

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARD**

**FOR**

**CONSTRUCTION PLANT TECHNICIAN**

**KNQF LEVEL 5**

**QUALIFICATION CODE: 0716 454 A**

# FOREWARD

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 be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes. These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these Occupational Standards were developed for developing a competency-based curriculum for Construction Plant Technician Level 5. These Occupational Standards will also be the basis for assessment of an individual for competence certification.

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

# PREFACE

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

The Technical and Vocational Education and Training Act CAP 210 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.

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

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

# ACRONYMNS

CBET Competency Based Education and Training

TVET Technical and Vocational Education and Training

RAM Random Access Memory

DVD Digital Versatile Disk

HDMI High-Definition Multimedia Interface

DVI Digital Visual Interface

VGA Video graphics Array

USB Universal Serial Bar

# OVERVIEW

The Construction Plant Technicians Level 5 qualification consists of competencies that a person must achieve to enable him/her to service, construction plant engineering in industry. It includes: apply digital literacy; applying communication skills; apply work ethics and practices; apply entrepreneurial skills; apply workshop technology; apply mathematics; apply mechanical science; and apply electrical and electronics principles. It also includes: maintain construction plant hydraulic system; maintain construction plant engines; maintain construction plant brake system; maintain construction plant transmission system; maintain construction plant steering and suspension systems; and maintain construction plant attachments

The units of competency comprising Construction Plant Technicians Certificate Level 5 qualifications include the following competencies:

# 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** | |
| 0715 451 05A | Apply Workshop Technology |
| 0541 441 06A | Apply Mathematics |
| 0732 441 07A | Apply Technical Drawing |
| 0715 441 08A | Apply Mechanical Science |
| 0713 441 09A | Apply Electrical and Electronics Principles |
| **CORE UNITS OF COMPETENCY** | |
| 0716451 10 A | Maintain Construction Plant Hydraulic System |
| 0716451 11 A | Maintain Construction Plant Engines |
| 0716 451 12A | Maintain Construction Plant Brake System |
| 0716 451 13A | Maintain Construction Plant Transmission System |
| 0716 451 14A | Maintain Construction Plant Steering and Suspension Systems |

# KEY TO UNIT CODE



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# BASIC UNITS OF COMPENTENCY

# 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 the 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.   9. ***External devices*** are identified and connected to the computer devices as per the 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 collaborations | * 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 the job requirements.   2. Online accounts and profiles are created in accordance with the work requirements.   3. Online jobs are identified according to the bidder’s skillset.   4. Online digital identity is managed according to industry best practices.   5. Online job bidding is done as per the specific job requirements.   6. Online tasks are executed according to the 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 the 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: | * Desktops * Laptops * Smartphones * Tablets * Smartwatches |
| 1. Computer hardware may include but are not limited to: | * The System Unit E.g. Motherboard, CPU, casing, * Input Devices e.g. Pointing, keying, scanning, voice/speech recognition, direct data capture devices. * Output Devices e.g. hardcopy output and softcopy output * Storage Devices e.g. main memory e.g. RAM, secondary storage (Solid state devices, Hard Drives, CDs & DVDs, Memory cards, Flash drives * Computer Ports e.g. HDMI, DVI, VGA, USB type C |
| 1. Computer software may include but are not limited to: | * System software e.g. Operating System (Windows, Macintosh, Linux, Android, iOS) * Application Software e.g. Word Processors, Spreadsheets, Presentations etc. * Utility Software e.g. Antivirus programs |
| 1. External devices may include but are not limited to: | * Printers * Projectors * Smart Boards * Speakers * External storage drives * Digital/Smart TVs |
| 1. Word processing concepts may include but are not limited to: | * Creating word documents * Editing word documents * Formatting word documents * Saving word documents * Printing word documents |
| 1. Mouse techniques may include but are not limited to: | * Clicking * Double-clicking * Right-clicking * Drag and drop |
| 1. Internet connection options may include but are not limited to: | * Mobile Networks/Data Plans * Wireless Hotspots * Cabled (Ethernet/Fiber) * Dial-Up * Satellite * ISDN (Integrated Services Digital Network) |
| 1. Data manipulation may include but are not limited to: | * Use of formulae * Use of functions * Sorting * Filtering * Visual representation using charts |
| 1. Electronic presentation concepts may include but are not limited to: | * Creating slides * Editing slides * Formatting slides * Applying slide effects and transitions * Creating and playing slideshows * Saving presentations * Printing slides and handouts |
| 1. Internet services may include but are not limited to: | * Communication Services * Information Retrieval Services * File Transfer * World Wide Web Services * Web Services * Directory Services * Automatic Network Address Configuration * News Group * Ecommerce |
| 1. Internet access applications/software may include but are not limited to: | * Browsers * Email Apps * eCommerce Apps |
| 1. Online collaboration tools may include but are not limited to: | * Online Storage * Online productivity applications * Online meetings, * Online learning environments, * Online calendars * Social networks |
| 1. Data protection and privacy may include but not limited to: | * Confidentiality of data/information * Integrity of data/information * Availability of data/information |
| 1. Internet security threats may include but not limited to: | * Malware attacks * Social engineering attacks * Software supply chain attacks * Advanced persistent threats (APT) * Distributed denial of service (DDoS) * Man-in-the-middle attack (MitM) * Password attacks * IoT Attacks * [Phishing Attacks](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#phishing-attacks) * [Ransomware](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#ransomware) |
| 1. Security threats control measures may include but not limited to: | * Counter measures against cyber terrorism * Physical Controls * Technical/Logical Controls * Operational Controls |
| 1. Online job platforms may include but are not limited to: | * Remotask * Data annotation. tech * Cloud worker * Upwork * One forma * Appen |
| 1. Job opportunities may include but not limited to: | * Self-employment * Service provision * product development * salaried employment |
| 1. Certificates and testimonialsmay include but not limited to: | * Academic credentials * Letters of previous employments/ services rendered * Letters of commendation * Certifications of participation * Awards |
| 1. Interview skills may include but not limited to: | * Listening skills * Grooming * Language command * Articulation of issues * Body language * Time management * Honesty * 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. Interviews   4. Third party report   5. Written assessment   6. Practical assessment   7. Projects |
| 1. Context of assessment | Competency may be assessed:   * 1. On the job   2. In a simulated work environment. |
| 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 the 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 to enhance inclusivity according to workplace requirements.  3.3 Non-verbal communication techniques are modeled 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 the 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: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrasing * Clarification request * Translation * Restructuring * Generalization |
| 1. Effective group interaction may include but not limited to: | * Identifying and evaluating what is occurring within an interaction in a non-judgmental way. * Using active listening. * Making decision about appropriate words, behavior. * Putting together response which is culturally appropriate. * Expressing an individual perspective. * Expressing own philosophy, ideology and background and exploring impact with relevance to communication |
| 1. Situations may include but are not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * 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. Interviews   4. Third party report   5. Written assessment   6. Practical assessment   7. Projects |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 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**

**ISCED UNIT CODE:** **0417 441 03A**

**UNIT DESCRIPTION**

This unit covers competencies required to effectively 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 the 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 the organization policy 10. Individual performance is evaluated and monitored according to the 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 the workplace requirements 3. Policies and guidelines are observed as per the 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 the 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 with organization policy.  3.6 Gender and diversity-related issues are identified and mainstreamed in accordance with workplace policy.  3.7 Healthy ***relationships*** are developed and maintained in line with the workplace.  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 the 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 the requirements of the job.  5.3 Team problems are solved as per the workplace guidelines  5.4 Problem-solving strategies are applied as per the workplace guidelines  5.5 Problems are analyzed and assumptions tested as per the 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: | * Verbal * Written * Informal * Formal |
| 1. Conflicts include but are not limited to: | * Interpersonal Conflict. * Intrapersonal Conflict. * Intergroup Conflict. * Intragroup Conflict. |
| 1. Relationships may include but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| 1. Team may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group * Virtual teams |
| 1. Personal growth may include but not limited to: | * Growth in the job * Career mobility * Gains and exposure the job gives * Net workings * Benefits that accrue to the individual as a result of noteworthy performance |
| 1. Personal objectives may include but not limited to: | * Long term * Short term * Broad * Specific |
| 1. Trainings and career opportunities may include but not limited to | * Participation in training programs * Serving as Resource Persons in conferences and workshops * Capacity building |
| 1. Resource may include may but not limited to: | * Human * Financial * Technology |
| 1. Creative and innovative may include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| 1. Emerging issues may include but not limited to: | * Artificial Intelligence * Data confidentiality * National cohesion * 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. Interview 5. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 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**

**ISCED UNIT CODE:** 0413 441 04A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate an understanding of entrepreneurship. 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 | 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 analysed 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 analysed 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 mayinclude but not limited to: | * Salary/Wages * Investments * Savings * Inheritance * Government Benefits |
| 1. Sources of business finance mayinclude but not limited to: | * Equity Financing * Debt Financing, * Personal Savings/Investment * Retained Earnings * Grants and Subsidies * Crowdfunding * supplier Credit: * Leasing and Asset Financing: |
| 1. Types of entrepreneurs may include but not limited to: | * Innovators * Imitators * Craft * Opportunistic * Speculators |
| 1. Characteristics of Entrepreneurs may include but not limited to: | * Creative * Innovative * Planner * Risk taker * Networker * Confident * Flexible * Persistent * Patient * Independent * Future oriented * Goal oriented |
| 1. Requirements for entry into self-employment may include but not limited to | * Technical skills * Management skills * Entrepreneurial skills * Resources * Infrastructure |
| 1. Forms of businesses ownership may include but not limited to: | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| 1. Innovative business standards may include but not limited to: | * New products * New methods of production * New markets * New sources of supplies * Change in industrialization |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Decision making
* Business communication
* Change management
* Competition
* Risk
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care 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. Analysed 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 |
| 1. Methods of Assessment | Competency may be assessed through:   1. Written tests 2. Oral questions 3. Third party report 4. Interviews 5. Portfolio |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. 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 COMPETENCIES

# APPLY WORKSHOP TECHNOLOGY

**UNIT CODE: 0715 451 05A**

**Unit Description**

This unit describes the competencies required by a technician in order to apply workshop practice in their work. It includes applying workshop safety, material science principles and workshop tools and equipment. It also includes performing material preservation and house keeping

**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 workshop safety | 1. Safe work environment is maintained as per workplace requirements 2. ***Workplace hazards*** and risks are controlled as per workplace requirements 3. ***Workplace accidents*** and incidents are managed as per workplace requirements |
| 1. Apply material science principles | 1. Safety procedures and practices are observed as per workplace requirements 2. Safe handling of materials is carried out as per job requirements 3. ***Engineering materials*** are selected as per job requirement 4. Engineering materials are classified as per job requirement |
| 1. Apply Workshop tools and equipment | * 1. Safety procedures and practices are observed as per workplace requirements   2. Technical Drawing are interpreted as per job requirements   3. ***Workshop Tools, equipment*** are selected as per the task to be performed   4. Workshop tools and equipment are calibrated as per manufactures manual   5. Workshop tools are used as per work requirement   6. Tools and equipment are maintained as per the workplace procedures |
| 1. Perform material preservation | * 1. Safety procedures and practices are observed as per workplace requirements   2. Preservation method is selected as per work requirement   3. Preservation method is applied as per work requirement |
| 1. Perform house keeping | * 1. Safety procedures and practices are observed as per workplace requirements   2. ***Housekeeping equipment and materials*** are selected as per the task to be performed   3. Waste sorting and disposal is carried out as per workplace procedure |

**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** |
| --- | --- |
| Workplace hazards may include but not limited to: | * Physical * Biological * Chemical * Ergonomics * safety |
| Workplace accidents may include but not limited to: | * cuts and bleeds * fracture * fainting * electric shock |
| Engineering materials may include but not limited to: | * metals * polymers * composites * ceramic |
| Workshop Tools, equipment and materials may include but not limited to: | * Measuring tools * Marking out tools * Cutting tools * Fitting tools * Forging tools * Sheet metal tools * Machining tools |
| Housekeeping equipment and materials may include but not limited to: | * Brooms * Detergents * Waste clothes |

**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
* Innovation
* Communication skills

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Work place hazards
* Hazard measurement and control
* Work place accidents
* Accidents contingency measures
* Engineering materials
* Workshop tools, equipment and machines
* Material preservation methods
* Waste management
* Housekeeping procedures

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Maintained work environment as per workplace requirement   2. Controlled workplace hazards and risks per workplace requirements   3. Managed workplace accidents and incidents as per workplace requirements   4. Selected engineering materials as per job requirement   5. Classified engineering materials as per job requirement   6. Selected workshop tools and equipment as per manufactures manual   7. Calibrated workshop tools and equipment as per manufactures manual   8. Maintained tools and equipment as per the workplace procedures   9. Applied preservation method as per work requirement   10. Carried out waste sorting and disposal as per workplace 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 demonstration 2. Written reports 3. Case studies 4. Written examination |
| 1. Context of assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended |

# APPLY MATHEMATICS

**UNIT CODE:** 0541 451 06A

**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. Carry out mensuration | 3.1 Units of measurements and their symbols are determined as per task requirement  3.2 Conversion of units of measurement are performed as per task requirement  3.3 Calculation of length, width, height, perimeter, area and angles of figures is performed as per task requirement  3.4 Measurements and estimations of quantities is performed as per task requirement |
| * 1. Apply statistics and probability | 4.1 Presentation of data is done as per task requirement  4.2 Measures of ***central tendency*** are obtained as per task requirement  4.3 Measures of ***dispersion*** are obtained as per task requirement   * 1. Probability of occurrence of events are determined |

**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. Written tests   2. Portfolio of evidence   3. Third party report |
| 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 DRAWING

**UNIT CODE:** 0732 441 07A

**UNIT DESCRIPTION**

This unit covers the competences required to apply technical drawings. It involves using technical drawing tools, equipment and materials, producing plane geometry drawings, orthographic drawings of components, solid geometry drawings, isometric drawings and assembly drawings.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Use and maintain drawing equipment and materials | * 1. ***Drawing equipment*** are identified according to   task requirements  1.2 ***Drawing materials*** are identified according to  task requirements  1.3 Drawing equipment are applied as per task requirement |
| 1. Produce plane geometry drawings | * 1. Different ***types of lines*** used in drawing and their meanings are identified according to standard drawing conventions   2. Different ***types of angles*** are constructed as per task requirement   3. Angles are bisected as per task requirement   4. Different types of angles are measured using appropriate measuring tools   5. Different types of plane geometric forms are constructed as per task requirement   6. Different scales are constructed 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 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. Auxiliary views and true shapes are produced 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 |

**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 |
| 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. Applied drawing equipment as per task requirement   2. Constructed different types of angles as per task requirement   3. Constructed different types of plane geometric forms as per task requirement   4. Developed patterns as per task requirement   5. Developed and interpenetrated solids as per task requirement   6. Constructed sections of different forms of projection as per task requirement   7. Developed and interpreted solids as per task requirement   8. Interpreted isometric curves and circles as per task requirement   9. Assembled parts on orthographic views as per task requirement   10. Produced sectional views 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. Portfolio of evidence   2. Practical test   3. Third party report   4. Written tests   5. 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 08A

**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, analysing 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 mechanical 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. Portfolio of evidence   2. Practical test   3. Third party report   4. Written tests   5. 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 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. Portfolio of evidence   2. Practical test   3. Third party report   4. Written tests   5. 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. |

# CORE UNITS OF COMPETENCIES

# MAINTAIN CONSTRUCTION PLANT HYDRAULIC SYSTEM

**UNIT CODE:** 0716 451 10A

**UNIT DESCRIPTION**

This unit describes the competencies required to service construction plant hydraulic valves, replace construction plant hydraulic filter, service construction plant fuel tank, service construction plant pump, service construction plant hydraulic cylinder.

|  |  |
| --- | --- |
| **ELEMENTS**  **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. Service construction plant hydraulic valves | * 1. ***Safety precautions*** are observed as per work requirement.   2. Hydraulic valve components are identified as per manufactures manual.   3. Selection of tools and equipment according to service manual.   4. Hydraulic valve***s*** are diagnosed for faults as per manufacturers manual.   5. ***Service kits*** for the valves are selected as per job requirements.   6. Hydraulic system is dismantled as per manufacturers manual.   7. Cleaning and inspection of hydraulic components is performed according to service manual.   8. Damaged ***hydraulic valve components*** are replaced as per manufacturers manual.   9. Hydraulic valves are tested for operation as per manufacturer’s specification.   10. ***Documentation*** of the service is performed as per job requirement.   11. ***Housekeeping*** is performed as per work requirement. |
| 1. Replace construction plant hydraulic filter | * 1. Safety precautions are observed as per work requirement.   2. Identification of hydraulic filters components are performed according to service manual.   3. Work area is prepared as per work requirement.   4. Service kits are selected as per job requirement.   5. Hydraulic filter is removed as per manufacturers manual   6. Hydraulic filter head is cleaned as per manufacturers manual   7. Hydraulic filter is installed as per manufacturers manual   8. Documentation of the service is performed as per job requirement.   9. Housekeeping is performed as per work requirement. |
| 1. Service construction plant fuel tank. | * 1. Safety precautions are observed as per work requirement.   2. Work area is prepared according to workshop procedures   3. Fuel tank is located according to manufactures manual   4. Indemnifications of hydraulic fuel tank components is performed according to manufactures manual   5. Tools and equipment are selected according to service needed   6. Service kits are selected according to service manual   7. Fuel tank is inspected as per job requirement.   8. Fuel tank is repaired as per job requirement   9. Housekeeping is performed as per work requirement. |
| 1. Service construction plant hydraulic pump | 1. Safety precautions are observed as per work requirement. 2. Work area is prepared as per work requirement. 3. Service kits are selected as per job requirement. 4. ***Hydraulic pump components*** is inspected as per manufacturers manual 5. Hydraulic pump drive belt is inspected for tension as per manufacturers manual 6. Hydraulic pump drive belt is replaced as per manufacturers manual 7. Hydraulic pump is detached for service as per manufacturers manual 8. Hydraulic pump components are replaced as per manufacturers manual 9. Hydraulic pump components are tested as per task requirements 10. ***Documentation*** of the service is performed as per job requirement. 11. Housekeeping is performed as per work requirement. |
| 1. Service construction plant hydraulic cylinder. | * 1. Safety precautions are observed as per work requirement.   2. Work area is prepared as per work requirement.   3. Service kits are selected as per job requirement.   4. Tools and equipment are selected according to job specifications   5. Hydraulic oil is drained as per job requirement.   6. ***Hydraulic cylinder components*** are disassembled as per manufacturers manual.   7. Hydraulic cylinder is inspected as per manufacturers manual   8. Hydraulic cylinder is reassembled as per manufacturers manual   9. Hydraulic cylinder is tested for operation as per manufacturers manual   10. Documentation of the service is performed as per job requirement.   11. Housekeeping is performed as per work requirements |

**RANGE**

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

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| **Variable** | **Range** may include but not limited to: |
| 1. ***Tools and equipment*** ***include but not limited to*** | **Tools**   1. Workbench 2. Hand tools 3. Power tools 4. Toolboxes 5. Measuring tools 6. Safety gear 7. Clamps 8. Saws 9. Drill press 10. Band saw 11. Bench grinder 12. Welding equipment 13. Dust extractor 14. Screwdriver set   **Equipment:**   1. Earth moving machines 2. Excavation equipment 3. Material handling equipment 4. Compacting equipment 5. Concrete machines 6. Paving machines 7. Stationery machines 8. Foundation machinery 9. Laptop computers 10. General workshop tools, machinery and equipment 11. Engine tool box |
| 1. ***Safety precautions includes but not limited to*** | 1. Personal protective gear 2. Training 3. Ventilation 4. Machine isolation 5. Machine stabilization 6. Hazard identification 7. Tool safety 8. Chemical handling 9. Communication |
| 1. ***Hydraulic filter includes but not limited to;*** | 1. Suction filter 2. Pressure filter 3. Return filter 4. Inline filter 5. Duplex filter 6. Magnetic filter 7. Hydraulic oil filter 8. Spin-on filter 9. Cartridge filter |
| 1. ***Hydraulic pump components includes but not limited to;*** | 1. Gear pump 2. Vane pump 3. Piston pump 4. Screw pump 5. Axial piston pump 6. Radial piston pump 7. Hand pump 8. Electric hydraulic pump 9. Hydraulic gear motor 10. Pressure compensator Gear pump 11. Vane pump 12. Piston pump 13. Screw pump 14. Axial piston pump 15. Radial piston pump 16. Hand pump 17. Electric hydraulic pump 18. Hydraulic gear motor 19. Pressure compensator |
| 1. ***Hydraulic cylinder components includes but not limited to*** | * + - 1. Double-acting cylinder       2. Single-acting cylinder       3. Telescopic cylinder       4. Rodless cylinder       5. Pneumatic cylinder       6. Miniature cylinder       7. High-pressure cylinder       8. Hydraulic lift cylinder       9. Welded cylinder       10. Tie-rod cylinder |
| 1. ***Documentation*** includes but not limited to: | Job cards  Checklists  Files  Logbooks |
| 1. ***Service kits*** | Seal kits  Filter kits  Hose repair kits  Valve repair kits  Pump repair kits  Cylinder repair kits  Pressure gauge kits  Hydraulic fluid kits  Hydraulic tool kits  Diagnostic kits |

**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:

* Decision making
* Communications (verbal and written)
* Problem solving
* Planning and organizing
* First aid
* Troubleshooting
* Critical thinking
* Research skills
* Report writing
* Record keeping

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Hydraulic components parts
* Hydraulic transmission system
* Cooling systems
* Lubrication systems
* Operation and maintenance of hydraulic equipment
* Safety precautions
* Environmental requirements
* Government laws, regulations and policies

**EVIDENCE GUIDE**

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

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| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Observed safety requirements as per work requirement   2. Carried out troubleshooting as per the manufacturer’s manual   3. Selected the correct service kits as per the job requirement   4. Overhauled construction plant component as per manufacturers manual   5. Serviced hydraulic system as per manufacturers manual   6. Prepared hydraulic repair and service report as per job requirement   7. Performed housekeeping as per work requirement |
| 2. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Materials relevant to the proposed activity or tasks |
| 3.Methods of Assessment | Competency in this unit may be assessed through:   * 1. Practical   2. Project   3. Written test   4. Portfolio of Evidence   5. Oral questioning   6. Third party report |
| 4.Context of Assessment | This competency may be assessed individually in the actual workplace or simulated workplace |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# MAINTAIN CONSTRUCTION PLANT ENGINES

**UNIT CODE:** 0716 451 11A

**UNIT DESCRIPTION**

This unit describes the competencies required to perform construction plant engine overhaul, service construction plant engine cooling system, service construction plant engine lubrication system, Service construction plant exhaust system and Service construction plant fuel system.

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| **ELEMENTS**  **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. Perform construction plant engine overhaul | * 1. Safety precautions are observed as per work requirement.   2. Preparation of the work area as per workshop procedures.   3. Tools and equipment are identified in the plant as per job requirement   4. Engine is demounted from the plant and dismantled safely as per manufacturer’s manual   5. ***Engine components*** are dismantled as per service manuals   6. Cleaning of engine components are performed according to workshop procedures   7. Inspections of engine components is performed according service manual   8. Measurements of engine component is performed according to service manual   9. Engine cylinder head is serviced as per service manual   10. Worn-out engine components are replaced according to service manual.   11. Engine components are assembled as per manufacturers manual   12. Engine timing and tune up is performed as per manufacturer’s specification   13. Tappet adjustment is carried out according to service manual   14. Compression test of the engine is performed according to service manual   15. Engine is mounted back to the construction plant machine as per manufacturers manual   16. Oil top up and coolant is carried out according to service manual   17. Engine is run and tested according to manufactures manual. |
| 1. Service construction plant engine cooling system | * 1. Safety precautions are observed as per work requirement.   2. Work area is prepared as per work requirement.   3. ***Service kits*** are selected as per job requirement.   4. Cooling system is inspected for leakages as per manufacturers manual.   5. ***Engine cooling system components*** are identified and inspected for faults as manufacturers manual   6. Engine electronic for faults are inspected as per the manufacturers manual   7. Cooling system is pressure tested according to manufacturer’s manual   8. Radiator core is performed as per manufacturers manual   9. Coolant is replaced according to manufacturer’s specification   10. Documentation of the service is performed as per job requirement.   11. Housekeeping is performed as per work requirements |
| 1. Service construction plant engine lubrication system | * 1. Safety precautions are observed as per work requirement.   2. Work area is prepared as per work requirement.   3. Tools and equipment are selected according to job requirement   4. ***Service kits*** are selected as per job requirement.   5. ***Engine lubrication system*** components are identified and inspected for wear as per job requirement.   6. Engine leakages are identified and rectified as permanufacturer’s specification   7. Engine oil is drained and replaced according to manufacturer’s specification   8. Engine is flushed as per manufacturer’s requirement   9. Lubricants are selected according to manufacturer’s specification   10. Engine lubrication system tests are conducted as per manufacturer’s specification.   11. Documentation of the service is performed as per job requirement.   12. Housekeeping is performed as per work requirement. |
| 1. Service construction plant exhaust system | * 1. Safety precautions are observed as per work requirement.   2. Work area is prepared as per work requirement.   3. Tools and equipment are selected according to job requirement   4. ***Service kits***are selected as per job requirement.   5. Leakage is checked according to workplace procedures.   6. Blockage is checked according to workplace procedures   7. Catalytic converter/ particulate filters is checked and tested according to workplace procedures   8. Dismantling of exhaust system according to manufactures manual   9. Exhaust system leaks are repaired according to manufacturer’s manual   10. Exhaust system is reassembled according to manufacturer’s specification   11. Oxygen sensor is checked and tested according to manufacturer’s specification   12. Exhaust system is tested according to service manual   13. Documentation is carried out according to workshop procedures   14. Housekeeping is performed according to workshop procedures |
| 1. Service construction plant fuel system | * 1. Safety precautions are observed as per work requirement.   2. Work area is prepared as per work requirement.   3. Tools and equipment are selected according to job requirement   4. ***Service kits*** are selected as per job requirement.   5. ***Fuel induction components*** are identified as per job requirement.   6. Fuel injectors, and throttle body air intake are inspected as per work requirement.   7. Fuel filters are inspected and replaced as per manufacturer’s specification.   8. Fuel lines and fuel rail is inspected as per job requirement.   9. Fuel pump and system is pressure tested as per manufacturer’s specifications.   10. Diesel injector pump is calibrated as per manufacturer’s specification.   11. Fuel pump is tested for operation as job requirement   12. Housekeeping is performed 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.

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| **Variable** | **Range** |
| 1. ***Resource requirements*** includes but not limited to: | **Tools and Equipment:**   1. Earth moving machines 2. Excavation equipment 3. Material handling equipment 4. Compacting equipment 5. Concrete machines 6. Paving machines 7. Stationery machines 8. Foundation machinery 9. Laptop computers 10. General workshop tools, machinery and equipment 11. Engine tool box   **Materials and Supplies**   1. Acid battery 2. Fuel 3. Cotton waste 4. Lubricants 5. First aid kit |
| 1. ***Engine components*** includes but not limited to: | 1. Engine oil seals 2. Engine oil rings/ piston gudgeon pin 3. Timing belts/chains 4. Piston 5. Crank shaft 6. Engine bearings 7. Engine pulleys 8. Engine V-belts 9. Engine gaskets 10. Engine blocks 11. Water/oil pump 12. Tappet clearance 13. Engine camshaft 14. Valve seats 15. Valve guides 16. Oil sump/strainer/PCV 17. Engine mountings |
| 1. ***Engine lubrication system*** includes but not limited to: | 1. Oil sump 2. Oil pump 3. Oil filters 4. Lubrication ducts |
| 1. ***Engine cooling system components*** includes but not limited to: | 1. Radiator cap 2. Radiator 3. Fan 4. Fan belts 5. Water pump 6. cooling system hoses 7. thermostat operations 8. thermostat switches/ sensors |
| 1. ***Fuel system components*** includes but not limited to: | 1. Fuel tank 2. Fuel pump 3. Priming pump (lift pump) 4. Fuel filter 5. Injectors |
| 1. ***Documentation materials*** includes but not limited to: | 1. Job cards 2. Checklists 3. Files 4. Logbooks |
| 1. ***Safety precautions*** | 1. Personal protective gear 2. Training 3. Ventilation 4. Machine isolation 5. Machine stabilization 6. Hazard identification 7. Tool safety 8. Chemical handling 9. Communication |
| 1. ***Fuel induction components*** | 1. Fuel injectors 2. Fuel pump 3. Fuel pressure regulator 4. Fuel rail 5. Throttle body 6. Intake manifold 7. Intake air temperature sensor 8. Mass flow air sensor 9. Fuel pressure dumper |
| 1. ***Service kits*** | 1. Seal kits 2. Filter kits 3. Hose repair kits 4. Valve repair kits 5. Pump repair kits 6. Cylinder repair kits 7. Pressure gauge kits 8. Hydraulic fluid kits 9. Hydraulic tool kits 10. Diagnostic kits |

**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:

1. Decision making
2. ICT skills
3. Communications (verbal and written)
4. Problem solving
5. Planning and organizing
6. First aid
7. Troubleshooting
8. Critical thinking
9. Research skills
10. Report writing
11. Record keeping
12. Driving skills

**Required knowledge**

The individual needs to demonstrate knowledge of:

1. Engine parts
2. Chassis and engine codes
3. Fuel induction system
4. Cooling systems
5. Lubrication systems
6. Operation and maintenance of engines
7. Safety precautions
8. Environmental requirements
9. Government laws, regulations and policies
10. Basic electrical and electronic principles
11. Welding and metal joining processes
12. Mechanics of machines
13. Materials and metallurgy
14. Plant maintenance
15. Hydraulics
16. IC engines
17. Mathematics

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Observed safety requirements as per work requirement   2. Carried out troubleshooting as per manufacturers manual   3. Selected the correct service kits as per job requirements   4. Overhauled construction plant engines as per manufacturers manual   5. Serviced engine lubrication system as per manufacturers manual   6. Serviced cooling system as per manufacturers manual   7. Serviced construction plant exhaust system as per manufacturers manual   8. Serviced construction plant fuel system as per manufacturers manual   9. Prepared engine repair and service report as per the work requirement.   10. Carried out housekeeping as per the work requirement |
| 2. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Materials relevant to the proposed activity or tasks |
| 3.Methods of Assessment | Competency in this unit may be assessed through:   * 1. Practical   2. Project   3. Written test   4. Portfolio of Evidence   5. Oral questioning   6. Third party report |
| 4.Context of Assessment | This competency may be assessed individually in the actual workplace or simulated workplace |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# MAINTAIN CONSTRUCTION PLANT BRAKE SYSTEM

**UNIT CODE:** 0716 451 12A

**UNIT DESCRIPTION**

This unit describes the competencies required to inspect construction plant braking system, service construction plant band brakes, service construction plant disk and drum brake system, service construction plant anchor type brake system and service construction plant toggle brakes.

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| **ELEMENTS**  **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. Inspect construction plant braking system | 1. ***Safety precautions*** are observed as per work requirement. 2. Work area is prepared as per work requirement. 3. Construction plant ***brake components*** are checked as per manufacturers manual 4. Construction plant brake faults are marked as per job requirement. |
| 1. Service construction plant band brakes | 1. Safety precautions are observed as per work requirement. 2. Work area is prepared as per work requirement. 3. Selection of correct tools and equipment are performed according to job requirement 4. ***Service kits***are selected as per job requirement. 5. Construction plant brake band are dismantle according to service manual. 6. Band brakes components are cleaned and inspected as per job requirement. 7. Band brake components are replaced as per manufacturer’s specifications. 8. Brake fluid is replaced as per service manual 9. Band brake is tested and adjusted as per job requirement. 10. Documentation is carried out according to workshop procedures. 11. Housekeeping is performed as per work requirement |
| 1. Service construction plant drum and disk brake system | 1. Safety precautions are observed as per work requirement. 2. Work area is prepared as per work requirement. 3. ***Service kits***are selected as per job requirement. 4. Selection of tools and equipment is performed according to job requirement 5. Dismantling of brake components are performed according to service requirement. 6. Disk and drum brake components are inspected as per job requirement. 7. ***Disk and drum brake components*** are replaced as per manufacturer’s specifications. 8. Servicing/ repairing of damage brake components is performed according to service manual. 9. Reassembling of brake components is carried out according to service manual. 10. Disk and drum brake components are tested as per task requirements. 11. Documentation is carried out according to workshop procedures. 12. Housekeeping is performed as per work requirement. |
| 1. Service construction plant anchor type brake system | * 1. Safety precautions are observed as per work requirement.   2. Identification of construction plant anchor brake is performed according to service manual.   3. Work area is prepared as per work requirement.   4. ***Service kits***are selected as per job requirement.   5. Dismantling of construction plant anchor brake system is performed according to service manual.   6. Anchor type brakes components are inspected as per job requirement.   7. Anchor type brakes components are serviced as per job requirement.   8. Anchor type brakes components are tested as per job requirement.   9. Documentation is carried out according to workshop procedures.   10. Housekeeping is performed as per work requirement. |
| 1. Service construction plant toggle brakes | 1. Safety precautions are observed as per work requirement. 2. Work area is prepared as per work requirement. 3. ***Service kits*** are selected as per job requirement. 4. Dismantling of construction plant toggle brake is performed according to service manual. 5. Toggle brakes components are inspected as per manufacturers manual 6. ***Toggle brakes components*** are serviced as per manufacturers manual 7. Toggle brakes components are tested as per manufacturers manual 8. Documentation is carried out according to workshop procedures. 9. Housekeeping is performed 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.

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| **Variable** | **Range** |
| 1. Tools and Equipmentincludes but not limited to: | **Tools and Equipment:**   1. Earth moving machines 2. Excavation equipments 3. Material handling equipments 4. Compacting equipments 5. Concrete machines 6. Paving machines 7. Stationery machines 8. Foundation machenery 9. Laptop computers 10. General workshop tools, machinery and equipment 11. Engine tool box   **Materials and Supplies**   1. Acid battery 2. Fuel 3. Cotton waste 4. Lubricants 5. First aid kit |
| 1. Disk and drum brake components include but not limited to: | 1. Brake pads 2. Brake disc 3. Brake caliper 4. Brake master cylinder 5. Brake pipes |
| 1. Toggle brakes componentsincludes but not limited to: | 1. Brake lever 2. Toggle mechanism 3. Brake shoes 4. Brake drum 5. Spring 6. Actuating rod 7. Pivot pin 8. Mounting bracket 9. Adjustment nut 10. Cable assembly |
| 1. Anchor type brakes components includes but not limited to: | 1. Anchor plate 2. Brake shoe 3. Brake drum 4. Actuating lever 5. Springs 6. Pivot pin 7. Adjustment screw 8. Brake lining 9. Mounting bracket |
| 1. Documentation includes but not limited to: | 1. Job cards 2. Checklists 3. Files 4. Logbooks |
| 1. Safety precautions includes but not limited to; | 1. Personal protective gear 2. Training 3. Ventilation 4. Machine isolation 5. Machine stabilization 6. Hazard identification 7. Tool safety 8. Chemical handling 9. Communication |

**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:

1. Decision making
2. ICT skills
3. Communications (verbal and written)
4. Problem solving
5. Planning and organizing
6. First aid
7. Troubleshooting
8. Critical thinking
9. Research skills
10. Report writing
11. Record keeping
12. Driving skills

**Required knowledge**

The individual needs to demonstrate knowledge of:

1. Operation and maintenance of engines
2. Safety precautions
3. Environmental requirements
4. Government laws, regulations and policies
5. Construction plant safety
6. Braking system principles
7. Basic electrical and electronic principles
8. Welding and metal joining processes
9. Mechanics of machines
10. Materials and metallurgy
11. Plant maintenance
12. Plant installation
13. Hydraulics
14. Mathematics

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Observed safety requirements as per the work requirement   2. Carried out troubleshooting as per manufacturers manual   3. Selected the correct service kits as per the work requirement   4. Overhauled toggle brakes componentsas per manufacturers manual   5. Serviced anchor type brakes as per manufacturers manual   6. Serviced Disk and drum brake as per manufacturers manual   7. Carried out housekeeping as per the work requirement |
| 2. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Materials relevant to the proposed activity or tasks |
| 3.Methods of Assessment | Competency in this unit may be assessed through:   * 1. Practical   2. Project   3. Written test   4. Portfolio of Evidence   5. Oral questioning Third party report |
| 4.Context of Assessment | This competency may be assessed individually in the actual workplace or simulated workplace |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# MAINTAIN CONSTRUCTION PLANT TRANSMISSION SYSTEM

**UNIT CODE:** 0716 451 13A

**UNIT DESCRIPTION**

This unit describes the competencies required to troubleshoot construction plant transmission system, sservice construction plant clutch assembly, service construction plant hydrostatic transmission system, construction plant hydrokinetic transmission system, Service construction plant final drive and service construction plant hydraulic motor

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| **ELEMENTS**  **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. Troubleshoot construction plant transmission system | 1. Safety precautions are observed as per work requirement. 2. Work area is prepared as per work requirement. 3. Tools and equipment are selected according to job requirement 4. Selecting of transmission service kits is carried out according to service manual 5. Dismantling of transmission components is carried out according to service manual. 6. ***Transmission system components*** are visually inspected as per work requirement. 7. Transmission system components faults are diagnosed as per manufacturer’s specifications. 8. Transmission system components are serviced as per manufacturers manual. 9. Transmission system components is tested as per manufacturers manual. 10. Documentation is carried out according to workshop procedures. 11. Housekeeping is performed as per work requirement. |
| 1. Service construction plant clutch assembly | 1. Safety precautions are taken as per manufacturers guidelines 2. Mechanics tools and equipment are selected as per job requirement. 3. ***Clutch assembly components*** are inspected as per service manual. 4. Construction plant clutch assembly is disassembled as per service manual 5. Clutch component are inspected according to service manual. 6. Clutch assembly components are serviced as per service manual. 7. Clutch assembly components are tested as per service manual. 8. Documentation is carried out as per workplace procedures 9. Housekeeping is performed as per work requirement. |
| 1. Service construction plant hydrostatic transmission system | 1. Safety precautions are taken as per the manufacturer’s guidelines 2. ***Tools and equipment*** are selected as per the job requirement 3. Hydraulic fluid level and filter is inspected as per service manual. 4. Dismantling of hydrostatic transmission system is carried out according to service manual. 5. ***Hydrostatic transmission fittings*** are inspected as per work requirement. 6. Hydraulic pressure is checked as per manufacturer’s specifications. 7. Drive motors are inspected as per work requirements. 8. Hydraulic fluid is replaced as per manufacturer’s specifications. 9. Adjustments and calibrations are performed as per manufacturer’s specifications. 10. Hydrostatic transmission system is tested as per job requirement. 11. Documentation is carried out as per workplace procedures 12. Housekeeping is performed as per work requirement. |
| 1. Service construction plant final drive | 1. ***Safety precautions*** are taken as per manufacturers guidelines 2. Work area is prepare according to workshop procedures 3. Tools and equipment are selected as per job requirement 4. Drive configurations are identified as per manufacturer’s specifications. 5. ***Final drive*** is identified and inspected as per service manual. 6. Dismantling of hydrostatic final drive is carried out according to service manual. 7. Final drive oil is inspected as per work requirement. 8. Final drive is serviced as the job description 9. Documentation is carried out as per workplace procedures 10. Housekeeping is performed as per work requirement. |
| 1. Service construction plant hydraulic motor | 1. Safety precautions are taken as per manufacturer’s guidelines 2. Work area is prepared according to workshop procedures 3. Hydraulic motor components are identified according to manufactures manual. 4. Tools and equipment are selected as per job requirement 5. Dismantling of hydraulic motor is performed according to service manual. 6. Hydraulic motor component is cleaned as per the work requirement. 7. ***Hydraulic motor component*** is inspected as per work requirement. 8. Hydraulic motor component are replaced as per service manual. 9. Cleaning and filtration of hydraulic motor is carried out according to manufactures manual. 10. Reconditioning and calibrations of hydraulic motor is performed according to service manual. 11. Hydraulic motor component is tested as per manufacturer’s specifications. 12. Documentation is carried out according to workshop procedures     1. Housekeeping is performed 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. ***Tools and equipment*** includes but not limited to: | **Tools and Equipment:**   1. Earth moving machines 2. Excavation equipments 3. Material handling equipments 4. Compacting equipments 5. Concrete machines 6. Paving machines 7. Stationery machines 8. Foundation machenery 9. Laptop computers 10. General workshop tools, machinery and equipment 11. Engine tool box   **Materials and Supplies**   1. Acid battery 2. Fuel 3. Cotton waste 4. Lubricants 5. First aid kit 6. Service kits |
| 1. Documentation materials includes but not limited to: | 1. Job cards 2. Checklists 3. Files 4. Logbooks |
| 1. Transmission system components includes but not limited to; | 1. Gearbox 2. Clutch assembly 3. Drive shafts 4. Torque converter 5. Differential 6. Transmission fluid 7. Synchronizers 8. Shift linkage 9. Transmission housing 10. Bearings |
| 1. Clutch assembly components includes but not limited to; | 1. Clutch disc 2. Pressure plate 3. Flywheel 4. Clutch release bearing 5. Clutch fork 6. Clutch master cylinder 7. Clutch slave cylinder 8. Clutch cable 9. Diaphragm spring 10. Pilot bearing |
| 1. Hydrostatic transmission fittings includes but not limited to; | 1. Hydraulic pump 2. Hydraulic motor 3. Control valve 4. Reservoir 5. Hydraulic hoses 6. Pressure gauge 7. Filters 8. Relief valve 9. Charge pump 10. Couplings |
| 1. Final drive includes but not limited to; | 1. Ring gear 2. Pinion gear 3. Differential case 4. Axle shafts 5. Bearings 6. Seals 7. Drive housing 8. Input shaft 9. Output shaft 10. Gear housing |
| 1. Hydraulic motor component includes but not limited to; | 1. Rotor 2. Stator 3. Drive shaft 4. Valve plate 5. Bearings 6. Housing 7. Pistons 8. Swashplate 9. Port plate 10. Seals |
| 1. Safety precautions includes but not limited to; | 1. Personal protective gear 2. Training 3. Ventilation 4. Machine isolation 5. Machine stabilization 6. Hazard identification 7. Tool safety 8. Chemical handling 9. Communication |
| 1. hydraulic motors includes but not limited to; | 1. Gear motor 2. Vane motor 3. Piston/reciprocating motor |

**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:

1. Decision making
2. Communications (verbal and written)
3. Problem solving
4. Planning and organizing
5. First aid
6. Troubleshooting
7. Critical thinking
8. Research skills
9. Report writing
10. Record keeping
11. Driving skills

**Required knowledge**

The individual needs to demonstrate knowledge of:

1. Operation and maintenance of engines
2. Safety precautions
3. Environmental requirements
4. Government laws, regulations and policies
5. Construction plant safety
6. Braking system principles
7. Basic electrical and electronic principles
8. Welding and metal joining processes
9. Mechanics of machines
10. Materials and metallurgy
11. Plant maintenance
12. Plant installation
13. Hydraulics
14. Mathematics

**EVIDENCE GUIDE**

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

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| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Observed safety requirements as per manufacturers guidelines   2. Carried out troubleshooting as per manufacturers manual   3. Selected the correct service kits as per work requirement   4. Overhauled final drive as per manufacturers manual   5. Serviced transmission system as per manufacturers manual   6. Serviced clutch assembly as per manufacturers manual   7. Serviced hydraulic motor as per manufacturers manual   8. Carried out housekeeping as per the work procedure |
| 2. Resource Implications | The following resources should be provided:  2.1 Appropriate simulated environment where assessment can take place   * 1. Materials relevant to the proposed activity or tasks |
| 3.Methods of Assessment | Competency in this unit may be assessed through:   * 1. Practical   2. Project   3. Written test   4. Portfolio of Evidence   5. Third party report |
| 4.Context of Assessment | This competency may be assessed individually in the actual workplace or simulated workplace |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# MAINTAIN CONSTRUCTION PLANT STEERING AND SUSPENSION SYSTEMS

**UNIT CODE:** 0716 451 14A

**UNIT DESCRIPTION**

This unit describes the competencies required to service construction plant hydraulic valves, replace construction plant hydraulic filter, service construction plant fuel tank, service construction plant pump, service construction plant hydraulic cylinder.

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| **ELEMENTS**  **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. Inspect construction plant steering and suspension systems. | 1. ***Safety precautions*** are taken as per manufacturer’s guidelines. 2. Tools and equipment are selected as per job requirement. 3. Steering systems are checked in accordance with service manual 4. Documentation is carried out as per workplace procedures 5. Housekeeping is performed as per work requirement. |
| 1. Service construction plant steering system | 1. Safety precautions are taken as per manufacturer’s guidelines. 2. Tools and equipment are selected as per job requirement. 3. Faulty ***steering components*** are inspected as per the service manual 4. Steering components are disassembled as per the service manual 5. Steering components are serviced as per the service manual 6. Steering components are tested as per task requirements 7. Technical information is applied as per workplace procedures 8. Lubricants and fluids are drained and disposed according to health and safety standards 9. ***Documentation*** is carried out as per workplace procedures 10. Housekeeping is performed as per work requirement. |
| 1. Service construction plant suspension system | 1. Safety precautions are observed as per manufacturer’s guidelines. 2. ***Tools and equipment*** are selected as per job requirement 3. Suspension systems are inspected as per workplace procedures 4. ***Suspension components*** are dismantled as per manufacturers manual 5. Suspension components are replaced as per manufacturer’s manual 6. Suspension components’ replacement parts are verified as per manufacturers’ part numbers 7. Road test is carried out as per job requirement 8. Suspension adjustment is set in accordance with manufacturers’ specifications 9. Documentation is carried out as per workplace procedures 10. Housekeeping is performed 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.

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| **Variable** | **Range** may include but not limited to: |
| 1. Tools and equipments includes but not limited to; | **Tools and Equipment:**   * Earth moving machines * Excavation equipment * Material handling equipment * Compacting equipment * Concrete machines * Paving machines * Stationery machines * Foundation machinery * Laptop computers * General workshop tools, machinery and equipment * Engine tool box   **Materials and Supplies**   * Acid battery * Fuel * Cotton waste * Lubricants * First aid kit |
| 1. Safety precautions includes but not limited to | * Personal protective gear * Training * Ventilation * Machine isolation * Machine stabilization * Hazard identification * Tool safety * Chemical handling * Communication |
| 1. Suspension components includes but not limited to; | * Springs * Shock absorbers * Struts * Control arms * Ball joints * Bushings * Stabilizer bar * Linkages * Torsion bars * Mounts Springs |
| 1. Steering components includes but not limited to; | * Steering wheels * Steering column * Steering gearboxes * Tie rods * Pitman arm * Centre link/drag link * Steering pump * Steering fluid reservoirs * Steering shaft * Steeling coupler |
| 1. Documentation includes but not limited to: | Job cards  Checklists  Files  Logbooks |

**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:

1. Decision making
2. Communications (verbal and written)
3. Problem solving
4. Planning and organizing
5. First aid
6. Troubleshooting
7. Critical thinking
8. Research skills
9. Report writing
10. Record keeping
11. Driving skills

**Required knowledge**

The individual needs to demonstrate knowledge of:

1. Hydraulic components parts
2. Hydraulic transmission system
3. Cooling systems
4. Lubrication systems
5. Operation and maintenance of hydraulic equipment
6. Safety precautions
7. Environmental requirements
8. Government laws, regulations and policies

**EVIDENCE GUIDE**

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

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| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Observed safety requirements as per manufactures guidelines   2. Carried out troubleshooting as per manufactures manual   3. Selected the correct service kits as per job requirement   4. Overhauled construction plant component as per manufactures manual   5. Serviced steering system as per manufactures manual   6. Serviced suspension system as per manufactures manual   7. Performed housekeeping as per work requirement |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place  1. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Practical   2. Project   3. Written test   4. Portfolio of Evidence   5. Third party report |
| 1. Context of Assessment | This competency may be assessed individually in the actual 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. |