

**REPUBLIC OF KENYA**

**OCCUPATIONAL STANDARDS**

**FOR**

**WELDING TECHNICIAN**

**KNQF LEVEL 6**

**PROGRAMME CODE: 0715 554A**

# FOREWORD

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

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

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

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

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

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Principal Secretary,

State Department for Technical and Vocational Education and Training,

# 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 (TVET) Act No. 29 of 2013 and Sessional Paper No. 4 of 2016 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.

Incumbent welding and fabrication industry experts in conjunction with expert subject trainers and other related stakeholders have developed these Occupational Standards for Welding and Fabrication Technician Level 6. These standards will be the basis for development of competency-based curriculum for Welding Technician Level 6.

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 everyone who participated in the development of these Occupational Standards.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Cabinet Secretary,

Ministry of Education, Science & Technology

# ABBREVIATIONS AND ACRONYMS

2D Two Dimensional

3D Three Dimensional

AC Alternating Current

CAD Computer Aided Design

CAE Computer Aided Engineering

CPU Central Processing Unit

DC Direct Current

DVI Digital Visual Interface

FCAW Flux Cored Arc Welding

GMAW Gas Metal Arc Welding

HDMI High-Definition Multimedia Interface

KNQF Kenya National Qualifications Framework

MAG Metal Active Gas

MIG Metal Inert Gas

MMAW Manual Metal Arc Welding

PLC Programmable Logic Controller

PPE Personal Protective Equipment

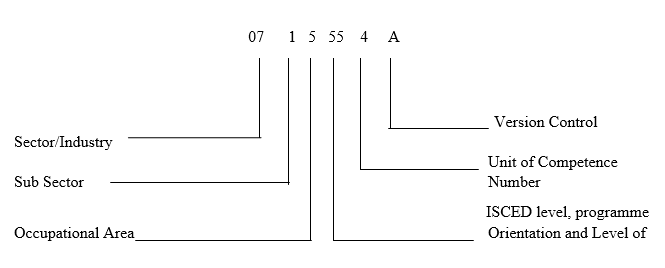
RAM Random Access Memory

TIG Tungsten Inert Gas

USB Universal Serial Bus

VGA Video Graphics Array

# KEY TO UNIT CODE



XX X X XX X X

# TABLE OF CONTENTS

[FOREWORD ii](#_Toc195612091)

[PREFACE iii](#_Toc195612092)

ABBREVIATIONS AND [ACRONYMS iv](#_Toc195612093)

[KEY TO UNIT CODE v](#_Toc195612094)

[TABLE OF CONTENTS vi](#_Toc195612095)

[OVERVIEW vii](#_Toc195612096)

[SUMMARY OF UNITS OF COMPETENCY vii](#_Toc195612097)

[BASIC UNITS OF COMPETENCY](#_Toc195612098)

[APPLY DIGITAL LITERACY 2](#_Toc195612099)

[APPLY COMMUNICATION SKILLS 13](#_Toc195612100)

[APPLY WORK ETHICS AND PRACTICES 18](#_Toc195612101)

[APPLY ENTREPRENEURIAL SKILLS 26](#_Toc195612102)

[COMMON UNITS OF COMPETENCY](#_Toc195612103)

[APPLY MATHEMATICS 33](#_Toc195612104)

[APPLY TECHNICAL DRAWINGS 37](#_Toc195612105)

[APPLY MECHANICAL SCIENCE 43](#_Toc195612106)

[APPLY METALLURGY 47](#_Toc195612107)

[APPLY ELECTRICAL AND ELECTRONICS PRINCIPLES 53](#_Toc195612108)

[APPLY ENGINEERING MATHEMATICS 58](#_Toc195612109)

[APPLY ENGINEERING MECHANICS 64](#_Toc195612110)

[PERFORM COMPUTER AIDED DRAWING 69](#_Toc195612111)

[CORE UNITS OF COMPETENCY](#_Toc195612112)

[PERFORM FABRICATION PROCESSES I 76](#_Toc195612113)

[PERFORM ARC WELDING PROCESSES I 80](#_Toc195612114)

[PERFORM BRAZING, SOLDERING AND GAS WELDING 84](#_Toc195612115)

[PERFORM METAL INERT GAS WELDING 91](#_Toc195612116)

[PERFORM TUNGSTEN INERT GAS WELDING 96](#_Toc195612117)

[PERFORM ARC WELDING PROCESSES II 100](#_Toc195612118)

[PERFORM FABRICATION PROCESSES II 106](#_Toc195612119)

[PERFORM GAS METAL ARC WELDING OPERATIONS 110](#_Toc195612120)

[PERFORM WELD INSPECTION 117](#_Toc195612121)

[DESIGN WELDING PRODUCTS 121](#_Toc195612122)

# OVERVIEW

This document contains occupational standards designed to prescribe competences required for the qualification of Welding Technician Level 6. These competences are required in order to Apply Digital Literacy, Communication Skills, Work Ethics and Practices, Entrepreneurial Skills, Mathematics, Technical Drawings, Mechanical Science, Electrical and Electronics Principles, Metallurgy, Engineering Mechanics, Engineering Mathematics, Computer Aided Drawing, perform Fabrication Processes I, Arc Welding Processes I, Gas welding, Soldering and brazing processes, Metal Inert Gas Welding, Tungsten Inert Gas Welding, Fabrication Processes II, Arc Welding Processes II, Gas Metal Arc Welding Operations, Weld Inspection and Design Welding Products. The occupational standards consist of basic, common and core units of competency as indicated hereafter.

# SUMMARY OF UNITS OF COMPETENCY

|  |  |
| --- | --- |
| **BASIC UNITS OF COMPETENCY** | |
| **UNIT CODE** | **UNIT TITLE** |
| 0611 441 01A | Apply Digital Literacy |
| 0031 441 02A | Apply Communication Skills |
| 0417 441 03A | Apply Work Ethics and Practices |
| 0413 441 04A | Apply Entrepreneurial Skills |
| **COMMON UNITS OF COMPETENCY** | |
| 0541 441 05A | Apply Mathematics |
| 0732 441 06A | Apply Technical Drawings |
| 0715 441 07A | Apply Mechanical Science |
| 0715 441 08A | Apply Metallurgy |
| 0715 441 09A | Apply Electrical and Electronics Principles |
| 0541 541 10A | Apply Engineering Mathematics |
| 0715 541 11A | Apply Engineering Mechanics |
| 0732 541 12A | Perform Computer Aided Drawing |
| **CORE UNITS OF COMPETENCY** | |
| 0715 251 13A | Perform Fabrication Processes I |
| 0715 251 14A | Perform Arc Welding Processes I |
| 0715 251 15A | Perform Brazing, Soldering and Gas Welding |
| 0715 351 16A | Perform Metal Inert Gas Welding |
| 0715 351 17A | Perform Tungsten Inert Gas Welding |
| 0715 451 18A | Perform Arc Welding Processes II |
| 0715 451 19A | Perform Fabrication Processes II |
| 0715 451 20A | Perform Gas Metal Arc Welding Operations |
| 0715 551 21A | Perform Weld Inspection |
| 0715 551 22A | Design Welding Products |

# BASIC UNITS OF COMPETENCY

# APPLY DIGITAL LITERACY

**UNIT CODE:** 0611 441 01A

**UNIT DESCRIPTION:**

This unit covers the competencies required to demonstrate digital literacy. It involves operating computer devices, solving tasks using the Office suite, accessing online/offline data and information, performing online communication and collaboration, applying cybersecurity skills and performing jobs online. It also involves applying job entry techniques.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Operate computer devices | * 1. C***omputer device*** usage is determined as per workplace requirements.   2. ***Computer hardware*** is identified according to job requirements.   3. ***Computer software*** is identified according to workplace requirements.   4. Computer devices are turned on or off as per correct workplace procedure.   5. ***Mouse techniques*** are applied in solving tasks as per workplace requirements.   6. Keyboardtechniques are applied in solving tasks as per workplace requirements.   7. Computer files and folders are created and managed as per workplace requirements.   8. ***Internet connection option***s are identified and applied in connecting computer devices to the internet as per work requirements   9. ***External devices*** are identified and connected to the computer devices as per job requirement. |
| 1. Solve tasks using Office suite | 1. ***Word processing concepts***are applied in solving workplace tasks as per job requirements. 2. Worksheet data is entered and prepared in accordance with work procedures. 3. Worksheet data is built and edited in accordance with workplace procedures. 4. ***Data manipulation*** on a worksheet is undertaken in accordance with work requirements. 5. Worksheets are saved and printed in accordance with job requirements. 6. ***Electronic presentation concepts***are applied in solving workplace tasks as per job requirements. |
| 1. Manage data and information | * 1. Office ***internet services*** are identified and applied in accordance with office procedures.   2. ***Internet access applications*** are determined in accordance with office operation procedures.   3. Internet search is performed as per job requirements.   4. Online digital content is downloaded in accordance with workplace requirements.   5. Digital content is identified and backed up in accordance with workplace procedures. |
| 1. Perform online communication and collaboration | * 1. Netiquette principles are observed as per work requirements.   2. Electronic mail communication is executed in accordance with workplace policy.   3. Digital content copyright and licenses are identified and applied according to workplace policies and regulatory requirements.   4. ***Online*** ***collaboration tools*** are applied in accordance with workplace policies and regulatory requirements. |
| 1. Apply cybersecurity skills | * 1. ***Data protection*** and ***privacy*** is classified in accordance with workplace policies and regulatory requirements.   2. ***Internet security threats*** are identified as per workplace policies and regulatory requirements.   3. Computer threats and crimes are detected in accordance to information management security guidelines   4. ***Cybersecurity control measures*** are applied in accordance with workplace policies and regulatory requirements. |
| 1. Perform online jobs | * 1. ***Online job platforms*** are identified as per job requirements.   2. Online accounts and profiles are created in accordance with work requirements.   3. Online jobs are identified according to bidder’s skillset.   4. Online digital identity is managed according to industry best practices.   5. Online job bidding is done as per specific job requirements.   6. Online tasks are executed according to job requirements.   7. Personal online payment account is managed in accordance with financial regulations. |
| 1. Apply job entry techniques | * 1. ***Job opportunities*** are sought based on competencies.   2. A winning resume/CV is developed as per job advertisement.   3. An application/cover letter is developed based on job advertisement.   4. ***Certificates and testimonials*** are organized as per resume.   5. ***Interview skills*** are demonstrated as per job advertisement. |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Computer devices may include but are not limited to: | * 1. Desktops   2. Laptops   3. Smartphones   4. Tablets   5. Smartwatches |
| 1. Computer hardware may include but are not limited to: | * 1. The System Unit E.g. Motherboard, CPU, casing,   2. Input Devices e.g. Pointing, keying, scanning, voice/speech recognition, direct data capture devices.   3. Output Devices e.g. hardcopy output and softcopy output   4. Storage Devices e.g. main memory e.g. RAM, secondary storage (Solid state devices, Hard Drives, CDs & DVDs, Memory cards, Flash drives   5. Computer Ports e.g. HDMI, DVI, VGA, USB type C etc. |
| 1. Computer software may include but are not limited to: | * 1. System software e.g. Operating System (Windows, Macintosh, Linux, Android, iOS)   2. Application Software e.g. Word Processors, Spreadsheets, Presentations etc.   3. Utility Software e.g. Antivirus programs |
| 1. External devices may include but are not limited to: | * 1. Printers   2. Projectors   3. Smart Boards   4. Speakers   5. External storage drives   6. Digital/Smart TVs |
| 1. Word processing concepts may include but are not limited to: | * 1. Creating word documents   2. Editing word documents   3. Formatting word documents   4. Saving word documents   5. Printing word documents |
| 1. Mouse techniques may include but are not limited to: | * 1. Clicking   2. Double-clicking   3. Right-clicking   4. Drag and drop |
| 1. Internet connection options may include but are not limited to: | * 1. Mobile Networks/Data Plans   2. Wireless Hotspots   3. Cabled (Ethernet/Fiber)   4. Dial-Up   5. Satellite   6. ISDN (Integrated Services Digital Network) |
| 1. Data manipulation may include but are not limited to: | * 1. Use of formulae   8.2 Use of functions  8.3 Sorting  8.4 Filtering  8.5 Visual representation using charts |
| 1. Electronic presentation concepts may include but are not limited to: | * 1. Creating slides   2. Editing slides   3. Formatting slides   4. Applying slide effects and transitions   5. Creating and playing slideshows   6. Saving presentations   7. Printing slides and handouts |
| 1. Internet services may include but are not limited to: | * 1. Communication Services   2. Information Retrieval Services   3. File Transfer   4. World Wide Web Services   5. Web Services   6. Directory Services   7. Automatic Network Address Configuration   8. News Group   9. Ecommerce |
| 1. Internet access applications/software may include but are not limited to: | * 1. Browsers   2. Email Apps   3. eCommerce Apps |
| 1. Online collaboration tools may include but are not limited to: | 12.1 Online Storage   * 1. Online productivity applications   2. Online meetings,   3. Online learning environments,   4. Online calendars   5. Social networks |
| 1. Data protection and privacy may include but not limited to: | * 1. Confidentiality of data/information   2. Integrity of data/information   3. Availability of data/information |
| 1. Internet security threats may include but not limited to: | 14.1 Malware attacks   * 1. Social engineering attacks   2. Software supply chain attacks   3. Advanced persistent threats (APT)   4. Distributed denial of service (DDoS)   5. Man-in-the-middle attack (MitM)   6. Password attacks   7. IoT Attacks   8. Phishing Attacks   9. Ransomware |
| 1. Security threats control measures may include but not limited to: | * 1. Counter measures against cyber terrorism   2. Physical Controls   3. Technical/Logical Controls   4. Operational Controls |
| 1. Online job platforms may include but are not limited to: | 16.1 Remotask   * 1. Data annotation.tech   2. Cloudworker   3. Upwork   4. Oneforma   5. Appen |
| 1. Job opportunities may include but not limited to: | * 1. Self-employment   2. Service provision   3. Product development   4. Salaried employment |
| 1. Certificates and testimonialsmay include but not limited to: | * 1. Academic credentials   2. Letters of previous employments/ services rendered   3. Letters of commendation   4. Certifications of participation   5. Awards |
| 1. Interview skills may include but not limited to: | * 1. Listening skills   2. Grooming   3. Language command   4. Articulation of issues   5. Body language   6. Time management   7. Honesty   8. Generally knowledgeable in current affairs and technical area |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Computer Hardware and Software Concepts
* Computer Security Concepts (Data security and privacy)
* Cyber security threats and control measures
* Understanding Computer Crimes
* Detection and protection against computer crimes
* Laws governing protection of ICT in Kenya
* Digital Identity Management
* Netiquette Principles
* Fundamentals of Copyright and Licenses
* Word processing;

Functions and concepts of word processing;

Documents and tables creation and manipulations;

Document editing;

Document formatting;

Word processing utilities

* Spreadsheets;

Meaning, types and importance of spreadsheets;

Components of spreadsheets;

Functions, formulae, and charts, uses and layout;

Data formulation, manipulation and application to cells;

Editing & formatting spreadsheets;

* Presentation Packages;

Types of presentation Packages.

Creating, formulating, running, editing, printing and presenting slides and handouts

* Networking and Internet;

Internet connectivity.

Browser and digital content management;

Managing data, information, and digital content

Electronic mail and World Wide Web

* Fundamentals of Online Working;

Online Profile Management;

e-Portfolio Management;

Online Jobs Bidding;

Online Payment Systems;

* Job entry techniques

Job searching sites

Interview preparation skills

Interview handling

**Required skills**

The individual needs to demonstrate the following skills:

* Active listening
* Keyboard Skills
* Mouse Skills
* Analytical skills
* Creativity
* Interpretation Skills
* Communication
* Spreadsheet operations (applying fundamental operations such as addition, subtraction, division and multiplication)
* Computer Use Safety Skills
* Document Editing Skills
* Document Formatting Skills
* Document Printing Skills
* Netiquette Skills
* Internet Browsing Skills
* Problem Solving Skills
* Online Collaboration Skills
* Cybersecurity Skills
* CV writing
* grooming

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | ***Assessment requires evidence that the candidate:***   * 1. Operated computer devices as per workplace policies and regulations.   2. Solved tasks using the office suite as per workplace policies and regulations.   3. Manage data and information as per workplace policies and regulations.   4. Performed online communication and collaboration as per workplace policies and regulations.   5. Applied cybersecurity skills in accordance with workplace policies and regulations.   6. Executed online tasks according to the job requirements.   7. Searched for job opportunity based on competencies.   8. Prepared job requirement documentations based on job opportunity.   9. Demonstrated interview skills based on the job opportunity. |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place.   2. Access to relevant work environments where assessment can take place.   3. Resources relevant to the proposed activities or task. |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Oral assessment   2. Portfolio of evidence   3. Third party report   4. Written assessment   5. Practical assessment   6. Projects |
| 1. Context of assessment | Competency may be assessed in the:   * 1. Workplace or simulated workplace. |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

# APPLY COMMUNICATION SKILLS

**UNIT CODE:** 0031 441 02A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate communication skills. It involves applying communication channels, written, non-verbal, oral, and group communication skills.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements that specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| --- | --- |
| 1. Apply communication channels | 1. Specific communication channels are identified and applied based on workplace requirements. 2. Challenges are identified and addressed as per the operational standards of the organization. 3. Communication channels are evaluated to meet workplace needs. |
| 1. Apply written communication skills | * 1. Types of written communication are identified and applied according to workplace requirements.   2. Written communication needs are identified and implemented according to workplace procedures.   3. Written communication guidelines are analyzed, evaluated, and revised based on workplace needs. |
| 1. Apply non-verbal communication skills | 3.1 Existing non-verbal communication techniques are identified and applied based on organization policy.  3.2 Non-verbal communication techniques are articulated and modelled to enhance inclusivity according to workplace requirements. |
| 1. Apply oral communication skills | 4.1 Types of oral communication are identified and established as per organization policy.  4.2 Pathways of oral communication are identified and established as per organization policy.  4.3 Pathways of oral communication are reviewed according to organization procedures.  4.4 Pathways of oral communication are maintained according to organization standards. |
| 1. Apply group communication skills | 1. Group communication strategies are appliedbased on the workplace needs. 2. Groups are organized in accordance with workplace procedures. 3. Effective questioning, listening and non-verbal communication techniques are used as per needs.   5.4 Group communication challenges are identified and addressed according to the workplace needs. |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Communication strategies may include but are not limited to: | * 1. Language switch   2. Comprehension check   3. Repetition   4. Asking confirmation   5. Paraphrasing   6. Clarification request   7. Translation   8. Restructuring   9. Generalization |
| 1. Effective group interaction may include but not limited to: | * 1. Identifying and evaluating what is occurring within an interaction in a non-judgmental way.   2. Using active listening.   3. Making decision about appropriate words, behaviour.   4. Putting together response which is culturally appropriate.   5. Expressing an individual perspective.   6. Expressing own philosophy, ideology and background and exploring impact with relevance to communication |
| 1. Situations may include but are not limited to: | * 1. Establishing rapport   2. Eliciting facts and information   3. Facilitating resolution of issues   4. Developing action plans |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Active listening
* Interpretation
* Negotiation
* Writing
* Oral skills
* Creative thinking
* Critical thinking
* Decision making
* Analytical
* Innovation
* Conflict skills
* Leadership
* Problem solving skills
* Management
* Organizational
* Teamwork

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups
* Styles of group leadership
* Key elements of communications strategy
* Principles of effective communication
* Turn-taking techniques
* Conflict resolution techniques
* Work planning
* Work organization
* Company policies
* Company operations and procedure standards
* Fundamental rights at the workplace
* Personal hygiene
* Accountability
* Workplace problems and how to deal with them

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency. | Assessment requires evidence that the candidate:   * 1. Identified and applied specific communication channels based on workplace requirements.   2. Identified and applied specific written communication correspondence according to the workplace requirements.   3. Applied and developed non-verbal strategies to communicate in all areas of the workplace requirements.   4. Established pathways of oral communication as per workplace policy.   5. Applied group communication strategies based on workplace needs. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place. 2. Appropriately simulated environment where assessment can take place. 3. Resources relevant to the proposed activity or tasks. |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Oral assessment   2. Portfolio of evidence   3. Third party report   4. Written assessment   5. Practical assessment   6. Projects |
| 1. Context of Assessment | Competency may be assessed:   1. In the workplace 2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY WORK ETHICS AND PRACTICES

**UNIT CODE:** 0417 441 03A

**UNIT DESCRIPTION**

This unit covers competencies required to apply work ethics and practices. It involves the ability to: conduct self-management, promote ethical work practices and values, promote teamwork, manage workplace conflicts, maintain professional and personal development, apply problem-solving and promote customer care.

**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 Range*** |
| --- | --- |
| 1. Apply self-management skills | 1. Personal vision, mission and goals are formulated based on potential and concerning organization objectives and strategic plan 2. Self-esteem and a positive self-image are developed and maintained based on value 3. Emotional intelligence and stress management are demonstrated as per workplace requirements. 4. Assertiveness is developed and maintained based on requirements of the job. 5. Accountability and responsibility for one's actions are demonstrated based on workplace instructions. 6. Time management, attendance and punctuality are observed as per the organization’s policy. 7. Personal goals are managed as per the organization’s objective 8. Self-strengths and weaknesses are identified based on personal objectives 9. Motivation, initiative and proactivity are utilized as per organization policy 10. Individual performance is evaluated and monitored according to agreed targets. |
| 1. Promote ethical work practices and values | 1. Integrity is demonstrated as per acceptable norms 2. Codes of conduct is applied as per workplace requirements 3. Policies and guidelines are observed as per workplace requirements 4. Professionalism is exercised in line with organizational policies |
| 1. Promote Team work | 3.1 ***Teams*** are formed to enhance productivity based on organization’s objectives  3.2 Duties are assigned to teams under organization policy.  3.3 Team activities are managed and coordinated as per set objectives.  3.4 Team performance is evaluated based on set targets as per workplace policy.  3.5 ***Conflicts*** are resolved between team members in line organization policy.  3.6 Gender and diversity-related issues are identified and mainstreamed in accordance workplace policy.  3.7 Healthy ***relationships*** are developed and maintained in line with workplace policies.  3.8 Adaptability and flexibility are applied in dealing with team members as per workplace policies |
| 1. Maintain professional and personal development | 4.1 ***Personal growth and development*** needs are identified and assessed in line with requirements of the job.  ***4.2 Training and career opportunities*** are identified and utilized based on job requirements.  4.3 ***Resources*** for training are mobilized and allocated based on organizations and individual skills needs.  4.4 Licenses and certifications relevant to the job and career are obtained and renewed as per policy.  4.5 Recognitions are sought as proof of career advancement in line with professional requirements.  4.6 Work priorities and personal commitments are balanced and managed based on the requirements of the job and personal objectives.  4.7 Dynamism and on-the-job learning are embraced in line with the organization’s goals and objectives. |
| 1. Apply Problem solving skills | 5.1 ***Creative, innovative*** and practical solutions are developed based on the problem  5.2 Independence and initiative in identifying and solving problems are demonstrated based on requirements of the job.  5.3 Team problems are solved as per workplace guidelines  5.4 Problem-solving strategies are applied as per workplace guidelines  5.5 Problems are analyzed and assumptions tested as per context of data and circumstances |
| 1. Promote Customer Care | 6.1 Customers' needs are identified based on their characteristics  6.2 Customer ***feedback*** is allowed and facilitated in line with organization policies.  6.3 Customer concerns and complaints are analyzed and resolved in line with the set organizational culture.  6.4 Proactive customer outreach programs are implemented as per organizational policies  6.5 Customer retention strategies are developed and implemented in line with the organizational policy |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Feedback may include but not limited to: | * 1. Verbal   2. Written   3. Informal   4. Formal |
| 1. Conflicts include but are not limited to: | * 1. Interpersonal Conflict.   2. Intrapersonal Conflict.   3. Intergroup Conflict.   4. Intragroup Conflict. |
| 1. Relationships may include but not limited to: | * 1. Man/Woman   2. Trainer/trainee   3. Employee/employer   4. Client/service provider   5. Husband/wife   6. Boy/girl   7. Parent/child   8. Sibling relationships |
| 1. Team may include but not limited to: | * 1. Small work group   2. Staff in a section/department   3. Inter-agency group   4. Virtual teams |
| 1. Personal growth may include but not limited to: | * 1. Growth in the job   2. Career mobility   3. Gains and exposure the job gives   4. Net workings   5. Benefits that accrue to the individual as a result of noteworthy performance |
| 1. Personal objectives may include but not limited to: | * 1. Long term   2. Short term   3. Broad   4. Specific |
| 1. Trainings and career opportunities may include but not limited to | * 1. Participation in training programs   2. Serving as Resource Persons in conferences and workshops   3. Capacity building |
| 1. Resource may include may but not limited to: | * 1. Human   2. Financial   3. Technology |
| 1. Creative and innovative may include but not limited to: | * 1. New ideas   2. Original ideas   3. Different ideas   4. Methods/procedures   5. Processes   6. New tools |
| 1. Emerging issues may include but not limited to: | * 1. Artificial Intelligence   2. Data confidentiality   3. National cohesion   4. Open offices |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Active listening
* Critical thinking
* Organizational
* Negotiation
* Monitoring
* Evaluation
* Problem solving
* Decision Making
* Leadership
* Creative/innovative thinking
* Adaptability
* Conflict management
* Emotional intelligence
* Teamwork

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Work values and ethics
* Company policies and procedures
* Company operations, procedures and standards
* Flexibility and adaptability
* Concept of time and leisure time
* Decision making
* Work planning
* Organizing work
* Monitoring and evaluation
* Record keeping
* Gender and diversity mainstreaming
* Drug and substance abuse
* Professional Growth And Development
* Creativity
* Innovation
* Problem Solving
* Customer care
* Mentoring and coaching.
* Emerging 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 require evidence that the candidate:   * 1. Applied self-management skills as per organizational procedures.   2. Promoted ethical practices and values as per organizational procedures.   3. Promoted teamwork as per workplace assignments.   4. Maintained professional and personal development as per organizational procedures.   5. Applied problem-solving skills based on work requirements.   6. Identified customer needs based on their characteristics.   7. Gave back customer feedback in line with organization policies. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place. 3. Resources relevant to the proposed activity or tasks. |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Oral questioning 2. Written test 3. Portfolio of Evidence 4. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. In the workplace 2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY ENTREPRENEURIAL SKILLS

**UNIT CODE :** 0413 441 04A

**UNIT DESCRIPTION**

This unit covers the competences required to apply entrepreneurial skills. It involves demonstrating an understanding of financial literacy, applying entrepreneurial concepts identifying entrepreneurship opportunities, applying business legal aspects, developing business innovative strategies, and developing business plans.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace function**.** | **PERFORMANCE CRITERIA**  These are assessable statements that specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in Range*** |
| --- | --- |
| 1. Apply financial literacy skills | 1. Sources of personal and business *funds* are identified as per financial procedures and standards 2. Personal finances are managed as per financial procedures and standards 3. Savings are managed as per financial procedures and standards 4. Debts are managed as per financial procedures and standards 5. Investments are undertaken as per financial procedures and standards 6. Insurance services are procured as per financial procedures and standards |
| 1. Apply entrepreneurial concept | 1. Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship 2. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 3. Ways of becoming an entrepreneur are identified as per principles of Entrepreneurship 4. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 5. Salaried employment and self-employment are distinguished as per principles of entrepreneurship 6. ***Requirements for entry into self-employment*** are identified according to business procedures and standards 7. Roles of an Entrepreneur in an enterprise are determined according to business procedures and standards 8. Contributions of entrepreneurship to National development are identified as per business procedures and standards |
| 1. Identify entrepreneurial opportunities | 1. Business ideas are identified as per business procedures and standards 2. Factors to consider when evaluating business opportunity viability are explored based on business procedure and standards 3. Entrepreneurial opportunities are evaluated as per business procedures and standards 4. Business ideas and opportunities are generated as per business procedures and standards 5. Business life cycle is analyzed as per business procedures and standards |
| 1. Apply business legal aspects | 1. ***Forms of business ownership*** are identified as per legal procedures and practices 2. Business Registration and Licensing processes are identified as per legal procedures and practices 3. Types of Contracts and Agreements are analyzed as per legal procedures and practices 4. Employment Laws are identified as per legal procedures and practices 5. Taxation laws are identified as per legal procedures and practices |
| 1. Innovate Business strategies | 1. Business innovation strategies are determined by the organization standards 2. Creativity in business development is demonstrated in accordance with business standards 3. ***Innovative business standards*** are developed as per business principles 4. Linkages with other entrepreneurs are created as per best practice 5. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Business idea is described as per business procedures and standards 2. Business description is developed as per business plan format 3. Marketing plan is developed as per business plan format 4. Organizational/Management plan is prepared in accordance with business plan format 5. Production/operation plan is prepared in accordance with business plan format 6. Financial plan is prepared in accordance with the business plan format 7. Executive summary is prepared in accordance with business plan format 8. Business plan is presented as per best practice 9. Business ideas are incubated as per institutional policy. |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Sources of personal funds may include but not limited to: | * 1. Salary/Wages   2. Investments   3. Savings   4. Inheritance   5. Government Benefits |
| 1. Sources of business finance may include but not limited to: | * 1. Equity Financing   2. Debt Financing,   3. Personal Savings/Investment   4. Retained Earnings   5. Grants and Subsidies   6. Crowdfunding   7. Supplier Credit:   8. Leasing and Asset Financing: |
| 1. Types of entrepreneurs may include but not limited to: | * 1. Innovators   2. Imitators   3. Craft   4. Opportunistic   5. Speculators |
| 1. Characteristics of entrepreneurs may include but not limited to: | * 1. Creative   2. Innovative   3. Planner   4. Risk taker   5. Networker   6. Confident   7. Flexible   8. Persistent   9. Patient   10. Independent   11. Future oriented   12. Goal oriented |
| 1. Requirements for entry into self-employment may include but not limited to | * 1. Technical skills   2. Management skills   3. Entrepreneurial skills   4. Resources   5. Infrastructure |
| 1. Forms of businesses ownership may include but not limited to: | * 1. Sole proprietorship   2. Partnership   3. Limited companies   4. Cooperatives |
| 1. Innovative business standards may include but not limited to: | * 1. New products   2. New methods of production   3. New markets   4. New sources of supplies   5. Change in industrialization |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Decision making
* Business communication
* Change management
* Competition
* Risk
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care standards
* Basic financial management
* Business strategic planning
* Impact of change on individuals, groups and industries
* Government and regulatory processes
* Local and international market trends
* Product promotion standards
* Market and feasibility studies
* Government and regulatory processes
* Local and international business environment
* Relevant developments in other industries
* Regional/ County business expansion standards

**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 sources of personal and business finance as per financial procedures and standards 2. Managed personal finances as per financial procedures and standards 3. Made investment decisions as per financial procedures and standards 4. Generatedbusiness ideas and opportunities based on business procedure and standards 5. Analyzed business life cycle based on business procedure and standards 6. Determined business innovative standards as per business principles 7. Developed and presented a business plan as per regulatory framework. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place 3. Resources relevant to carrying out the tasks required |
| 1. Methods of Assessment | Competency may be assessed through:   1. Project 2. Written tests 3. Oral questions 4. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. At the workplace 2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# COMMON UNITS OF COMPETENCY

# APPLY MATHEMATICS

**UNIT CODE:** 0541 441 05A

**UNIT DESCRIPTION:**

This unit describes the competences required in order to apply algebra, trigonometric functions, coordinate geometry, statistics, vector theorem, matrices and to carry out mensuration.

**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 task requirement   2. Calculations involving logarithms are performed as per task requirement   3. Scientific calculator is used in solving mathematical problems as per task requirement   4. Simultaneous equations are solved as per task requirement   5. Quadratic equations are solved as per as per task requirement |
| * 1. Apply trigonometric functions | * 1. Calculations involving trigonometry are performed as per task requirement   2. Calculations involving reciprocal trigonometric functions are performed as per task requirement   3. Pythagorean trigonometric identity is applied as per task requirement |
| * 1. Apply coordinate geometry | * 1. Linear equations are calculated as per task requirement   2. Graphs of given linear equations are drawn as per task requirement   3. Normal and parallel are determined as per task requirement |
| * 1. Carry out mensuration | * 1. Units of measurements and their symbols are determined as per task requirement   2. Conversion of units of measurement are performed as per task requirement   3. Calculation of length, width, height, perimeter, area and angles of figures is performed as per task requirement   4. Measurements and estimations of quantities is performed as per task requirement |
| * 1. Apply statistics and probability | * 1. Presentation of data is done as per task requirement   2. Measures of ***central tendency*** are obtained as per task requirement   3. Measures of ***dispersion*** are obtained as per task requirement   4. Probability of occurrence of events are determined |
| * 1. Apply vector theorem | * 1. Vectors and scalar quantities are determined as per task requirement   2. Operations on vectors are performed as per task requirement   3. Resolution of vectors is performed as per task requirement |
| * 1. Apply matrices | * 1. Matrices operations are performed as per mathematical methods   2. Inverse of matrices are obtained as per task requirement   3. Simultaneous equations are solved using matrices as per task requirement |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Central tendency may include but not limited to: | * 1. Mean   2. Mode   3. Median |
| 1. Dispersion may include but not limited to: | * 1. Variance   2. Standard deviation |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* 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

**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. Solved simultaneous equations as per task requirement   2. Solved quadratic equations as per as per task requirement   3. Performed calculations involving trigonometry as per task requirement   4. Determined normal and tangents as per task requirement   5. Performed calculation of length, width, height, perimeter, area and angles of figures as per task requirement   6. Obtained measures of central tendency as per task requirement   7. Performed resolution of vectors as per task requirement   8. Solved simultaneous equations using matrices as per task requirement |
| 1. Resource Implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Oral questioning   2. Portfolio of evidence   3. Third party report   4. Written tests |
| 1. Context of Assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

# APPLY TECHNICAL DRAWINGS

**UNIT CODE:** 0732 441 06A

**UNIT DESCRIPTION**

This unit covers the competences required to apply technical drawings. It involves competences to select, use and maintain drawing equipment and materials. It also involves applying technical drawing tools, equipment and materials, producing plain geometry drawings, solid geometry drawings, orthographic drawings of components, isometric drawings, assembly drawings and geometric CAD drawings.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Apply technical drawing tools, equipment and materials | 1.1 ***Drawing equipment*** are identified and gathered according to task requirements  1.2 ***Drawing materials*** are identified and gathered according to task requirements  1.3 Drawing equipment are used as per task requirement |
| 1. Produce plain geometry drawings | * 1. Different ***types of lines*** used in drawing and their meanings are identified according to standard drawing conventions   2. Different types of geometric forms are constructed as per task requirement   3. Different ***types of angles*** are constructed as per task requirement   4. Different types of angles are measured using appropriate measuring tools   5. Angles are bisected as per task requirement   6. Sketches and drawings of patterns are interpreted as per task requirement   7. Patterns are developed as per task requirement |
| 1. Produce ***solid geometry drawings*** | 1. Sketches and drawings of patterns are produced as per task requirement 2. Solids are produced as per task requirement 3. Solids are developed and interpenetrated as per task requirement 4. Different ***symbols and abbreviations*** are applied as per task requirement 5. Auxiliaries’ views and true shapes are produced as per task requirement |
| 1. Produce orthographic drawings of components | 1. First and third angle orthographic sketches and drawings of components are interpreted and produced as per task requirement 2. Freehand sketching of different types of geometric forms, tools, equipment, diagrams and components is conducted as per task requirement 3. Sections of different forms of projection are constructed as per task requirement |
| 1. Produce Isometric drawings | 1. Isometric sketches and drawings of components are interpreted and produced as per task requirement 2. Isometric curves and circles are interpreted and produced as per task requirement 3. Oblique sketches are constructed as per task requirement |
| 1. Produce assembly drawings | 1. Parts are assembled on orthographic views as per task requirement 2. ***Sectional views*** are produced as per task requirement    1. Produced drawing is hatched as per task requirement    2. Part lists are identified as per task requirement |
| 1. Produce geometric CAD drawings | 1. Drawing requirements are identified as per work requirements 2. ***CAD software*** is identified as per work requirement 3. ***Geometric CAD drawings*** are prepared as per work requirement |

**RANGE**

| **Variable** | **Range**  ***May include but is not limited to:*** |
| --- | --- |
| 1. Drawing equipment include but are not limited to: | * 1. Drawing boards   2. T-square   3. Set squares   4. Drawing set   5. Computers with CAD packages |
| 1. Drawing materials include but are not limited to: | * 1. Drawing papers   2. Pencils   3. Erasers   4. Masking tapes   5. Paper clips |
| 1. Types of lines include but are not limited to: | * 1. Boarder lines   2. Faint continuous lines   3. Broken lines   4. Chain lines   5. Centre lines   6. Cutting lines |
| 1. Types of angles include but are not limited to: | * 1. 30 degrees   2. 45 degrees   3. 60 degrees   4. 90 degrees   5. 180 degrees |
| 1. Symbols and abbreviations include but are not limited to: | * 1. First angle   2. Third angle   3. E.g. of abbreviations   4. Scale- 1:2   5. Diameter – D20   6. Radius -R20 |
| 1. Isometric sketches and drawings include but are not limited to: | * 1. Use of 30 degrees |
| 1. Orthographic drawings include but are not limited to: | * 1. Front view   2. End view   3. Plan view |
| 1. Pictorial views include but are not limited to: | * 1. Front view   2. End view   3. Plan view |
| 1. Sectional views include but are not limited to: | * 1. Cutting lines   2. Assembled view |
| 1. Geometric forms include but are not limited to: | * 1. Circles   2. Triangles   3. Rectangles   4. Parallelogram   5. Polygons   6. Pyramids   7. Conic sections   8. Prisms   9. Loci |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Used drawing equipment as per task requirement   2. Developed patterns as per task requirement   3. Developed and interpenetrated solids as per task requirement   4. Constructed sections of different forms of projection as per task requirement   5. Constructed oblique sketches as per task requirement   6. Assembled parts on orthographic views as per task requirement   7. Prepared geometric CAD drawings as per work requirement |
| 1. Resource Implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Oral questioning   2. Portfolio of evidence   3. Practical test   4. Third party report   5. Written tests   6. Project work |
| 1. Context of Assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

# APPLY MECHANICAL SCIENCE

**UNIT CODE:** 0715 441 07A

**UNIT DESCRIPTION**

This unit describes the competences required in order to apply mechanical science. It includes resolving forces, determining effects of loads in mechanical systems, analyzing properties of materials, determining the nature of friction in mechanical systems and solving problems related to motion.

**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. Resolve forces | * 1. Theorems of forces are applied according to job requirements   2. Forces are resolved as per force theorems   3. Resultant forces are applied as per job requirements |
| 1. Determine effects of loads in mechanical systems. | 1. ***Types of forces*** are applied as per job requirements 2. Equilibrium of forces and plane framework are calculated as per job requirements 3. Point loads are analyzed as per job requirements 4. Principle of moments is applied as per work requirements. |
| 1. Analyze properties of materials | * 1. ***Mechanical properties*** and stress are applied as per job requirements   2. Mechanical properties of materials are tested as per job requirements   3. Direct stresses are calculated as per job requirements   4. Materials are selected are as per job requirements |
| 1. Determine the nature of friction in automotive systems | * 1. Friction is applied as per job requirements   2. Laws of friction are applied as per job requirements   3. Effects of friction are established as per job requirements   4.4 Tools and equipment are operated as per job requirements |
| 1. Solve problems related to motion. | * 1. Laws of motion are applied as per job requirements   2. Parameters of motion are calculated as per job requirements   3. Motion graphs are drawn as per job requirements   4. Relationship between linear and angular motion is established as per job 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**  ***May include but not limited to:*** |
| --- | --- |
| 1. Types of forces | * 1. Friction   2. Centrifugal   3. Centripetal   4. Gravitational   5. Inertia   6. Shear |
| 1. Mechanical properties | * 1. Tensile strength   2. Young modulus   3. Brittleness   4. Compressive strength   5. Shear strength   6. Plasticity   7. Modulus of rigidity Elasticity |

**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:

* Use of basic mechanical machines
* Perform various unit conversions of engineering quantities
* Logical thinking
* Problem solving
* Drawing graphs

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton’s laws of motion
* Laws of conservation of energy
* Laws of friction
* Types of forces
* Mechanical advantage and efficiency
* Properties of materials
* SI units of physical quantities
* Power, energy, work done, torque and safety factor

**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. Resolved forces as per force theorems   2. Applied principle of moments as per work requirements   3. Applied mechanical properties and stress as per job requirements   4. Calculated direct stresses as per job requirements   5. Applied laws of friction as per job requirements   6. Applied laws of motion as per job requirements |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Oral questioning   2. Portfolio of evidence   3. Practical test   4. Third party report   5. Written tests   6. Project work |
| 1. Context of Assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

# APPLY METALLURGY

**UNIT CODE:** 0715 441 08A

**Unit Description**

This unit describes the competences required in order to apply materials and metallurgy. It includes evaluating properties of engineering materials, using steel, aluminium, copper and its alloys, titanium and their alloys as well as performing metal testing.

**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. Evaluate properties of engineering materials | 1. Occupational safety and health procedures are observed as per work requirements 2. ***Engineering materials*** are selected as per task requirement 3. ***Physical properties*** of engineering materials are determined as per task requirement 4. ***Mechanical properties*** of engineering materials are determined as per task requirement 5. ***Thermal properties*** of engineering materials are determined as per task requirement 6. ***Forms of supply*** of engineering materials are selected as per task requirement |
| 1. Apply steel and its alloys | * 1. ***Steels*** are selected as per task requirement   2. ***Alloy steels*** are selected as per task requirement   3. Steel products are designed as per task requirement   4. Alloy steel products are designed as per task requirement   5. ***Housekeeping*** is performed as per work requirements |
| 1. Apply aluminium and its alloys | 1. Aluminium is selected as per task requirement 2. Aluminium alloys are selected as per task requirement 3. Aluminium products are designed as per task requirement 4. Aluminium alloy products are designed as per task requirement 5. Housekeeping is performed as per work requirements |
| 1. Apply copper and its alloys | * 1. Copper is selected as per task requirement   2. Copper alloys are selected as per task requirement   3. Copper products are designed as per task requirement   4. Copper alloy products are designed as per task requirement   5. Housekeeping is performed as per work requirements |
| 1. Apply titanium and its alloys | 1. Titanium is selected as per task requirement 2. Titanium alloys are selected as per task requirement 3. Titanium products are designed as per task requirement 4. Titanium alloy products are designed as per task requirement 5. Housekeeping is performed as per work requirements |
| 1. Perform metal testing | * 1. ***Metal preparation*** is performed as per task requirement   2. Testing tools, machines and equipment are set up as per task requirement   3. ***Non-destructive tests*** arecarried out as per task requirement   4. ***Destructive tests*** are carried out as per task requirement   5. Metal testing tools, machines and equipment are maintained as per task requirement   6. Housekeeping is carried out as per work requirement |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Engineering materials include but are not limited to: | * 1. Ferrous metals   2. Non-ferrous metals |
| 1. Physical properties include but are not limited to: | * 1. Color   2. Lustre   3. Opacity   4. Magnetism |
| 1. Mechanical properties include but are not limited to: | * 1. Strength   2. Hardness   3. Ductility   4. Malleability   5. Toughness   6. Rigidity   7. Elasticity   8. Plasticity   9. Brittleness |
| 1. Thermal properties include but are not limited to: | * 1. Melting point   2. Linear expansivity   3. Heat capacity |
| 1. Forms of supply include but are not limited to: | * 1. Ingots   2. Bars   3. Plates   4. Pellets   5. Tubes   6. Pipes   7. Sheets   8. Strips   9. Wires |
| 1. Steels include but are not limited to: | * 1. Low carbon steel   2. Medium carbon steels   3. Mild steel |
| 1. Alloy steels include but are not limited to: | * 1. Stainless steel   2. Tool steel   3. High speed steel |
| 1. Housekeeping includes but is not limited to: | * 1. Cleaning   2. Lubrication   3. Proper storage of materials and equipment   4. Waste disposal |
| 1. Metal preparation includes but is not limited to: | * 1. Pre-cleaning   2. Surface polishing   3. Grinding   4. Cutting   5. Etching |
| 1. Non-destructive tests include but are not limited to: | * 1. Visual Inspection   2. Ultrasonic test   3. Radiographic test   4. Magnetic Particle Test   5. Dye penetrant test   6. Eddy current test   7. Acoustic emission test   8. Xray test   9. Laser test   10. Infrared (thermography) test |
| 1. Destructive tests include but are not limited to: | * 1. Tensile testing   2. Hardness testing   3. Impact test (Charpy and Izod)   4. Fatigue test   5. Creep test   6. Torsion test   7. Bend test   8. Fracture toughness test   9. Corrosion test |

**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:

* Problem solving
* Creativity and innovation
* Use of tools and equipment
* Communication skills

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Materials
* Basic Chemistry
* Material handling
* Safety procedures

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Determined physical properties of engineering materials as per task requirement   2. Determined mechanical properties of engineering materials as per task requirement   3. Designed steel products as per task requirement   4. Designed alloy steel products as per task requirement   5. Designed aluminium products as per task requirement   6. Designed aluminium alloy products as per task requirement   7. Designed copper products are designed as per task requirement   8. Designed copper alloy products as per task requirement   9. Designed titanium products as per task requirement   10. Designed titanium alloy products are designed as per task requirement   11. Carried out non-destructive tests arecarried out as per task requirement   12. Carried destructive tests out as per task requirement |
| 1. Resource implications | The following resources should be provided:  2.1 Access to relevant workplace where assessment can take place  2.2 Appropriately simulated environment where assessment can take place  2.3 Resources relevant to carrying out the tasks required |
| 1. Methods of assessment | Competency may be assessed through:   1. Project 2. Practical 3. Written tests 4. Portfolio of Evidence |
| 1. Context of assessment | Competency may be assessed:  4.1 At the workplace  4.2 In a simulated work environment |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY ELECTRICAL AND ELECTRONICS PRINCIPLES

**UNIT CODE:** 0713 441 09A

**UNIT DESCRIPTION**

This unit describes the competences required in order to apply electrical and electronics principles. It involves applying basic concepts of electrical quantities, cells and batteries, magnetism and electromagnetism, basic electrical machines and electronics principles.

**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 basic concepts of electrical quantities | * 1. ***SI unit***s in Electrical are identified as per task requirement   2. ***Quantitie***s of Charge, force, work and power are applied as per task requirement   3. Calculations involving Ohm’s law are performed as per task requirement   4. Measuring instruments for electrical quantities are applied as per task requirement |
| 1. Apply DC and AC circuits | 1. Calculations of DC parallel and series circuits are performed as per task requirement 2. Calculations involving series resistor, inductor and capacitors in AC circuits are performed as per task requirement 3. Calculations involving parallel resistor, inductor and capacitors in AC circuits are performed as per task requirement |
| 1. Apply the concept of cells and batteries | 1. Various sources of electricity are used as per task requirement 2. Electrolysis is applied as per task requirement 3. E.M.F and internal resistance of cells is determined as per task requirement 4. Primary and secondary cells are applied as per task requirement 5. Cells and batteries are applied as per task requirement 6. Maintenance of batteries is carried out as per task requirement |
| 1. Apply magnetism and electromagnetism | * 1. Magnetic and nonmagnetic materials are used as per task requirement   2. Magnetic field patterns are utilized as per task requirement   3. Force on current carrying conductor is applied as per task requirement   4. Magnetic circuit quantities are applied as per task requirement   5. Magnetism curve and hysteresis loop are applied as per task requirement   6. Electromagnetic induction principle is applied as per task requirement |
| 1. Apply basic electrical machines | 1. E***lectrical machines*** are applied as per task requirement 2. DC machines are applied as per task requirement 3. AC machines are applied as per task requirement |
| 1. Apply electronics components | 6.1 Capacitors are applied as per task requirement  6.2 Resistors are applied as per task requirement   * 1. Inductors are applied as per task requirement   2. Diodes are applied as per task requirement   3. Application and testing of electronics components is performed as per task requirement |

**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**  May include but not limited to: |
| --- | --- |
| 1. SI unit includes but not limited to: | * 1. Power – Watts (W)   2. Current – Amperes (A)   3. Resistance – Ohms(Ω)   4. Voltage – Volts (V) |
| 1. Quantities includes but not limited to: | * 1. Charge   2. Force   3. Work   4. Power |
| 1. Electrical machinesinclude but not limited to: | * 1. DC motors   2. Transformers   3. Generators DC |

**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:

* Use of electrical instruments
* Power factor correction
* Logical thinking
* Problem solving
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Electrical power calculations
* Electrical formulas
* Power triangle
* SI units of various electrical parameters
* Types of electrical machines for various uses
* 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 quantities of Charge, force, work and power as per task requirement   2. Performed calculations involving Ohm’s law as per task requirement   3. Performed calculations of DC parallel and series circuits as per task requirement   4. Determined E.M.F and internal resistance of cells as per task requirement   5. Applied force on current carrying conductor as per task requirement   6. Applied electrical machines as per task requirement   7. Applied capacitors as per task requirement   8. Applied resistors as per task requirement   9. Applied inductors as per task requirement |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Oral questioning   2. Portfolio of evidence   3. Practical test   4. Third party report   5. Written tests   6. Project work |
| 1. Context of assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

# APPLY ENGINEERING MATHEMATICS

**UNIT CODE:** 0541 541 10A

**Unit Description**

This unit describes the competences required in order to apply engineering mathematics. It enables the learner to; apply algebra, apply trigonometry and hyperbolic functions, apply complex numbers, perform coordinates geometry, carry out binomial expansion, apply calculus, carry out mensuration, apply statistics, apply vector theorem and apply matrices.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Apply algebra | * 1. Indices calculations are performed as per laws of indices   2. Logarithms calculations are performed as per laws of logarithms   3. Simultaneous equations are performed as per job requirement   4. Quadratic equations are solved as per job requirement |
| 1. Apply trigonometry and hyperbolic functions | * 1. Calculations are performed as per trigonometric rules   2. Calculations are performed according to ***hyperbolic functions*** rules   3. Trigonometric identities are applied as per job requirement |
| 1. Apply complex numbers | * 1. Complex numbers are represented on Argand diagrams as per job requirement   2. ***Operations*** involving complex numbers are performed as per job requirement   3. De Moivre’s theorem is applied as per as per job requirement |
| 1. Perform coordinates geometry | * 1. Polar equations are solved as per job requirement   2. Polar equations graphs are drawn as per job requirement   3. Normal and tangents are determined as per job requirement |
| 1. Carry out binomial expansion | * 1. Binomial series is determined as per as per job requirement   2. Roots of numbers are determined as per job requirement   3. Errors of small changes are determined as per job requirement |
| 1. Apply calculus | 1. Derivatives of functions are determined as per job requirement 2. Differentiation is applied as per job requirement 3. Integrals of functions are determined as per job requirement 4. Integration is applied as per job requirement |
| 1. Carry out mensuration | * 1. Perimeter and areas of regular figures are obtained as per job requirement   2. Volume and surface area of solids are obtained as per job requirement   3. Area of irregular figures is obtained as per job requirement |
| 1. Apply statistics and probability | * 1. ***Measures of central tendency*** are obtained as per job requirement   2. ***Measures of dispersion*** are obtainedas per job requirement   3. Laws of probability are applied as per job requirement   4. ***Probability distribution*** methods are applied as per job requirement   5. Sampling distribution methods are applied as per job requirement |
| 1. Apply vector theorem | * 1. Vectors and scalar quantities are defined as per job requirement   2. ***Operations*** on vectors are performed as per job requirement   3. Position vectors are determined as per as per job requirement   4. Resolution of vectors is performed as per job requirement   5. Vector and scalar products are obtained as per job requirement |
| 1. Apply matrices | * 1. Matrices operations are performed as per job requirement   2. Inverse of matrices are obtained as per job requirement   3. Simultaneous equations are solved using matrices as per job requirement |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Operations may include but not limited to: | * 1. Addition   2. Subtraction   3. Multiplication   4. Division |
| 1. Hyperbolic functions may include but not limited to: | * 1. Sinh x   2. Cosh x   3. Cosech x   4. Tanh x   5. Sech x |
| 1. Measures of central tendency may include but not limited to: | 1. Mean 2. Median 3. Mode |
| 1. Measures of dispersion may include but not limited to | * 1. Co-efficient of Range.   2. Co-efficient of Variation.   3. Co-efficient of Standard Deviation.   4. Co-efficient of Quartile Deviation.   5. Co-efficient of Mean Deviation |
| 1. Probability distributions may include but not limited to: | * 1. Binomial distribution   2. Poisson distribution   3. Normal distribution |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Algebra
* Linear algebra
* Basic calculus
* Geometry
* 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 understanding and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   1. Applied algebra as per job requirement 2. Applied trigonometry and hyperbolic functions as per job requirement 3. Applied complex numbers as per job requirement 4. Applied coordinates geometry as per job requirement 5. Applied calculus as per job requirement 6. Carried out binomial expansion as per job requirement 7. Carried out mensuration as per job requirement 8. Applied statistics as per job requirement 9. Applied vector as per job requirement 10. Applied matrices as per job requirement |
| 1. Resource implications | The following resources should be provided:  2.1 Access to relevant workplace where assessment can take place  2.2 Appropriately simulated environment where assessment can take place  2.3 Resources relevant to carrying out the tasks required |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Written tests   2. Oral questions   3. Third party report   4. Portfolio of evidence |
| 1. Context of assessment | Competency may be assessed:   * 1. At the workplace   2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY ENGINEERING MECHANICS

**UNIT CODE:** 0715 541 11A

**UNIT DESCRIPTION**

This unit of competency describes the competences required in order to apply engineering mechanics principles. This includes applying forces and moments, apply friction principles, apply kinematics of motion, apply mechanical work-energy theorem, apply kinetics of motion, apply law of machines, determine loading conditions, apply simple mechanisms, design belts, ropes and chain drives, design toothed gears and gear trains, design mechanical rotor dynamic machines, apply stress and strain concepts, apply simple bending theory and apply torsion theory in mechanical systems.

**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 forces and moments in a mechanical system | * 1. Beams and shafts are designed as per job requirement   2. Beams and shafts are selected as per job requiremen   3. Rotating mechanical parts are designed as per job requirement |
| 1. Apply friction principles in mechanical systems | * 1. Lubrication of moving parts is done as per job requirement   2. Moving objects are designed as per job requirement   3. Coolants and cutting fluids are selected as per job requirement |
| 1. Apply kinematics of motion in mechanical systems | * 1. Moving objects are designed as per job requirement   2. Structural supports are designed as per job requirement   3. Structural supports are selected as per job requirement   4. Displacement-time graphs are generated as per job requirement |
| 1. Apply mechanical work-energy theorem | * 1. Mechanical work is determined as per job requirement   2. Energy requirements are obtained as per job requirement   3. Mechanical power is determined as per job requirement |
| 1. Apply kinetics of motion in mechanical systems | * 1. Moving objects are designed as per job requirement   5.2 Structural supports are selected as per job requirement  5.3 Kinematic linkages are selected as per job requirement |
| 1. Apply law of machines | * 1. Simple machines are designed as per job requirement   2. Simple machines are selected as per job requirement   3. Machine speeds are adjusted as per job requirement |
| 1. Determine loading conditions in mechanical systems | 7.1 Structures are designed as per job requirement   * 1. Beams and shafts are selected as per job requirement   2. Machine components are designed as per job requirement |
| 1. Apply simple mechanisms | * 1. Mechanisms are designed as per job requirement   2. Mechanisms are selected as per job requirement   3. Linkages are designed as per job requirement |
| 1. Design belts, ropes and chain drives | * 1. Belt drives are designed as per job requirement   2. Rope drives are designed as per job requirement Chain drives are designed as job requirement |
| 1. Design toothed gears and gear trains | * 1. ***Toothed gears*** are designed as per job requirement   2. Toothed gears are selected as per job requirement   3. Gears are serviced as per job requirement |
| 1. Design mechanical rotor dynamic machines | * 1. Pumps are designed as per job requirement   2. Pumps are selected as per job requirement   3. Rotary compressors are designed as per job requirement   4. Fans and vanes are designed as per job requirement |
| 1. Apply stress and strain concepts in mechanical systems | 12.1 Common engineering materials are selected as job requirement  12.2 ***Engineering components*** are designed as job requirement  12.3 Engineering components are selected as per job requirement |
| 1. Apply simple bending theory in mechanical systems | * 1. Beams are designed as per job requirement   2. Beams are selected as per job requirement   3. Shafts are designed as per job requirement   4. Shafts are selected as per job requirement |
| 1. Apply torsion theory in mechanical systems | * 1. Torque of components is obtained as per job requirement   2. Shafts are designed as per job requirement   3. Shafts are designed as per job requirement   14.4 Angle of twist of components is obtained as per job requirement |

**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**  ***May include but not limited to:*** |
| 1. Simple machines | * 1. Pulley   2. Wedge   3. Inclined plane   4. Pulley   5. Wheel and axle   6. Screw jack |
| 1. Toothed gears | * 1. Bevel gears   2. Spur gears   3. Worm gears   4. Spiral bevel gears   5. Helical gears |
| 1. Engineering components | * 1. Beams   2. Thin cylinders   3. Thin shells |

**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:

* Arithmetic skills
* Mechanical machine operation
* Critical thinking
* Analytical skills

**Required knowledge**

The individual needs to demonstrate knowledge of:

* General Physics
* Engineering Mathematics
* Measurements

**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. Designed beams and shafts as per job requirement   2. Designed moving objects as per job requirement   3. Generated displacement-time graphs as per job requirement   4. Determined mechanical power as per job requirement   5. Selected kinematic linkages as per job requirement   6. Designed simple machines as per job requirement   7. Selected beams and shafts as per job requirement   8. Selected mechanisms as per job requirement   9. Designed belt drives as per laws of tension   10. Selected toothed gears as per job requirement   11. Designed pumps as per job requirement   12. Designed ***engineering components*** as per job requirement   13. Designed shafts as per job requirement   14. Obtained torque of components as per job requirement |
| 2. Resource Implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 3. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Project   2. Practical   3. Written tests   4. Oral Questioning   5. Portfolio of evidence |
| 1. 4. Context of Assessment | Competency may be assessed in a workplace or simulated workplace |
| 1. 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM COMPUTER AIDED DRAWING

**UNIT CODE:** 0716 541 12A

**Unit Description**

This unit covers the competences required to perform computer aided drawing. It involves navigating CAD software, producing geometric, pictorial, orthographic and assembly drawings as well as designing mechanical components.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Navigate CAD software | 1. Computing equipment and software are identified according to task requirement 2. Drawing ***CAD software*** is applied as per work requirements 3. CAD Software templates are identified as per drawing requirement 4. ***CAD Files*** are imported into working space as per drawing requirements 5. Symbols, codes and standards to be applied are identified according to software functionality 6. ***Drawing elements*** are used to draw according to customer specification 7. ***Editing tools*** are used to manipulate drawings according to customer specification |
| 1. Produce geometric drawings | * 1. ***Drawing lines*** are identified according to standard drawing conventions   2. ***Geometrical forms*** are constructed according to standard drawing conventions   3. ***Types of angles*** are constructed according to principles of trigonometry   4. ***Geometric drawings*** are developed in accordance with standard conventions |
| 1. Produce pictorial drawings | * 1. Drawing symbols and abbreviations are applied according to standard drawing conventions   2. ***Pictorial drawings*** are produced as per work requirements   3. Pictorial drawings are saved as per work requirements |
| 1. Produce orthographic drawings. | 1. First angle orthographic drawings are developed as per standard conventions of orthographic drawings 2. Third angle orthographic drawings of are developed as per standard conventions of orthographic drawings 3. Orthographic drawings are saved as per work requirements |
| 1. Produce assembly drawings | 1. Orthographic views are exploded according to standard conventions of orthographic drawings 2. Pictorial views are exploded according to standard conventions of pictorial drawings 3. Orthographic and pictorial views are assembled as per drawing specifications 4. Sectional views are produced according to standard conventions of drawing 5. Parts list is developed according to drawing schematic |
| 1. Design mechanical components | 1. Mechanical components are designed as per work requirements 2. Computer aided engineering (CAE) is applied in simulation as per work requirements 3. Improvements to increase efficiency is determined according to design analysis results 4. Manufacturing database is created according to manufacturing process 5. Improvements on designed document is achieved according the manufacturing design |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. CAD software may include but not limited to: | * 1. AutoCAD   2. Inventor   3. SolidWorks |
| 1. CAD Files may include but not limited to | * 1. DWG   2. STL   3. DXF   4. STEP |
| 1. Drawing elements may include but not limited to: | * 1. Points   2. Line angles   3. Circles and arcs   4. Planes (horizontal, vertical)   5. Figures and solids   6. Shapes |
| 1. Editing tools may include but not limited to: | * 1. Delete, undo and redo commands   2. Fillet and chamfer commands   3. Trim, extend and break commands   4. Zoom and pan commands   5. Move, copy, and paste commands   6. Rotate and mirror commands   7. Object snapping and grouping commands   8. Dimension and scaling commands |
| 1. types of lines may include but not limited to: | * 1. Dimension lines   2. Hidden detail lines   3. Extension lines   4. Section lines   5. Phantom lines   6. Break lines   7. Chain   8. Zigzag |
| 1. types of geometric forms may include but not limited to: | * 1. Circle   2. Rectangle   3. Triangle   4. Polygon   5. Quadrilaterals |
| 1. Types of angles may include but not limited to | * 1. Acute   2. Obtuse   3. Right |
| 1. Geometrical drawings may include but not limited to | * 1. 2-Dimensional   2. 3-Dimensional   3. Orthographic   4. Isometric |
| 1. Pictorial drawings may include but not limited to | * 1. Isometric   2. Oblique   3. Cabinet   4. Cavalier |
| 1. Different types of geometric forms may include but not limited to: | * 1. Circle   2. Rectangle   3. Triangle   4. Polygon |
| 1. Different types of angles may include but not limited to: | * 1. Acute   2. Obtuse   3. Right |

**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
* Numerical skills
* Image interpretation
* Drawing synthesis
* Communication
* Computer skills
* Software navigation (manipulates drawing entities, modify dimension styles, create and use layers, manipulate the drawing origin, define and utilize symbol libraries, etc.)

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Organizational policies and procedures relevant to creating CAD drawings
* Various CAD programs their capabilities, functions and processes
* Drawing outcomes (orthographic, isometric, perspective,2D, 3D)
* Drawing elements (points, line angles, circles, arcs, planes, solids and figures, dimensions and hatchings shapes, etc.)
* Solid modeling, developing sectioned models, etc.
* Geometric constructions
* Measurement and scaling
* Engineering calculations (clearance and tolerance)
* Engineering drawing symbols
* Awareness of copyright and intellectual property issues and legislation in relation to drawing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   1. Applied drawing CAD software as per work requirements. 2. ImportedCAD Filesinto working space as per drawing requirements. 3. Used editing tools to manipulate drawing according to customer specification 4. Developed geometric drawings according to standard drawing conventions 5. Produced pictorial drawings as per work requirements. 6. Saved Orthographic drawings as per work requirements Produced geometric drawings. 7. Assembled Orthographic and pictorial views as per drawing specifications. 8. Computer aided engineering (CAE) is applied in simulation as per work requirements. |
| 1. Resource Implications | The following resources should be provided:   1. Appropriately simulated environment where assessment can take place 2. Access to relevant work place 3. Resources relevant to the proposed activity or task. |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Practical assessments 2. Project 3. Third party report 4. Written examinations 5. Portfolio of Evidence |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended |

# CORE UNITS OF COMPETENCY

# PERFORM FABRICATION PROCESSES I

**UNIT CODE:** 0715 251 13A

**UNIT DESCRIPTION**

This unit specifies competences required to perform fabrication processes. It involves carrying out bench work, sheet metal work and maintaining fabrication tools, machines and equipment

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Carry out bench work | 1. Occupational safety and health standardsare practiced 2. Working drawing is interpreted as per job requirement 3. Bench work tools and equipmentare assembled as per work requirement 4. Workpiece ***material preparation*** is carried out as per job requirement 5. Work pieces up to 6 mm thickness are fitted as per task requirement    1. ***House- keeping*** is carried out as per work place procedures |
| 1. Carry out sheet metal work | * 1. Occupational safety and health standards are practiced   2. Working drawing is interpreted as per job requirement   3. Sheet metal tools and equipment are assembled as per work requirement   4. Pattern development is performed as per the task requirement   5. Sheet metal products are produced as per task requirement   6. House -keeping is carried out as per work place procedures |
| 1. Maintain fabrication tools, machines and equipment | * 1. Fabrication machines, tools and equipment for maintenance are identified as per work requirement   2. Preventive maintenance is conducted as per work procedure   3. Fabrication machines, tools and equipment are repaired as per manufacturers manual   4. Preventive maintenance report is prepared as per work procedure  1. House -keeping is carried out as per work place procedures |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Material preparation | * 1. Measuring   2. Marking out   3. Cutting   Surface preparation |
| 1. House- keeping | * 1. Cleaning   2. Waste disposal |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures
* BS and ISO drafting standards
* Drafting techniques
* Workplace housekeeping procedures

**Required Skills**

The individual needs to demonstrate the following skills:

* + Preparing working drawings
  + Templates development
  + Maintenance of drafting tools
  + Designing techniques
  + Critical thinking

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | * 1. Assembled fabrication tools and equipment as per work requirement   2. Prepared fabrication materials are as per job requirement   3. Fitted work pieces as per task requirement   4. Assembled sheet metal tools and equipment as per work requirement   5. Performed pattern development as per task requirement   6. Produced sheet metal products as per task requirement   7. Conducted preventive maintenance as per work procedure   8. Prepared preventive maintenance report as per work procedure |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   1. Practical 2. Projects 3. Third party report 4. Written tests 5. Oral questioning |
| 1. Context of assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**PERFORM ARC WELDING PROCESSES I**

**UNIT CODE:** 0715 251 14A

**UNIT DESCRIPTION**

This unit specifies competences required to perform arc welding processes. The competences include carrying out manual metal arc welding, arc cutting process and maintaining arc welding machines, tools and equipment.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| 1. Carry out manual metal arc welding | * 1. Health and safety procedures are applied as per work requirement   2. Drawing is interpreted as per work requirement   3. ***Arc welding machines, tools and equipment*** are assembled as per work requirement   4. Welding ***material preparation*** is carried out as per job requirement   5. ***Arc*** ***welding parameters*** are identified as per work requirement   6. Arc welding of steel up to 6 mm thickness is performed in flat and horizontal positions as per work requirement.   7. Housekeeping is carried out as per workplace procedure |
| 1. Carry out arc cutting process | * 1. Health and safety procedures are applied as per work requirement   2. Drawing is interpreted as per work requirement   3. ***Machines, tools and equipment*** are assembled as per work requirement   4. Arc cutting material preparation is carried out as per job requirement   5. Arc cutting parameters are identified as per work requirement   6. Arc cutting of steel up to 6 mm thickness is performed in flat and horizontal positions as per work requirement   7. Arc cut product finishing is performed as per job requirement   8. Housekeeping is carried out as per workplace procedure |
| 1. Maintain arc welding machines, tools and equipment | * 1. Health and safety procedures are applied as per work requirement   2. Arc welding machines, tools and equipment preventive maintenance is conducted as per manufacturer’s manual   3. Faulty arc welding tools are repaired as per manufacturer’s manual   4. Housekeeping is carried out as per workplace procedure |

**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**  **May include but not limited to;** |
| 1. Arc welding machines, tools and equipment include but not limited to: | * 1. Arc welding machines * AC arc welding machine * DC arc welding machine * AC/DC welding machine   1. Arc welding tools and equipment * Welding screens * Chipping hammer * Wire brushes * Fire extinguishers * Welding jigs and fixtures |
| 1. Material preparation include but not limited to: | * 1. Measuring   2. Marking out   3. Cutting   4. Edge preparation |
| 1. Arc welding parameters include but not limited to: | 1. Current 2. Arc length 3. Arc force |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* MMAW welding techniques
* Health and safety
* Workplace housekeeping
* Maintenance of welding machines
* Workplace procedures

**Required Skills**

The individual needs to demonstrate the following skills:

* + Critical thinking
  + Time management
  + Interpreting working drawings
  + Joint preparation
  + MMAW welding

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Applied health and safety procedures as per work requirement   2. Carried out welding material preparation as per job requirement   3. Performed arc welding procedure as per work requirement.   4. Performed arc cutting procedure as per work requirement   5. Conducted arc welding machines, tools and equipment preventive maintenance as per manufacturer’s manual |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical   2. Projects   3. Third party report   4. Written tests |
| 1. Context of assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM BRAZING, SOLDERING AND GAS WELDING

**UNIT CODE:** 0715 251 15A

**UNIT DESCRIPTION**

This unit specifies competences required to perform brazing, soldering and gas welding. It involves carrying out gas welding, gas cutting, brazing, soldering and maintaining brazing, soldering and gas welding machines, tools and equipment.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Carry out gas welding | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per drawing standards   3. ***Gas welding machines, tools and equipment*** are assembled as per work requirement   4. Welding ***material preparation*** is carried out as per job requirement   5. Gas welding ***parameters*** are identified as per work requirement   6. Gas welding of metals up to 16 mm thickness is performed in all positions as per job requirement   7. Gas weld ***inspection*** is carried out as per job requirement   8. Gas welded product finishing is performed as per job requirement   9. ***Housekeeping*** is carried out as per work procedure |
| * 1. Carry out gas cutting | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per drawing standards   3. Gas cutting tools and equipment are assembled as per work requirement   4. Gas cutting ***material preparation*** is carried out as per job requirement   5. ***Gas cutting parameters*** are identified as per work requirement   6. Gas cuttingof metals up to 16 mm thickness is performed in all positions as per job requirement   7. Gas cutting ***inspection*** is carried out as per job requirement   8. Gas cut product ***finishing*** is performed as per job requirement   9. ***Housekeeping*** is carried out as per work procedure |
| 1. Carry out brazing | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per job requirement   3. Brazing tools and equipmentare assembled as per work requirement   4. Brazing material preparation is carried out as per job requirement   5. Brazing ***parameters*** are identified as per work requirement   6. Brazing of metals is performed in all positionsas per job requirement   7. Brazing ***inspection*** is carried out as per job requirement   8. Brazing product finishing is performed as per job requirement   9. ***Housekeeping*** is carried out as per work procedure |
| 1. Carry out soldering | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per job requirement   3. ***Soldering tools and equipment*** are assembled as per work requirement   4. Soldering ***material preparation*** is carried out as per job requirement   5. Soldering parameters are identified as per work requirement   6. Soldering of metals ***is*** performed in all positionsas per job requirement   7. Soldering ***inspection*** is carried out as per job requirement   8. Soldered product finishing is performed as per job |
| 1. Maintain brazing, soldering and gas welding machines, tools and equipment | * 1. Brazing, soldering and gas welding machines, tools and equipment for maintenance are identified as per work requirement   2. ***Preventive maintenance*** is conducted as per work procedure   3. ***Broken brazing, soldering and gas welding tools*** are repaired as per manufacturer’s manual   4. Preventive maintenance report is prepared as per work procedure |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| * + - 1. Gas welding machines, tools and equipment include but are not limited to: | 1.1 Gas welding equipment   * Oxygen cylinders * Acetylene cylinder * Propane cylinder * Gas welding torch   1.2 Gas welding tools   * + Fire extinguishers   + Welding jigs and fixtures   + Hoses   + Gas regulators   + Gauges   + Nozzle cleaner   1.3 Materials   * + Gas welding PPE   + Filler rods   + Plates   + Pipes   + Tubes |
| * + - 1. Material preparation include but are not limited to: | * 1. Measuring   2. Marking out   3. Cutting   4. Edge preparation   5. Joint preparation |
| * + - 1. Parameters include but are not limited to: | * 1. Working pressure   2. Oxygen-fuel ratio   3. Temperature |
| * + - 1. Inspection include but not limited to: | 5.1 Non-destructive   * Visual inspection * Ultrasonic inspection * Magnetic particle induction * Radiography inspection * Dye penetrant * Eddy current testing   5.2 Destructive   * Tensile test * Impact test * Corrosion test * Macro etching |
| * + - 1. Finishing includes but is not limited to: | * 1. Buffing   2. Polishing   3. Grinding   4. Blueing   5. Varnishing   6. Oil blacking   7. Bluing   8. Deburring   9. Electroplating   10. Enamelling   11. Painting |
| * + - 1. Housekeeping include but not limited to: | * 1. Hazard identification   2. Cleaning of the work area   3. Return of the tools to the storage area |
| * + - 1. Soldering tools and equipment include but are not limited to: | 19.1 Equipment   * Soldering gun * Propane gun * Soldering iron   19.2 Materials   * Soldering wire * Flux |
| * + - 1. Preventive maintenance | * 1. Cleaning of the external surfaces of the machine   2. Inspecting cables, connectors and power sources   3. Lubricating of moving parts   4. Replace consumables and spare parts   5. Ensuring proper cooling and ventilation |
| * + - 1. Broken brazing, soldering and gas welding tools | * 1. Soldering gun   2. Propane gun   3. Soldering iron |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures
* Gas welding and soldering equipment
* Joint preparation
* Gas welding and soldering techniques
* Welded joint standards
* Gas cutting techniques

**Required Skills**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Preparing joints
  + Gas welding and soldering
  + Brazing
  + Gas cutting
  + Maintenance of gas welding machines

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Carried out gas welding material preparation as per job requirement   2. Performed gas welding of metals up to 16 mm thickness in all positions as per job requirement   3. Carried out gas cutting material preparation as per job requirement   4. Performed gas cutting of metals up to 16 mm thickness in all positions as per job requirement   5. Carried out brazing material preparation as per job requirement   6. Performed brazing of metals in all positions as per job requirement   7. Carried out soldering material preparation as per job requirement   8. Performed soldering of metals in all positions as per job requirement   9. Conducted preventive maintenance as per work procedure |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Oral questioning   2. Portfolio of evidence   3. Practical test   4. Third party report   5. Written tests   6. Project work |
| 1. Context of assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

**PERFORM METAL INERT GAS WELDING**

**UNIT CODE:** 0715 351 16A

**UNIT DESCRIPTION**

This unit specifies competencies to perform Metal Inert Gas (MIG) welding operations. It involves drafting working drawing, carrying out Metal Inert Gas (MIG) welding and maintaining metal inert gas welding machines, tools and equipment

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Draft working drawing | * 1. Work drawings are drafted according to work requirement   2. Dimensions are established as per job requirements   3. Welding symbols are established as per the welding standards   4. Operation procedure is developed as per the job requirement |
| 1. Carry out Metal Inert Gas (MIG) welding | * 1. Safety procedures are observed as per work requirement   2. Working drawing is interpreted as per task requirement   3. ***MIG welding machines, tools and equipment*** are assembled as per work requirement   4. Welding ***material preparation*** is carried out as per job requirement   5. ***MIG welding parameters*** are set as per work requirement   6. MIG welding of metals up to 10 mm thickness is performed in flat, horizontal and vertical positions as per job requirement   7. MIG welded product ***finishing*** is performed as per job requirement   8. Housekeeping is carried out as per work procedure |
| 1. Maintain MIG welding machines, tools and equipment | * 1. MIG welding machines, tools and equipment for maintenance are identified as per work requirement   2. ***Preventive maintenance*** is conducted as per work procedure   3. MIG welding tools are repaired as per manufacturers manual |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Metal inert gas welding machines, tools and equipment include but are not limited to: | 1.1 MIG welding machines   * AC machine * DC machine * AC/DC machine * Diesel generators   1.2 MIG welding tools   * + Driers   + Welding screens   + Fire extinguishers   + Welding jigs and fixtures   1.3 Materials   * + MIG welding PPE   + Electrodes   + Plates   + Pipes   + Tubes |
| 1. Material preparation include but are not limited to: | * 1. Measuring   2. Marking out   3. Cutting   4. Edge preparation   5. Joint preparation |
| 1. Metal inert gas welding parameters include but are not limited to: | * 1. Current   2. Arc force |
| 1. Finishing includes but are not limited to: | 1. Buffing 2. Polishing 3. Grinding 4. Blueing 5. Varnishing 6. Oil blacking 7. Bluing 8. Deburring 9. Painting |
| 1. Preventive maintenance includes but are not limited to: | * 1. Cleaning of the external surfaces of the machine   2. Inspecting cables, connectors and power sources   3. Lubricating of moving parts   4. Replace consumables and spare parts   5. Ensuring proper cooling and ventilation |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures
* MIG welding equipment
* Joint preparation
* Applications of MIG Welding
* Workplace housekeeping procedures

**Required Skills**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Maintenance of metal inert gas welding machines
  + Preparing joints
  + Gas Metal Arc welding

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Developed operation procedure as per the job requirement   2. Observed safety procedures are observed as per work requirement   3. Interpreted working drawing as per task requirement   4. Carried out welding material preparation as per job requirement   5. Performed MIG welding of metals up to 10 mm thickness in flat, horizontal and vertical positions as per job requirement   6. Performed MIG welded product finishing as per job requirement |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   1. Project 2. Practical tests 3. Portfolio of evidence 4. Third party report 5. Oral questioning 6. Written tests |
| 1. Context of assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**PERFORM TUNGSTEN INERT GAS WELDING**

**UNIT CODE:** 0715 351 17A

**UNIT DESCRIPTION**

This unit specifies competencies required perform Tungsten Inert Gas (TIG) welding operations. It involves drafting working drawing, carrying out Tungsten Inert Gas (TIG) welding, and maintaining gas metal arc welding equipment

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Draft working drawing | * 1. Work drawing is drafted according to work requirement   2. ***Welding symbols*** are interpreted as per the welding standards   3. Operation procedure is developed as per job requirement |
| 1. Carry out Tungsten Inert Gas (TIG) welding | * 1. Safety procedures are observed as per work requirement   2. Working drawing is interpreted as per job requirement   3. TIG welding machines, tools and equipment are assembled as per work requirement   4. Welding ***material preparation*** is carried out as per job requirement   5. ***TIG welding parameters*** are set as per work requirement   6. TIG welding of metals up to 10 mm thickness is performed in flat, horizontal and vertical positions as per job requirement   7. TIG welded product finishing is performed as per job requirement   8. Housekeeping is carried out as per work procedure |
| 1. Maintain TIG welding machines, tools and equipment | * 1. TIG welding machines, tools and equipment for maintenance are identified as per work requirement   2. ***Preventive maintenance*** is conducted as per work procedure   3. Fabrication machines, tools and equipment are repaired as per manufacturers manual   4. Preventive maintenance report is prepared as per work procedure |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Material preparation include but are not limited to: | * 1. Measuring   2. Marking out   3. Cutting   4. Edge preparation   5. Joint preparation |
| 1. TIG welding parameters include but are not limited to: | * 1. Current   2. Arc force   3. Voltage |
| 1. Finishing includes but are not limited to: | * 1. Buffing   2. Polishing   3. Grinding   4. Blueing   5. Varnishing   6. Oil blacking   7. Bluing   8. Deburring   9. Painting |
| 1. Preventive maintenance includes but are not limited to: | * 1. Cleaning of the external surfaces of the machine   2. inspecting cables, connectors and power sources   3. Lubricating of moving parts   4. Replace consumables and spare parts   5. Ensuring proper cooling and ventilation |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures
* TIG welding equipment
* Joint preparation
* Applications of TIG welding

**Required Skills**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Preparing joints
  + Tungsten inert gas welding
  + Workplace housekeeping procedures
  + Maintenance of TIG welding machines

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Developed operation procedure as per the job requirement   2. Observed safety procedures are observed as per work requirement   3. Interpreted working drawing as per task requirement   4. Carried out welding material preparation as per job requirement   5. Performed TIG welding of metals up to 10 mm thickness in flat, horizontal and vertical positions as per job requirement   6. Performed TIG welded product finishing as per job requirement |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   1. Observation 2. Portfolio of evidence 3. Oral questioning 4. Third party report 5. Written tests |
| 1. Context of assessment | Competency may be assessed:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM ARC WELDING PROCESSES II

**UNIT CODE:** 0715 451 18A

**UNIT DESCRIPTION**

This unit specifies competences required to perform Manual Metal Arc Welding (MMAW) operations. It involves carrying out manual metal arc welding, gouging and maintaining welding machines, tools and equipment.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Carry out Manual Metal Arc Welding (MMAW) | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per job requirement   3. MMAW ***machines, tools, equipment*** and ***materials*** are assembled as per work requirement   4. MMAW ***material preparation*** is carried out as per job requirement   5. MMAW ***parameters*** are identified as per work requirement   6. MMAWofmetals up to 16 mm thickness is performed in all positions as per job requirement   7. MMAW ***inspection*** is carried out as per job requirement   8. Arc welded product finishing is performed as per job requirement   9. ***Housekeeping*** is carried out as per work procedure |
| 1. Carry out gouging | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per drawing standards   3. Gouging machines, tools and equipment are assembled as per work requirement   4. Gouging ***material preparation*** is carried out as per job requirement   5. Gouging ***parameters*** are identified as per work requirement   6. Gouging ofmetalsup to 16 mm is performed in all positions as per job requirement   7. Inspection of gouged part is carried out as per job requirement   8. Gouged product finishing is performed as per job requirement   9. ***Housekeeping*** is carried out as per work procedure |
| 1. Maintain welding machines, tools and equipment | 1. Occupational health and safety standards are observed as per work requirement 2. Welding machines, tools and equipment for maintenance are identified as per work requirement 3. ***Preventive maintenance*** is conducted as per work procedure 4. ***Broken welding tools*** are repaired as per manufacturer’s manual 5. Preventive maintenance report is prepared as per work procedure |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Machines, tools equipment and materials include but are not limited to: | 1.1 Arc welding machines   * AC machine * DC machine * AC/DC machine * Diesel generators   1.2 Arc welding tools   * + Driers   + Welding screens   + Fire extinguishers   + Welding jigs and fixtures   1.3 Materials   * + MMAW welding PPE   + Electrodes   + Plates   + Pipes   + Tubes |
| 1. Material preparation include but are not limited to: | * 1. Measuring   2. Marking out   3. Cutting   4. Edge preparation   5. Joint preparation |
| 1. Parameters include but are not limited to: | * 1. Current   2. Arc length   3. Arc force |
| 1. Inspection includes but is not limited to: | 5.1 Non-destructive   * Visual inspection * Ultrasonic inspection * Magnetic particle induction * Radiography inspection * Dye penetrant * Eddy current testing   5.2 Destructive   * Tensile test * Impact test * Corrosion test * Macro etching * Bend test |
| 1. Finishing includes but are not limited to: | * 1. Buffing   2. Polishing   3. Grinding   4. Blueing   5. Varnishing   6. Oil blacking   7. Bluing   8. Deburring   9. Electroplating   10. Enamelling   11. Painting |
| 1. Housekeeping includes but are not limited to: | * 1. Hazard identification   2. Cleaning of the work area   3. Return of the tools to the storage area |
| 1. Preventive maintenance includes but are not limited to: | * 1. Cleaning of the external surfaces of the machine   2. Inspecting cables, connectors and power sources   3. Lubricating of moving parts   4. Replace consumables and spare parts   5. Ensuring proper cooling and ventilation |
| 1. Broken welding tools include but are not limited to: | * 1. Chipping hammer   2. Chisel   3. Tongs   4. Welding jigs and fixtures |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures
* MMAW welding equipment
* Joint preparation
* Types of electrodes
* Welded joint standards
* MMAW cutting techniques
* Maintenance of welding machines

**Required Skills**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Preparing joints
  + MMAW welding
  + MMAW cutting

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Carried out MMAW material preparation as per job requirement   2. Performed arc welding of metals up to 16 mm thickness as per job requirement   3. Carried out MMAW inspection as per job requirement   4. Performed gouging of metals up to 16 mm thickness as per job requirement   5. Carried out preventive maintenance as per work procedure |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Oral questioning   2. Portfolio of evidence   3. Practical test   4. Third party report   5. Written tests   6. Project work |
| 1. Context of assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

# PERFORM FABRICATION PROCESSES II

**UNIT CODE:** 0715 451 19A

**UNIT DESCRIPTION**

This unit specifies competences required to perform fabrication processes. It involves carrying out bench work, sheet metal work and maintaining fabrication tools, machines and equipment

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Carry out bench work | 1. Occupational safety and health standardsare practiced 2. Working drawing is interpreted as per job requirement 3. Bench work tools and equipmentare assembled as per work requirement 4. Workpiece ***material preparation*** is carried out as per job requirement 5. Work pieces up to 16 mm thickness are fitted as per task requirement 6. ***House- keeping*** is carried out as per work place procedures |
| 1. Carry out sheet metal work | * 1. Occupational safety and health standards are practiced   2. Working drawing is interpreted as per job requirement   3. Sheet metal tools and equipment are assembled as per work requirement   4. Pattern development is performed as per the task requirement   5. Sheet metal products are produced as per task requirement   6. House -keeping is carried out as per work place procedures |
| 1. Maintain fabrication tools, machines and equipment | * 1. Fabrication machines, tools and equipment for maintenance are identified as per work requirement   2. Preventive maintenance is conducted as per work procedure   3. Fabrication machines, tools and equipment are repaired as per manufacturers manual   4. Preventive maintenance report is prepared as per work procedure   5. House -keeping is carried out as per work place procedures |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Material preparation | * 1. Measuring   2. Marking out   3. Cutting   4. Surface preparation |
| 1. House- keeping | * 1. Cleaning   2. Waste disposal |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures
* BS and ISO drafting standards
* Drafting techniques
* Workplace housekeeping procedures

**Required Skills**

The individual needs to demonstrate the following skills:

* + Preparing working drawings
  + Templates development
  + Maintenance of drafting tools
  + Designing techniques
  + Critical thinking

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | * 1. Assembled fabrication tools and equipment as per work requirement   2. Prepared fabrication materials are as per job requirement   3. Fitted work pieces as per task requirement   4. Assembled sheet metal tools and equipment as per work requirement   5. Performed pattern development as per task requirement   6. Produced sheet metal products as per task requirement   7. Conducted preventive maintenance as per work procedure   8. Prepared preventive maintenance report as per work procedure |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   1. Practical 2. Projects 3. Third party report 4. Written tests 5. Oral questioning |
| 1. Context of assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM GAS METAL ARC WELDING OPERATIONS

**UNIT CODE:** 0715 451 20A

**UNIT DESCRIPTION**

This unit specifies competences required to perform Gas Metal Arc Welding (GMAW) operations. It involves carrying out metal inert gas welding, metal active gas welding, flux- cored arc welding, tungsten inert gas welding, and maintaining gas metal arc welding equipment.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Carry out Metal inert Gas (MIG) welding | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per job requirement   3. MIG welding ***machines, tools and equipment*** are assembled as per work requirement   4. MIG welding ***material preparation*** is carried out as per job requirement   5. MIG ***welding parameters*** are identified as per work requirement   6. MIG weldingofmetals up to 16 mm thickness is performed in all positions as per job requirement   7. MIGweld ***inspection*** is carried out as per job requirement   8. MIG welded product ***finishing*** is performed as per job requirement   9. ***Housekeeping*** is carried out as per work procedure |
| 1. Carry out Metal Active Gas (MAG) welding | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per job requirement   3. MAG welding machines, tools and equipment are assembled as per work requirement   4. MAG welding ***material preparation*** is carried out as per job requirement   5. MAG ***welding parameters*** are identified as per work requirement   6. MAG welding of metals up to 16 mm thickness is performed in all positionsasper job requirement   7. MAG weld ***inspection*** is carried out as per job requirement   8. MAG welded product ***finishing*** is performed as per job requirement   9. ***Housekeeping*** is carried out as per work procedure |
| 1. Carry out Flux Cored Arc Welding (FCAW) | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per job requirement   3. FCAW machines, tools and equipment are assembled as per work requirement   4. FCAW ***material preparation*** is carried out as per job requirement   5. FCAW ***parameters*** are identified as per work requirement   6. FCAW of metals up to 16 mm thickness ***is*** performed in all positionsas per job requirement   7. FCAW product ***inspection*** is carried out as per job requirement   8. FCAW product ***finishing*** is performed as per job requirement   9. ***Housekeeping*** is carried out as per work procedure |
| 1. Carry out Tungsten Inert Gas (TIG) welding | * 1. Occupational health and safety standards are observed as per work requirement   2. Working drawing is interpreted as per job requirement   3. TIG welding machines, tools and equipment are assembled as per work requirement   4. TIG welding ***material preparation*** is carried out as per job requirement   5. TIG welding ***parameters*** are identified as per work requirement   6. TIG welding of metals up to 16 mm thickness is performed in all positions as per job requirement   7. TIG weld Inspection is carried out as per job requirement   8. TIG welded product **f*inishing*** is performed as per job requirement   9. ***Housekeeping*** is carried out as per work procedure |
| 1. Maintain Gas Metal Arc Welding (GMAW) equipment | * 1. GMAW machines, tools and equipment for maintenance are identified as per work requirement   2. ***Preventive maintenance*** is conducted as per work procedure   3. ***GMAW tools*** are repaired as per manufacturer’s manual   4. Preventive maintenance report is prepared as per work procedure |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Machines, tools and equipment include but are not limited to: | 1.1 Arc welding machines   * AC machine * DC machine * AC/DC machine * Diesel generators   1.2 Arc welding tools   * + Driers   + Welding screens   + Fire extinguishers   + Welding jigs and fixtures   1.3 Materials   * + MIG welding PPE   + Electrodes   + Plates   + Pipes   + Tubes |
| 1. Material preparation include but are not limited to: | * 1. Measuring   2. Marking out   3. Cutting   4. Edge preparation   5. Joint preparation |
| 1. Parameters include but are not limited to: | * 1. Current   2. Pressure   3. Wire speed |
| 1. Inspection includes but are not limited to: | 4.1 Non-destructive   * Visual inspection * Ultrasonic inspection * Magnetic particle induction * Radiography inspection * Dye penetrant * Eddy current testing   4.2 Destructive   * Tensile test * Impact test * Corrosion test * Macro etching * Bend test |
| 1. Finishing includes but are not limited to: | * 1. Buffing   2. Polishing   3. Grinding   4. Blueing   5. Varnishing   6. Oil blacking   7. Bluing   8. Deburring   9. Electroplating   10. Enamelling   11. Painting |
| 1. Housekeeping includes but are not limited to: | * 1. Hazard identification   2. Cleaning of the work area   3. Return of the tools to the storage area |
| 1. Preventive maintenance includes but are not limited to: | * 1. Cleaning of the external surfaces of the machine   2. Inspecting cables, connectors and power sources   3. Lubricating of moving parts   4. Replace consumables and spare parts   5. Ensuring proper cooling and ventilation |
| 1. Broken welding tools include but are not limited to: | * 1. Chipping hammer   2. Chisel   3. Tongs   4. Welding jigs and fixtures |
| 1. GMAW tools | * 1. Welding torches   2. Flashback arrestors   3. Welding Regulators   4. Chipping hammer |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures
* MWAW equipment
* Joint preparation
* Welding standards

**Required Skills**

The individual needs to demonstrate the following skills:

* + Interpreting working drawings
  + Preparing joints
  + GMAW techniques
  + Maintenance of GMAW machines

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. PerformedMIG welding of metals up to 16 mm thickness in all positions as per job requirement   2. Carried out MIG weld inspection as per job requirement   3. Performed MAG welding of metals up to 16 mm thickness in all positions as per job requirement   4. Carried out MAG weld inspection as per job requirement   5. Performed FCAW of metals up to 16 mm thickness in all positions as per job requirement   6. Performed TIG welding of metals up to 16 mm thickness in all positions as per job requirement   7. Conducted preventive maintenance as per work procedure |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   1. Projects 2. Practical 3. Oral questioning 4. Portfolio of evidence 5. Third party report 6. Written tests |
| 1. Context of assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM WELD INSPECTION

**UNIT CODE:** 0715 551 21A

**UNIT DESCRIPTION**

This unit specifies competences required to performweld inspection. It involves carrying out non-destructive weld testing, destructive weld testing and maintaining welding testing equipment.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Carry out non-destructive weld testing | 1. Occupational health and safety standards are observed as per work requirement 2. ***Non-destructive weld test parameters*** are identified as per work requirement 3. Weld to be inspected is prepared as per job requirement 4. ***Non-destructive weld test*** is carried out as per job requirement 5. Housekeeping is carried out as per work procedure 6. Non-destructive weld test report is prepared as per task requirement |
| * 1. Carry out destructive weld testing | * 1. Occupational health and safety standards are observed as per work requirement   2. ***Destructive weld test parameters*** are identified as per work requirement   3. Weld to be inspected is prepared as per job requirement   4. ***Destructive weld test*** is carried out as per job requirement   5. Housekeeping is carried out as per work procedure   6. Destructive weld test report is prepared as per task requirement |
| * 1. Maintain weld testing equipment | * 1. Weld inspection ***machines, tools and equipment*** for maintenance are identified as per work requirement   2. ***Preventive maintenance*** is conducted as per work requirement   3. Weld Inspection machines, tools and equipment are repaired as per manufacturer’s manual   4. Preventive maintenance report is prepared as per work procedure |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| * + - 1. Non-destructive weld test parameters | * 1. Flaws   2. Pinholes   3. Penetration   4. Undercut |
| * + - 1. Non-destructive weld test | * 1. Visual inspection   2. Ultrasonic inspection   3. Magnetic particle induction   4. Radiography inspection   5. Dye penetrant   6. Eddy current testing |
| * + - 1. Destructive weld test parameters | * 1. Tensile strength   2. Yield strength   3. Impact resistance |
| * 1. Destructive weld test equipment | * 1. Tensile test   2. Impact test   3. Corrosion test   4. Macro etching |
| * 1. Weld Inspection machines, tools and equipment | 5.1 Tools   * Pneumatic tools * Gauges * Electromagnets   5.2 Machines   * Universal testing machine * Ultrasonic testing machine * Radiography   5.3 Consumables   * Films * Ferromagnetic Materials * Dyes |
| 1. Preventive maintenance | * 1. Lubrications   2. Belt adjustments   3. Planning   4. Scheduling   5. Record keeping |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures
* Destructive and non-destructive equipment
* Weld preparation
* Welded joint standards
* Applications of destructive and non-destructive equipment techniques.
* Workplace housekeeping procedures

**Required Skills**

The individual needs to demonstrate the following skills:

* + Maintenance of destructive and non-destructive equipment
  + Interpreting working drawings
  + Preparing weld joints
  + Destructive and non-destructive techniques

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   1. Prepared weld to be inspected as per job requirement 2. Carried out non-destructive weld test as per job requirement 3. Carried out destructive weld test as per job requirement 4. Conducted preventive maintenance as per work procedure |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Project   2. Oral questioning   3. Portfolio of evidence   4. Practical test   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

# DESIGN WELDING PRODUCTS

**UNIT CODE:** 0715 551 22A

**UNIT DESCRIPTION**

This unit specifies competences required by to design welding products. It involves developing welding products structural blueprints, pipe welding templates, welding fixtures drawing, and sheet metal welding templates.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the range)*** |
| --- | --- |
| 1. Develop welding products structural blueprints | * 1. Product ***structural design specifications*** are determined as per design brief   2. ***Drafting equipment*** and ***materials*** are assembled as per work requirement   3. Preliminary product design is drafted as per job requirement   4. ***Product structural blueprint*** is prepared as per work requirement |
| 1. Develop pipe welding templates | * 1. Pipe welding design specifications are determined as per design brief   2. Pipe welding ***drafting equipment*** and ***materials*** are assembled as per work requirement   3. Pipe welding preliminary product design is developed as per drawing standards   4. Pipe welding template is cut as per conventional drawing standard |
| 1. Develop welding fixtures drawing | 1. Welding fixture drawing specifications are determined as per the design brief 2. Welding fixtures ***drafting equipment*** and ***materials*** are assembled as per work requirement 3. Welding fixture drawing is developed as per work procedure |
| 1. Develop sheet metal welding templates | * 1. Sheet metal design specifications are determined as per the design brief   2. Sheet metal equipment and materials are assembled as per work requirement   3. Sheet metal preliminary design is drafted as per job requirement   4. Sheet metal welding template is developed as per job requirement   5. Template is traced and cut as per work requirement |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| * + - 1. Structural design specifications include but are not limited to: | * 1. Dimensions   2. Loading capacity   3. Shape   4. Working environment |
| 1. Drafting equipment include but are not limited to: | * 1. Drawing table   2. Drawing equipment |
| 1. Materials include but are not limited to: | * 1. Drafting paper   2. Blueprint paper   3. Template paper |
| 1. Product structural blueprint include but are not limited to: | * 1. Blue print paper   2. Working drawing |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Workplace procedures
* Designing techniques and job execution process
* Using drafting equipment
* Drafting standards
* Workplace housekeeping procedures

**Required Skills**

The individual needs to demonstrate the following skills:

* + Preparing working drawings
  + Interpreting working drawings
  + Templates development
  + Critical thinking

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | * 1. Drafted preliminary product design as per job requirement   2. Preparedproduct structural blueprint as per work requirement   3. Developed pipe welding preliminary product design as per job requirement   4. Cut pipe welding template as per job requirement   5. Developed welding fixture drawing as per work procedure   6. Developed sheet metal welding template as per job requirement   7. Traced template and cut as per work requirement |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   1. Practical 2. Projects 3. Third party report 4. Written tests 5. Oral questioning |
| 1. Context of assessment | Competency may be assessed in the workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |