rotary Compressors   + Dynamic flow compressor     - Axial flow compressors     - Radial flow compressors |
| * *Compressor Accessories* may include but not limited to: | * Intercoolers and after-coolers * Intake filters * Compressor controls |
| * *Maintenance* may include but not limited to: | * Repair * Inspection and modification * Overhaul * Lubrication * Servicing * Test running |
| * *Work completion details* may include but not limited to: | * + Plant and maintenance records   + Job cards   + Check sheets   + On device labelling updates   + Reporting and/or documenting equipment defects. |
| * *Isolations* may include but not limited to: | * Mechanical or other associated processes |
| * *Regulations, Polices and Standards* may include but not limited to: | * + Occupational Safety and Health Act   + Company policies   + Manufacturers’ specifications |
| * *Potential failures /Indication of failures* may include but not limited to: | * + Noise   + Vibration   + Odour   + Cracks   + Leaks   + Loss of performance   + Unintended motion   + Color of lubricant |
| * *Safety equipment* may include but not limited to: | * + Pressure relief valve   + Safety valve   + Non return valve |
| * *PPE* may include but not limited to: | * + Ear protection (muffs or plugs)   + Working protective gloves   + Safety boots |
| * *Hazards* may include but not limited to: | * Burns from high-pressure fluid * Injection of fluid into the skin * Fire Hazards * Bruises, cuts or abrasions from failing pneumatic lines * Injury of people due to unguarded rotating part * During maintenance of equipment and their parts. * Injury due to sudden release of residual pressurized air. * Slippage due to oily floor area. * Electric shock from motors/ A.C. Solenoids |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

|  |
| --- |
| * Relevant environmental, occupational health and safety legislation and regulations |
| * Personal protective equipment (PPE) and safety equipment. |
| * Types of compressor |
| * Compressor parts and accessories |
| * Hand and portable power tools |
| * Assess potential hazards. |
| * Scheduled and preventative maintenance on the system. |
| * Technical Drawing, pneumatic circuit diagrams and data |
| * Uses documentation. |
| * Pneumatic principles |
| * Pre- and post-operational inspections. |
| * Completes daily equipment logbook. |
| * Troubleshooting and basic repairs on equipment |
| * Emergency procedures. |
| * Identification and selection of tools and materials |
| * Identify and use relevant test equipment |
| * Testing techniques |
| * Dismantle and assemble components to specified tolerances |
| * Communicate effectively |
| * Basic First aid |

**Required Skills**

|  |  |
| --- | --- |
| **The trainee needs to demonstrate the following fundamental skills** | |
| * Communication skills | * Environmental Literacy |
| * Numeracy skills | * Employability skills |
| * Digital literacy skills | * Entrepreneurship skills |
| * Occupational health safety and Practices |  |

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | * 1. Observed safety at workplace and sound housekeeping   2. Identified different types of oil used in hydraulics   3. Identified pneumatic components and attachments   4. Selected and correctly used tools and equipment   5. Operated and monitored pneumatic system   6. Conducted and scheduled basic preventative maintenance   7. Performed pre- and post-operational tests   8. Conducted basic First Aid and Emergency evacuation |
| 1. Resource Implications | * 1. Air Compressor   2. Pneumatic system/model   3. Pneumatic simulation   4. Relevant legislations, e.g. OSHA, Environmental Act; and regulations   5. Workshop tools and equipment   6. Pneumatic manuals |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observed behavior of the learners at workplace   2. Inspection of written operation procedures   3. Inspection of log books |
| 1. Context of Assessment | Competency will be assessed individually in the actual workplace or through accredited institution |
| 1. Guidance information for Assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended |

## MAINTAIN INDUSTRIAL MATERIAL HANDLING EQUIPMENT

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

**UNIT DESCRIPTION**

This unit covers competencies required to maintain industrial material handling equipment. It involves applying industrial material handling equipment maintenance safety procedures, conducting routine/ preventative maintenance for material handling equipment, troubleshooting industrial material handling equipment for faults, performing industrial MHE repair and maintenance, MHE pretesting procedures, reporting and documentation.

**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 Industrial material handling equipment maintenance safety Procedures | * 1. Personal safety gear is prescribed as per rules and regulations of the ***Occupational Safety Act***   2. Safety measures for the maintenance of the hydraulic system is defined as per OSHA and SOPs   3. Work place safety measures are adhered to according to SOPs |
| 1. Conduct routine/ preventative maintenance for material handling equipment | * 1. Regular inspection of the material handling equipment is done according to manufacturer’s recommendation   2. Corrective/breakdown maintenance as per SOPs   3. Scheduled maintenance is done as per SOPs   4. Predictive maintenance is done on the MHE as per SOPs |
| 1. Troubleshoot industrial material handling equipment for faults | * 1. Pre-operational checks are conducted on the material handling equipment in accordance to the manufacturers’ recommendations and SOPs   2. The functionality of the components for the material handling equipment is checked as per manufacturer’s specifications   3. Troubleshooting is done to identify faults on the material handling equipment components |
| 1. Carry out MHE maintenance | * 1. Perform ***tests*** in accordance with defined procedures   2. MHE auxiliaries are serviced and or replaced according to SOP   3. Loose bolts are fittings are tightened   4. Moving parts are lubricated   5. Filters are serviced and or replaced as per Manufacturers recommendations and SOPs   6. Seals, gaskets and Cotter pins are serviced and or replaced according to SOPs   7. Oil levels are checked and serviced as per Manufactures recommendation   8. Inventory is updated |
| 1. Perform MHE operation test | * 1. The MHE is test run and monitored to detect deviation from the normal ***operating procedures***   2. Corrective action is taken to rectify ***abnormalities*** when detected   3. Perform Housekeeping operations |
| 1. Reporting and Documentation | * 1. MHE Inventory is updated   2. MHE maintenance records are updated |

**RANGE**

| **Variable** | **Range** |
| --- | --- |
| *Types of Material Handling Equipment* may include but not limited to: | * + Hand tools and equipment   + Hand tracks   + Dolly   + Flat Belt Conveyor   + Troughed Belt Conveyor   + Slat belt   + Vibrating screeners   + Chute Conveyor   + Chain Conveyor   + Bucket Elevators   + Screw Conveyor   + Pallet truck and Pallet Jacks   + Walkie Stackers   + Gantry Cranes |
| *Material* may include but not limited to: | * + Loose material   + Packaged material   + Palletized material |
| *Tests* may include but not limited to: | * + Visual inspection   + Audio inspection   + Test run   + Sling tests |
| *Correct Operational Response* may include but not limited to: | * + Capacity rating   + Type of material   + Conveyor speed   + Operating environment |
| *Abnormalities* may include but not limited to: | * + Wobbling belts/Chains   + Slackened belt/chain   + Vibrations   + Defective lifting equipment |
| *Appropriate Personnel* may include but not limited to: | * + Maintenance personnel   + Supervisors and managers   + Operators   + Off-loaders   + Suppliers   + Colleagues |
| *Appropriate Authority* may include but not limited to: | * + International and local regulations |
| *Documentation* may include but not limited to: | * + Test certificates and reports   + Manufacturers documentation |
| *PPE* may include but not limited to: | * + Hand and forearm protection, such as gloves   + Eye protection   + Steel-toed safety shoes or boots   + Metal, fiber, or plastic metatarsal guards   + Ear muffs and Nose masks |
| *Hazards* may include but not limited to: | * + Falling objects   + Improperly stacked materials   + Twisting and turning   + Bending   + Strains and sprains from lifting loads improperly   + Fractures and bruises caused by being struck by materials   + Cuts and bruises caused by falling materials   + Inhalations risks   + Sight impairment |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

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

**Required Skills**

|  |
| --- |
| * Relevant environmental, occupational health and safety legislation and regulations |
| * Personal protective equipment (PPE) and safety equipment. |
| * Types of material handling equipment |
| * Parts and accessories of material handling equipment |
| * Assess potential hazards. |
| * Scheduled and preventative maintenance of the equipment. |
| * Uses documentation. |
| * Completes daily equipment logbook. |
| * Troubleshooting and basic repairs on the equipment |
| * Identify and use relevant test equipment |
| * Testing techniques |
| * Dismantle and assemble components of the equipment |
| * Communicate effectively |
| * Basic First aid |

**Required Skills**

|  |  |
| --- | --- |
| **The trainee needs to demonstrate the following fundamental skills** | |
| * Communication skills | * Environmental Literacy |
| * Numeracy skills | * Employability skills |
| * Digital literacy skills | * Entrepreneurship skills |
| * Occupational health safety and Practices |  |

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | * 1. Observed safety at workplace and sound housekeeping   2. Identified different types of material handling equipment   3. Identified components and attachments of material handling equipment   4. Selected and correctly use material handling equipment   5. Monitored the equipment   6. Conducted scheduled and basic preventative maintenance   7. Conducted basic First Aid and Emergency evacuation |
| 1. Resource Implications | * 1. Different types of material handling equipment   2. Material handling simulation   3. Relevant legislations, e.g. OSHA, Environmental Act; and regulations   4. Workshop tools and equipment   5. Material handling equipment manuals |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observed behavior of the learners at workplace   2. Inspection of written maintenance procedures   3. Analysis of log books |
| 1. Context of Assessment | Competency will be assessed individually in the actual workplace or through accredited institution |
| 1. Guidance information for Assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended |

# MAINTAIN INDUSTRIAL PUMP

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

**UNIT DESCRIPTION**

This unit covers competencies required to maintain industrial pump. It involves applying industrial pump maintenance safety procedures, conducting routine/ preventative maintenance for industrial pumps troubleshooting industrial pumps for faults, performing industrial pumps maintenance, industrial pump operation test and preparing industrial pump maintenance report.

**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 Industrial pump maintenance safety Procedures | * 1. Personal safety gear is prescribed as per rules and regulations of the ***Occupational Safety Act***   2. Safety measures for the maintenance of the Industrial pumps is defined as per OSHA and SOPs   3. Work place safety measures are adhered to according to SOPs |
| 1. Conduct routine/ preventative maintenance for industrial pumps | * 1. Monitoring of bearing temperature is done to avoid excessive vibration on the bearing as per manufacturers recommendations   2. Shaft seal condition is done regularly as per manufacturers recommendations   3. Annual maintenance is done on the pumps is done as per SOPs   4. Quarterly maintenance is done on the pumps is done as per SOPs |
| 1. Troubleshoot industrial pumps for faults | * 1. Pre-operational checks are conducted on the pump in accordance to the manufacturers’ recommendations and SOPs   2. The functionality of the components for the pump is checked as per manufacturer’s specifications   3. Troubleshooting is done to identify faults on the pump components |
| 1. Perform industrial pumps Maintenance | * 1. Logs books, daily check charts and pump reports are implemented   2. Working check card for pump are generated according to SOPs   3. Spare inventory record maintained according to SOPs   4. All clearances and tolerances are restored to the manufacture’s specifications   5. Seals, O-rings, glands, main shafts, impeller lock nuts, impeller, both drive-end and non-drive -end ***bearings*** are serviced and or replaced according to SOPs   6. Right lubrication (food grade or non-food grade) identified according to manufactures specifications   7. Pump alignment using Dial Test indicator performed   8. Pumps next due date for service is updated on the check card and pump schedule as per SOPs   9. Tools and material inventory is updated according SOPs |
| 1. Perform industrial pump operation test | 1. The pump is test run and monitored to detect deviation from the normal ***operating procedures*** 2. Corrective action is taken to rectify ***abnormalities*** when detected |
| 1. Prepare industrial pump maintenance report | * 1. Standard maintenance procedures are followed as recorded in maintenance manuals   2. Maintenance scheduling is documented according to manufacturer specifications   3. Maintenance report is developed and stored as per workplace procedure |

**RANGE**

This section provides work environment and condition to which the performance criteria (PC) apply. It allows for different work environment and situation that will affect performance

| **Variable** | **Range** |
| --- | --- |
| * *Occupational Safety and Health Act 2007* may include but not limited to: | * + Personal safety equipment   + Responsibility of the employee   + Responsibility of the employer   + Work area safety   + Work area hazards   + Accident reporting procedure |
| * *Types of pump* may include but not limited to: | * + Centrifugal pump   + Reciprocating Pump   + Piston Pump   + Diaphragm Pump   + Rotary Pump   + Lobe Pump   + Screw Pump |
| * *Types of Bearing* may include but not limited to: | * + Plain/ Journal bearing   + Ball Bearings   + Roller bearings   + Thrust bearings |
| * *Types of Seals* may include but not limited to: | * + Mechanical seals   + Gaskets   + O-rings   + Gland packing |
| * *Pump Auxiliaries* may include but not limited to: | * + Pump lubrication oil systems   + Valves   + Pump prime movers including A.C and D.C motors, steam turbines, oil engines |
| * *Hazards* may include but not limited to: | * + Liquid spillage   + Unguarded rotating parts   + High temperature   + Explosion   + Pump vibrations   + shock   + Electromagnetic emissions |
| * *Safety Standards* may include but not limited to: | * + Relevant sections of Occupational Health and Safety legislation   + Industry standards   + Manufacturers’ recommendations   + National standards for plant and relevant state legislation. |
| * *Procedures* may include but not limited to: | * + Manufacturer guidelines (e.g. instructions, specifications or checklists)   + Industry operating procedures   + Workplace procedures (e.g. work instructions, operating procedures or checklists) |
| * *Appropriate/Relevant personnel* may include but not limited to: | * + Production personnel   + Maintenance personnel   + Supervisors/Team leaders and managers or equivalent   + Technical and engineering officers or equivalent   + Operating staff and contractor staff. |
| * *Tests* may include but not limited to: | * + Valves operating checks   + Performance tests   + Leak checks   + Cavitation’s checks   + Vibration tests |
| * *Personal Protective Equipment (PPE)* may include but not limited to: | * + Thermally insulated gloves   + Ear protection (muffs or plugs)   + Working protective gloves   + Safety boots |
| * *Faults/ abnormal operating conditions* may include but not limited to: | * + Loss of pumping capacity   + power failure   + Tubing occlusion   + Cavitation’s   + Vibration   + Noise   + Misalignment   + Load faults   + Leakages |
| * *Appropriate emergency response* may include but not limited to: | * + Identification of emergency   + Isolation of power source   + Selection and application of appropriate fire-fighting equipment and PPE   + Notification of downstream users   + Notification of appropriate regulatory authorities |

**REQUIRED KNOWLEDGE AND SKILLS**

**Required Knowledge**

|  |
| --- |
| * Relevant environmental, occupational health and safety legislation and regulations |
| * Classification of pumps |
| * Pump construction and operating principles |
| * Pump Diagrams |
| * Pump Preventative maintenance |
| * Pump Installation |
| * Recording procedures |
| * Pump speed control equipment |
| * Pump fittings |
| * Lubrication and bearings |
| * Fire protection control systems |
| * First aid |

**Required Skills**

|  |  |
| --- | --- |
| **The trainee needs to demonstrate the following fundamental skills** | |
| * Communication skills | * Environmental Literacy |
| * Numeracy skills | * Employability skills |
| * Digital literacy skills | * Entrepreneurship skills |
| * Occupational health safety and Practices |  |

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | * 1. Observed safety at workplace and sound housekeeping   2. Identified different types of pump   3. Identified parts of pumps   4. Identified pump fittings   5. Operated and monitored pumps performance   6. Conducted basic preventative maintenance   7. Conducted basic First Aid and Emergency evacuation |
| 1. Resource Implications | * 1. Various pumps   2. Pump simulations   3. Pump manuals   4. Relevant legislations, e.g. OSHA, Environmental Act; and regulations   5. Workshop tools |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observed behavior of the learners   2. Inspection of written operation procedures   3. Inspection of log books |
| 1. Context of Assessment | Competency will be assessed individually in the actual workplace or through accredited institution |
| 1. Guidance information for Assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended |