THE REPUBLIC OF KENYA

NATIONAL OCCUPATIONAL STANDARDS

FOR

PLUMBER

LEVEL 4

TVET CDACC

P.O. BOX 15745-00100

NAIROBI

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FOREWORD

The provision of quality education and training is fundamental to the Government's overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya's development blue print and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution and this resulted in the formulation of the Policy Framework for Reforming Education and Training. A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, Curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that industry takes a leading role in Curriculum development to ensure the Curriculum addresses its competence needs. It is against this background that these Occupational Standards were developed for the purpose of developing a competency-based Curriculum for Plumbing Level 4. These Occupational Standards will also be the basis for assessment of an individual for competence certification.

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

PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING
MINISTRY OF EDUCATION

PREFACE

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

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

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Construction Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for a Plumber Level 4. These Occupational Standards will be the basis for development of competency-based Curriculum for Plumbing Level 4. These Standards will also be the basis for assessment of an individual for competence certification.

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

I am grateful to Council Secretariat, Council Technical Committee, Construction SSAC and expert workers and all those who participated in the development of these Occupational Standards.

CHAIRMAN, TVET CDACC

ACKNOWLEDGEMENT

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

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

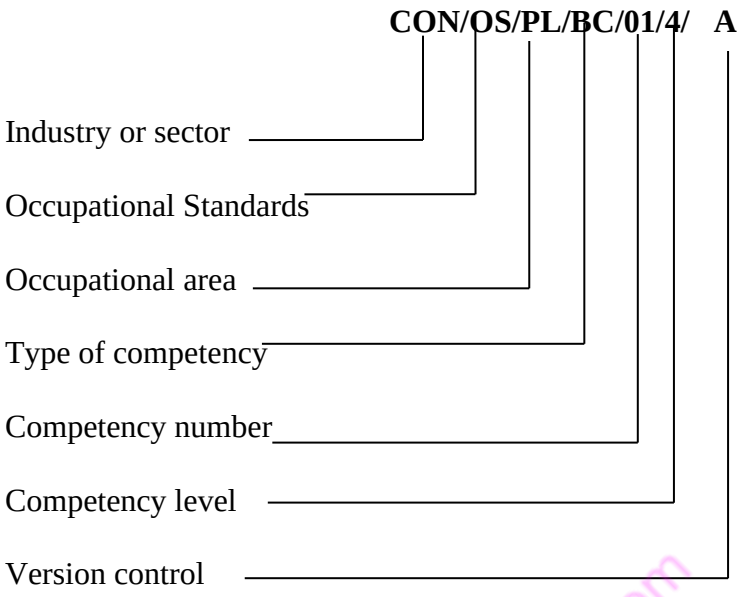
I acknowledge any other institution which in one way or another contributed to the success of development of these Standards but has not been mentioned.

CHAIRMAN
CONSTRUCTION SECTOR SKILLS ADVISORY COMMITTEE

ABBREVIATIONS AND ACRONYMNS

BC	Basic Competency
CBET	Competency Based Education and Training
CC	Common Competency
CDACC	Curriculum Development Assessment and Certification Council
CR	Core Competency
EMCA	Environmental Management and Coordination Act
OS	Occupational Standards
OSHA	Occupation Safety and Health Act
PPE	Personal Protective Equipment
PL	Plumbing
SSAC	Sector Skills Advisory Committee
TVET	Technical and Vocational Education and Training

KEY TO UNIT CODE



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OVERVIEW

Plumbing Level 4 qualification consists of competencies that an individual must achieve to enable him/her offer plumbing services comprising of installing water pipes and systems in buildings, sanitary appliances, drainage systems,water storage systems and auxilliary appliances in buildings and installing rainwater harvesting system. It also entails maintaining plumbing systems.

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

Basic Units of Competency

Unit Code	Unit Title
CON/OS/PL/BC/01/4/A	Demonstrate communication skills
CON/OS/PL/BC/02/4/A	Demonstrate digital literacy
CON/OS/PL/BC/03/4/A	Demonstrate entrepreneurial skills
CON/OS/PL/BC/04/4/A	Demonstrate employability skills
CON/OS/PL/BC/05/4/A	Demonstrate environmental literacy
CON/OS/PL/BC/06/4/A	Demonstrate occupational safety and health practices

Common Units of Competency

Unit Code	Unit Title
CON/OS/PL/CM/01/4/A	Apply Basic Mathematics
CON/OS/PL/CM/02/4/A	Perform Workshop processes
CON/OS/PL/CM/03/4/A	Apply Technical Drawing
CON/OS/PL/CM/04/4/A	Apply Scientific principles

Core Units of Competency

Unit Code	Unit Title
CON/OS/PL/CR/01/4/A	Install Water Pipes and Ancillary Appliances
CON/OS/PL/CR/02/4/A	Install Rainwater Harvesting Systems
CON/OS/PL/CR/03/4/A	Install Drainage System
CON/OS/PL/CR/04/4/A	Install Sanitary Appliances
CON/OS/PL/CR/05/4/A	Install Water Storage Systems and Ancillary Appliances
CON/OS/PL/CR/06/4/A	Maintain Plumbing Systems

BASIC UNITS OF COMPETENCY

DEMONSTRATE COMMUNICATION SKILLS

UNIT CODE: CON/OS/PL/BC/01/4/A

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Obtain and convey workplace information	1.1 Specific and relevant information is accessed from ***appropriate sources*** based on standard procedures 1.2 Effective questioning, active listening and speaking skills are used to gather and convey information based on communication needs 1.3 Appropriate ***medium*** is used to transfer information and ideas in accordance with workplace guidelines 1.4 Appropriate non- verbal communication is used as per the communication needs 1.5 Appropriate lines of communication with supervisors and colleagues are identified and followed based on workplace requirements 1.6 Location and storage of information is undertaken according to workplace procedures 1.1 Personal interaction is carried out clearly and concisely according to workplace requirements
2. Complete relevant work-related documents	2.1 Range of forms relating to conditions of employment are completed according to workplace procedures 2.2 Workplace data is recorded based on workplace requirements 2.3 Errors in recording information are identified and acted upon

	in accordance with workplace policies 2.4 Reporting requirements are completed according to organizational guidelines
3. Communicate information about workplace processes	3.1 Information sources are identified according to workplace procedures 3.2 ***Methods of communication*** are selected based on workplace guidelines 3.3 Multiple operations are communicated according to workplace structure 3.4 Work-related questions are asked and responded based on set protocols 3.5 Information is selected and organized according to workplace requirements 3.1 Verbal and written reporting is undertaken as per workplace requirements 3.2 Communication is maintained according to workplace standards
4. Lead workplace discussions	4.1 Response to workplace issues are sought and provided as per workplace protocol 4.2 Constructive contributions are made based on ***workplace discussions*** 4.3 Workplace objectives and action plan are communicated according to workplace requirements
5. Identify and communicate issues arising in the workplace	5.1 Issues and problems are identified as per workplace guidelines 5.2 Problems and issues in the workplace are organized according to workplace operations 5.3 Dialogue is initiated with appropriate personnel as per workplace structure 5.4 Problems and issues raised are communicated as per the workplace reporting procedures

RANGE

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

Variable	**Range**
1. Methods of communication may include but not limited to:	• Non-verbal gestures • Verbal • Face to face

	• Two-way radio • Speaking to groups • Using telephone • Written • Internet
2. Workplace discussion may include but not limited to:	• Coordination meetings • Toolbox discussion • Peer-to-peer discussion

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Communication
- Active listening
- Interpretation
- Negotiation
- Writing

Required Knowledge

The individual needs to demonstrate knowledge of:

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

EVIDENCE GUIDE

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

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Dealt with a range of communication/information at one time 1.2 Made constructive contributions in workplace issues 1.3 Sought workplace issues effectively 1.4 Responded to workplace issues promptly 1.5 Presented information clearly and effectively in written form 1.6 Used appropriate sources of information 1.7 Asked appropriate questions 1.8 Provided accurate information
2. Resource Implications	2. 1 Access to relevant workplace where assessment can take place 2. 2 Appropriately simulated environment where assessment can take place 2. 3 Materials relevant to the proposed activity or tasks

3. Methods of Assessment	3.1 Third-party reports 3.2 Portfolio 3.3 Interview 3.4 Written tests 3.5 Observation 3.6 Oral questioning
4. Context of Assessment	Competency may be assessed 4.1 On the job 4.2 Off the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE DIGITAL LITERACY

UNIT CODE: CON/OS/PL/BC/03/4/A

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Identify computer software and hardware	1.1 ***Appropriate computer software*** is identified according to manufacturer's specification 1.2 ***Appropriate computer hardware*** is identified according to manufacturer's specification
2. Apply security measures to data, hardware, software	2.1 ***Data security and privacy are classified*** in accordance with the technological situation 2.2 ***Security and control measures*** are applied in accordance with laws governing protection of ICT 2.3 Computer threats and crimes are detected as per information security management guidelines. 2.4 Protection against computer crimes is undertaken in accordance with laws governing protection of ICT
3. Apply computer software in solving tasks	3.1 Basic word processing concepts are applied in resolving workplace tasks 3.2 Word processing utilities are applied in accordance with workplace procedures 3.3 Data is manipulated on worksheet in accordance with office procedures
4. Apply internet and email in communication at workplace	4.1 Electronic mail is applied in workplace communication in accordance with office procedures 4.2 Office internet functions are defined and executed in accordance with office procedures

	4.3 Network configuration and uses are determined in accordance with office operations procedures

RANGE

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

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

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Analytical
- Interpretation
- Typing
- Communication

- Computing

Required Knowledge

The individual needs to demonstrate knowledge of:

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

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified input, output, CPU and storage media devices of computers in accordance to computer specification 1.2 Identified concepts, types and functions of computer software

	according to operation manual 1.3 Identified and controlled security threats 1.4 Detected and protected computer crimes 1.5 Applied word processing in office tasks 1.6 Prepared work sheet and applied data to the cells in accordance to workplace procedures 1.7 Used Electronic Mail for office communication as per workplace procedure 1.8 Applied internet and World Wide Web for office tasks in accordance with office procedures 1.9 Applied laws governing protection of ICT
2. Resource Implications	2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place 2.3 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency may be assessed through: 3.1 Written tests 3.2 Practical assignment 3.3 Interview 3.4 Oral Questioning 3.5 Observation
4. Context of Assessment	Competency may be assessed 4.1 On the job 4.2 Off the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE ENTREPRENEURIAL SKILLS

UNIT CODE: CON/OS/PL/BC/04/4/A

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Create and maintain small scale business	1. 1Generation and evaluation of business ideas is undertaken in accordance with the existing procedure 1. 2Competencies are matched with business opportunities in accordance with business practices. 1. 3Procedure for starting a small business is identified as per the legal requirements 1. 4SWOT/ PESTEL analysis and or industrial survey is carried out according to office procedures 1. 5***Business operations*** are monitored and controlled following established procedures. 1. 6Quality assurance measures are implemented in accordance with the business practices. 1. 7Good relations are maintained with staff/workers as per the workplace policies. 1. 8Policies and procedures on occupational safety and health and environmental concerns are constantly observed as per the workplace policies
2. Establish small scale business customer base	2. 1Good customer relations are maintained in accordance with office procedures 2. 2New customers and markets are identified, explored and reached out to according to the marketing plan

	2. 3Promotions/Incentives are offered to loyal customers in accordance with office procedures 2. 4Additional products and services are evaluated and tried in accordance with marketing strategy 2. 5Customer record is maintained in accordance with office procedures
3. Manage small scale business	3.1 Enterprise is built up and sustained in line with judicious control of cash flows. 3.2 Profitability of enterprise is ensured as per the internal controls. 3.3 Unnecessary or lower-priority expenses and purchases are avoided as per the marketing strategy 3.4 Basic cost-benefit analysis are undertaken in accordance with office procedures 3.5 Basic financial management are undertaken in accordance with office procedures 3.6 Basic financial accounting in undertaken in accordance with office procedures 3.7 Business ***internal controls*** are implemented in accordance with office procedure 3.8 Setting business priorities and strategies is carried out according to office procedures 3.9 Preparation and interpretation of basic financial statements is undertaken in accordance with set procedures 3.10 Preparation of business plans for small business is undertaken in accordance with ***business strategy*** 3.11 Business Social Responsibility is maintained in accordance with Standard Operations Procedures (SOP)
4. Grow/ expand small scale business	4.1 Prepared business growth strategy for small sale business in accordance with office procedures 4.2 Incorporated technology in small scale business growth in accordance with technological trends 4.3 Emerging issues and trends are considered in accordance with business growth strategy 4.4 Built audience interest in product/service according to growth strategy 4.5 Boosted cooperate communication according to business ***communication strategy***

RANGE

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

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

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Marketing
- Advertising
- Basic bookkeeping
- Accounting
- Communication

Required Knowledge

The individual needs to demonstrate knowledge of:

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

EVIDENCE GUIDE

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

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrated entrepreneurial skills 1.2 Demonstrate competencies to create a small-scale business 1.3 Demonstrated ability to conceptualize and plan a micro/small business 1.4 Grew customer base for the small-scale business 1.5 Demonstrated ability to manage/operate a micro/small-scale business 1.6 Demonstrated competencies to grow a micro/small-scale business

2.	Resource Implications	The following resources should be provided: 2.1 Assessment location 2.2 Case studies on micro/small-scale enterprises 2.3 Assessment materials
3.	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Written tests 3.2 Observation 3.3 Oral questioning 3.4 Portfolio 3.5 Projects
4.	Context of Assessment	Competency may be assessed 4.1 On the job 4.2 Off the job 4.3 During industrial attachment
5.	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE EMPLOYABILITY SKILLS

UNIT CODE: CON/OS/PL/BC/05/4/A

UNIT DESCRIPTON

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Conduct self-management	1.1 Personal vision, mission and goals are formulated based on potential and in relation to organization objectives 1.2 Emotional intelligence is demonstrated as per workplace requirements. 1.3 Individual performance is evaluated and monitored according to the agreed targets. 1.4 Assertiveness is developed and maintained based on the requirements of the job. 1.5 Accountability and responsibility for own actions are demonstrated based on workplace instructions. 1.6 Self-esteem and a positive self-image are developed and maintained based on values. 1.7 Time management, attendance and punctuality are observed as per the organization policy. 1.8 Goals are managed as per the organization's objective 1.9 Self-strengths and weaknesses are identified based on personal objectives

2. Demonstrate critical safe work habits	2.1. Stress is managed in accordance with workplace policy. 2.2. Punctuality and time consciousness is demonstrated in line with workplace policy. 2.3. Personal objectives are integrated with organization goals based on organization's strategic plan. 2.4. ***Resources*** are utilized in accordance with workplace policy. 2.5. Work priorities are set in accordance to workplace goals and objectives. 2.6. Leisure time is recognized and utilized in line with personal objectives. 2.7. ***Drugs and substances of abuse*** are identified and avoided based on workplace policy. 2.8. HIV and AIDS prevention awareness is demonstrated in line with workplace policy. 2.9. Safety consciousness is demonstrated in the workplace based on organization safety policy. 2.10. ***Emerging issues*** are identified and dealt with in accordance with organization policy.
3. Demonstrate workplace learning	3.1 Learning opportunities are sought and managed based on job requirement and organization policy. 3.2 Improvement in performance is demonstrated based on courses attended. 3.3 Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job 3.4 Time and effort is invested in learning new skills based on job requirements 3.5 Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy. 3.6 New systems are developed and maintained in accordance with the requirements of the job. 3.7 Awareness of personal role in workplace ***innovation*** is demonstrated based on requirements of the job.
4. Demonstrate workplace ethics	4.1 Policies and guidelines are observed as per the workplace requirements 4.2 Self-worth and professionalism is exercised in line with personal goals and organizational policies 4.3 Code of conduct is observed as per the workplace

	requirements 4.4 Integrity is demonstrated as per legal requirement

RANGE

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

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

	• Processes • New tools

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

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

Required Knowledge

The individual needs to demonstrate knowledge of:

- Work values and ethics
- Company policies
- Company operations, procedures and standards
- Occupational Health and safety procedures
- Fundamental rights at work
- Personal hygiene practices
- Workplace communication
- Concept of time
- Time management
- Decision making
- Types of resources
- Work planning
- Record keeping
- Workplace problems and how to deal with them
- Assertiveness
- Team work
- HIV and AIDS
- Drug and substance abuse

- Safe work habits
- Professional growth and development
- Technology in the workplace
- Emerging issues
    - Social media
    - Terrorism
    - National cohesion

EVIDENCE GUIDE

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

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Conducted self-management 1.2 Demonstrated critical safe work habits 1.3 Demonstrated workplace learning 1.4 Demonstrated workplace ethics
2. Resource Implications	The following resources should be provided: 2.1. Access to relevant workplace where assessment can take place 2.2. Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral questioning 3.2 Portfolio of evidence 3.3 Third Party Reports 3.4 Written tests
4. Context of Assessment	Competency may be assessed 4.1 On-the-job 4.2 Off-the –job **4.3** During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE ENVIRONMENTAL LITERACY

UNIT CODE: CON/OS/PL/BC/06/4/A

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Control environmental hazard	1.1 Storage methods for environmentally hazardous materials are followed according to environmental regulations and OSHS. 1.2 Disposal methods of hazardous wastes are followed according to environmental regulations and OSHS. 1.3 ***PPE*** is used according to OSHS.
2. Control environmental pollution	2.1 ***Environmental pollution control measures*** are compiled following standard protocol. 2.2 Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999 2.3 Methods for minimizing noise pollution complied following environmental regulations.
3. Demonstrate sustainable use of resource s	3.1 Methods for minimizing wastage are complied with. 3.2 ***Waste management procedures*** are employed following principles of 3Rs (Reduce, Reuse, Recycle) 3.3 Methods for economizing or reducing resource consumption are practiced.
4. Evaluate current	4.1 Information on resource efficiency ***systems and***

practices in relation to resource usage	***procedures*** are collected and provided as per work groups/sector 4.2 ***Current resource usage*** is measured and recorded as per work group/sector 4.3 Current purchasing strategies are analyzed and recorded according to industry procedures. 4.4 Current work processes to access information and data is analyzed following enterprise protocol.
5. 5. Identify environmental legislations/conventions for environmental concerns	5.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 5.2 Industrial standard/environmental practices are described according to the different environmental concerns

RANGE

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

Variable	**Range**
1. PPE may include but are not limited to:	• Masks • Gloves • Goggles • Safety hat • Overall • Hearing protector • Safety boots
2. Environmental pollution control measures may include but are not limited to:	• Methods for minimizing or stopping spread and ingestion of airborne particles • Methods for minimizing or stopping spread and inhaling gases and fumes • Methods for minimizing or stopping spread and ingestion of liquid wastes

3. Waste management procedures may include but are not limited to:	• Sorting • Storing of items • Recycling of items • Disposal of items • Handling • Transport
4. Current resources usage may include but are not limited to:	• Electric • Water • Fuel • Telecommunications • Supplies • Materials

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Measuring
- Recording
- Analytical
- Monitoring
- Writing
- Communication

Required Knowledge

The individual needs to demonstrate knowledge of:

- Storage methods of environmentally hazardous materials
- Disposal methods of hazardous wastes
- Usage of PPE Environmental regulations
- OSHS
- Types of pollution
- Environmental pollution control measures
- Different solid wastes
- Solid waste management

- Different noise pollution
- Methods of minimizing noise pollution
- Solid Waste Act
- Methods of minimizing wastage
- Waste management procedures
- Economizing of resource consumption
- Principle of 3Rs
- Types of resources
- Techniques in measuring current usage of resources
- Calculating current usage of resources
- Types of workplace environmental hazards
- Environmental regulations
- Environmental regulations applying to the enterprise.
- Procedures for assessing compliance with environmental regulations.
- Collection of information on environmental and resource efficiency systems and procedures,
- Measurement and recording of current resource usage
- Analysis and recording of current purchasing strategies.
- Analysis current work processes to access information and data Analysis of data and information

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Controlled environmental hazards 1.2 Controlled environmental pollution 1.3 Demonstrated sustainable resource use 1.4 Evaluated current practices in relation to resource usage
2. Resource Implications	The following resources should be provided: 2.1 Workplace with storage facilities 2.2 Tools, materials and equipment relevant to the tasks (e.g. cleaning tools, cleaning materials, trash bags, etc.) 2.3 PPEs 2.4 Manuals and references 2.5 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection

		2.6 Case studies/scenarios relating to environmental Protection
3	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written tests 3.4 Third party reports 3.5 Portfolio
4	Context of Assessment	Competency may be assessed 4.1 On the job 4.2 Off the job 4.3 During industrial attachment
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE OCUPATIONAL SAFETY AND HEALTH PRACTICES

UNIT CODE: CON/OS/PL/BC/07/4/A

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Adhere to workplace procedures for hazards and risk prevention	1.1 Arrangement of work area and items in accordance with workplace procedures requirements 1.2 Work standards and procedures are followed based on instructions 1.3 ***Prevention and control measures*** are applied based on instructions
2. Participate in arrangements for workplace safety and health maintenance	2.1 Orientations on ***OSH requirements and regulations*** is undertaken in line with policy. 2.2 Feedback on occupational health and safety are provided as per workplace instructions. 2.3 Workplace procedures for reporting hazards, incidents, injuries and sickness are adhered to as per workplace policy. 2.4 ***OSH-related training needs*** are identified and proposed as per workplace policy.

RANGE

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

Variable	Range
1. Prevention and control measures may include but are not limited to:	• Eliminate the hazard • Isolate the hazard • Substitute the hazard with a safer alternative • Use administrative controls to reduce the risk • Use engineering controls to reduce the risk • Use personal protective equipment • Safety, Health and Work Environment Evaluation • Periodic and/or special medical examinations of workers
2. Safety gears /PPE (Personal Protective Equipment's) may include but are not limited to:	• Arm/Hand guard, gloves • Eye protection (goggles, shield) • Hearing protection (ear muffs, ear plugs) • Hair Net/cap/bonnet • Hard hat • Face protection (mask, shield) • Apron/Gown/coverall/jump suit • Anti-static suits • High-visibility reflective vest
3. Incidents and emergencies may include but are not limited to:	• Chemical spills • Equipment/vehicle accidents • Explosion • Fire • Gas leak • Injury to personnel • Structural collapse • Toxic and/or flammable vapors emission.
4. OSH requirements / regulations may include but are not limited to:	• Building code • Permit to Operate

5. OSH-related trainings may include but are not limited to:	• Safety Orientations relevant to tasks • Safe and Correct Operation of Tools and Equipment • Health Orientations/trainings • Prevention and Control of OSH Hazards in the workplace • Chemical Handling • Safety Trainings • Prevention and Control of Work-related Injuries and Illness • Basic First-aid Trainings • Emergency Response Trainings • Trainings on use of fire-extinguisher

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

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

Required Knowledge

The individual needs to demonstrate knowledge of:

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

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	1.1. Assessment requires evidence that the candidate: 1.2. Arranged work area and items in accordance with 1.3. workplace procedures requirements 1.4. Followed work standards and procedures based on instructions 1.5. Applied ***Prevention and control measures*** based on instructions 1.6. Undertook orientations on ***OSH requirements and regulations*** in line with policy. 1.7. Provided feedback on occupational health and safety as per workplace instructions. 1.8. Adhered to workplace procedures for reporting hazards, incidents, injuries and sickness to as per workplace policy. 1.9. Identified and proposed ***OSH-related training needs*** as per workplace policy.
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral questioning 3.2 Portfolio of evidence 3.3 Third Party Reports 3.4 Written tests
4. Context of Assessment	Competency may be assessed 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

COMMON UNITS OF COMPETENCY

APPLY ENGINEERING MATHEMATICS

UNIT CODE:CON/OS/PL/CC/01/4/A

UNIT DESCRIPTION:

This unit describes the competencies required to apply Engineering Mathematics. It involves applying algebra and co-ordinate geometry, carrying out mensuration, applying matrices and statistics and plotting simple graphs.

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	1.1 Calculations involving indices and logarithms are carried out as per the concept 1.2 Linear algebraic expressions and equations are formed and solved based on the concept 1.3 Scientific calculator is used in solving mathematical problems in line with manufacturer's manual 1.4 Simultaneous equations are performed as per the concept 1.5 Quadratic equations are solved as per the concept
2. Apply co-ordinate Geometry	2.1 Polar equations are calculated using coordinate geometry 2.2 Graphs of given polar equations are drawn using the Cartesian plane 2.3 Normal and tangents are determined using coordinate geometry
3. Carry out Mensuration	3.1 Perimeter and areas of regular ***figures*** are obtained 3.2 Volume and surface area of solids are obtained 3.3 Area of irregular figures are obtained 3.4 Areas and volumes are obtained using Pappus theorem
4. Apply Matrices	4.1 Determinant and inverse of 2x2 matrix are obtained

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.***
	4.2 Solutions of simultaneous equations are obtained
5. Apply basic statistics	5.1 Grouped and ungrouped data is identified and interpreted based on given sample 5.2 Ungrouped data is organized based on the concept 5.3 Data is represented in frequency tables based on the concept 5.4 The median, mode and mean of grouped and ungrouped data is calculated based on the concept 5.5 Data is presented in a chart form based on the concept
6. Plot simple graphs	6.1 ***Graphs*** *are* plotted for given set of data based on data 6.2 Information from a given graph is interpreted based on data

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. Figures may include but not limited to:	• Square • rectangle • triangle • polygons • circles
2. Graphs limited to:	• linear graphs • bar graphs

	• pie chart • pictograph

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Communication
- Logical thinking
- Problem solving
- Interpersonal
- Drawing
- Interpretation
- Sketching
- Measuring skills

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 angles
- Types of tables and graphs
- Presentation

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: 1.1 Carried out mensuration correctly 1.2 Applied basic algebra appropriately 1.3 Performed geometrical calculations correctly 1.4 Demonstrated knowledge of applied basic statistics appropriately 1.5 Plotted simple graphs correctly
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant or appropriately simulated environment where assessment can take place 2.2 Measuring equipment 2.3 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Written tests 3.2 Practical Tests 3.3 Oral Questioning 3.4 Interviewing 3.5 Portfolio 3.6 Third party report
4. Context of Assessment	Competency may be assessed individually: 4.1 On-the-job 4.2 Off-the-job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

PERFORM WORKSHOP PROCESSES

UNIT CODE: CON/OS/PL/02/4/A

UNIT DESCRIPTION

This unit covers the competencies required to perform workshop process. Competencies include observing workshop health and ssafety precautions, using, maintaining and sstorage of workshop tools, equipment and instruments, preparation of materials and supplies for plumbing works and carrying out workshop housekeeping activities.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***(Bold and italicised terms are elaborated in the Range)***
1. 1. Observe workshop health and safety precautions	1.1 ***PPEs*** are identified and used as per manufacturer's instructions and legal requirements. 1.2 Workshop rules and regulations are adhered to as per workplace policy. 1.3 ***Safety equipment*** are identified and used as per the manufacturer's instructions. 1.4 First Aid procedures are adhered to as per workplace policy.
2. Use, care and maintain workshop tools, instruments and equipment	2.1 ***Workshop tools***, ***instruments and equipment*** are identified based on their functionality. 2.2 Workshop tools, Instruments and equipment are used as per the manufacture's manuals. 2.3 Workshop tools, Instruments and equipment are handled as per manufacturer's manual. 2.4 Workshop tools, instruments and equipment are cared for, maintained and storage as per standard procedure. 2.5 Workshop tools, equipment and instruments are checked for functionality in line with workplace policy. 2.6 Workshop instruments and equipment are calibrated as per the standard operating procedure.
3. Prepare materials and supplies for plumbing	2.1 ***Plumbing works materials and supplies*** are identified based on their use. 2.2 Plumbing works materials are measured and cut

ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***(Bold and italicised terms are elaborated in the Range)***
works	based on job requirement. 2.3 Plumbing works accessories are identified based on job requirement. 2.4 Plumbing works materials are used as per the job requirements. 2.5 Plumbing works is tested based on instructions.
4. Perform housekeeping activities	2.6 Wastes are segregated and disposed of in line with environment protection guidelines. 2.7 Tools and equipment are cleaned, maintained and stored as per manufacturers' instructions. 2.8 Plumbing materials and supplies are stored as per manufacturers' instructions. 2.9 Records are kept as per workshop 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
1. Workshop tools, instruments and equipment may include but is not limited to:	• Pliers • Hacksaws • Hammers • Spirit levels • Snips • Mallets • Diestock • Pipe wrench ***Plumbing works materials and supplies***
2. PPEs may include but is not limited to:	• Safety boots • Gloves • Ear muffs • Dust mask

Variable	Range
	• Overalls • Helmet • Goggles
3. Safety equipment may include but is not limited to:	• Fire-fighting equipment • PPEs

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Communication
- Interpretation
- Freehand sketching
- Critical thinking
- Logical thinking
- Problem solving
- Drawing graphs
- Using different measuring tools

Required knowledge

The individual needs to demonstrate knowledge of;

- Drawing tools, equipment and materials
- Proper use of PPEs
- Safety precautions
- Waste segregation and disposal

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:** 1.1 Adhered to the proper use of PPE 1.2 Observed the workshop rules 1.3 Performed the First Aid procedures in the workshop 1.4 Observed workshop procedures in the storage of tools 1.5 Safely used testing equipment and tools

	1.6 Observed EHS in the waste disposal 1.7 Properly demonstrated care and maintenance of workshop tools 1.8 Obtained, recorded and interpreted test results 1.9 Identified faulty tools and instruments 1.10 Repaired/Replaced faulty tools
2 Resource Implications	The following resources should be provided: 2.1 Functional workshop 2.2 A simulated environment equipped with plumbing tool, equipment and machines 2.3 Materials relevant to the task 2.4 Manufacturer's specifications and manuals relevant to the task
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Practical Tests 3.2 Written tests 3.3 Oral Questioning 3.4 Interviewing 3.5 Portfolio 3.6 Third party reports
4 Context of Assessment	Competency may be assessed individually: 4.1 On-the-job, 4.2 Off-the-job or a combination of these. 4.3 During industrial attachment
5 Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY TECHNICAL DRAWING

UNIT CODE: CON/OS/PL/CC/03/4/A

UNIT DESCRIPTION

This unit covers the competencies required to prepare and apply technical drawing. It involves competencies to select, use and maintain drawing equipment and materials. It also involves developing plane geometry drawings, solid geometry drawings, pictorial and orthographic drawings.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	**PERFORMANCE CRITERIA** ***(Bold and italicised terms are elaborated in the Range)***
1. Select, use and maintain drawing equipment, materials and tools	1.1 ***Drawing equipment*** are identified and gathered according to task requirements 1.2 ***Drawing materials*** are identified and gathered according to task requirements 1.3 Drawing equipment are used and maintained as per manufacturer's instructions 1.4 Drawing materials are used as per workplace procedures
2. Develop plane geometry drawings	2.1 Freehand sketching of different types of geometric forms and diagrams is conducted 2.2 Different types of lines used in drawing and their meanings are identified according to standard drawing conventions 2.3 Different types of ***geometric forms*** are constructed according to ***standard conventions*** 2.4 Different types of angles are constructed, measured and bisected according to principles of trigonometry 2.5 Plane geometry drawings are done to scale based on specification.
3. Develop solid geometry drawings	3.1 Pattern drawings are interpreted according to standard conventions 3.2 Solid geometry drawings are constructed according to given plane geometry. 3.3 Solid geometry drawings are done to scale based on specification.

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
4. Develop orthographic and pictorial drawings	4.1 Symbols and abbreviations are identified and interpreted according to standard drawing conventions 4.2 First and third angle orthographic drawings are interpreted and developed in accordance with the standard conventions 4.3 Orthographic elevations are dimensioned in accordance with standard conventions 4.4 Isometric drawings are interpreted and developed in accordance with standard conventions 4.5 Oblique drawings are interpreted and developed in accordance to standard conventions 4.6 Orthographic and pictorial drawings are done to scale based on specification.

RANGE

Variable	Range
1. Drawing tools and equipment may include but is not limited to:	• Drawing boards • T squares • Set squares • drawing sets • Paper clips
2. Drawing materials may include but is not limited to:	• Drawing papers • Pencils • Erasers • masking tapes
3. Geometric forms may include but is not limited to:	• Triangles • Square • rectangles • parallelogram • polygons • circles • pyramids

	• conic sections • prisms • ellipse • parabola • hyperbola
4. Standard conventions may include but is not limited to:	• Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends) • Drawing scale (paper size and drawing symbols) • International drawing standards

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
- Sketching
- Interpretation
- 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: 1.1 Selected, used and maintained drawing equipment and materials appropriately 1.2 Developed plain geometry drawings correctly 1.3 Developed solid geometry drawings correctly 1.4 Developed pictorial and orthographic drawings correctly
2. Resource Implications	The following resources should be provided: 2.1 Drawing room 2.2 Drawing equipment and materials 2.3 Computers with appropriate program
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Written tests 3.3 Oral Questioning 3.4 Interviewing 3.5 Portfolio 3.6 Third party reports
4. Context of Assessment	Competency may be assessed individually: 4.1 On-the-job, 4.2 Off-the-job or a combination of these. 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY SCIENTIFIC PRINCIPLES

UNIT CODE: CON/OS/PL/CC/04/4/A

UNIT DESCRIPTION

This unit describes the competence in applying scientific principles. It involves applying principles of: units of measurements, force, work, energy and power, friction, heat, pressure in fluids and mechanical properties of materials.

This standard applies in the construction industry.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA ***(Bold and italicized terms are elaborated in the Range)***
1 Apply principles of units of measurements	1.1 Units of measurements are identified based on task given 1.2 Units are converted based on standard conventions.
2 Apply principles of Force, work, energy and power	2.1 Force, work, energy and power are defined based on standard conventions 2.2 Forms of energy are described based on the state of the matter 2.3 Energy is converted according to scientific principles 2.4 Simple calculations on work, energy and power are solved based on the task requirements
3 Apply principles of Friction	3.1 Friction is defined and interpreted based on standard conventions 3.2 The advantages and disadvantages of friction are identified based on scientific principles 3.3 Simple problems on friction are solved based on task requirements
4 Apply principles of heat	4.1 ***Sources of heat*** are identified based on scientific principles 4.2 Effects of heat on matter is identified based on scientific principles 4.3 ***Methods of heat transfer*** are identified and interpreted based on scientific principles
5 Apply principles of pressure in	5.1 Density and variation of pressure is defined based on scientific principles 5.2 ***Laws*** are identified based on scientific principles

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicized terms are elaborated in the Range)*
fluids	5.3 Simple calculations on pressure in liquids are performed based on scientific principles
6 Apply mechanical properties of materials	6.1 ***Mechanical properties*** are identified and interpreted based on type of material 6.2 Advantages and disadvantages of materials are identified based on use of materials 6.3 Materials are tested based on type of material.

RANGE

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

Variable	Range
1. Sources of heat may include but is not limited to:	• Solar • Biomass • Geothermal • Fuel • Electric
2. Methods of heat transfer limited to:	• Conduction • Convection • Radiation
3. Laws limited to*:*	• Law of floatation • Archimedes principles
4. Mechanical properties may include but is not limited to:	• Malleability • Strength • Hardness • Brittleness • Elasticity • Toughness • Ductility • Electrical conductivity

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

- Solving problems
- Analytical
- Interpretation
- Interpersonal
- Computational skills
- Critical thinking

Required knowledge

- Construction materials
- Measurement
- Mechanical properties
- Friction
- Force, work, energy and power
- Principles of heat
- Pressure in fluids
- Basic electricity

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Applied units of measurements appropriately 1.2 Applied Force, work, energy and power appropriately 1.3 Applied principles of Friction appropriately 1.4 Applied principles of heat appropriately 1.5 Applied pressure in fluids appropriately 1.6 Applied mechanical properties of materials appropriately
2. Resource Implications	The following resources should be provided: 2.1 Samples of construction materials 2.2 Material Testing Laboratories 2.3 Safety equipment 2.4 Computers 2.5 Calculators 2.6 Materials testing tools and equipment
3. Methods of	Competency may be assessed through: 3.1 Written tests

	Assessment	3.2 Oral questioning 3.3 Observation 3.4 Interviewing 3.5 Third party reports
4.	Context of Assessment	Competency may be assessed individually: 4.1 On-the-job, 4.2 Off-the-job or a combination of these. 4.3 During industrial attachment
5.	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CORE UNITS OF COMPETENCY

INSTALL WATER PIPES AND ANCILLARY APPLIANCES

UNIT CODE: CON/OS/PL/CR/01/4/A

UNIT DESCRIPTION

This unit covers the competencies required to install water pipes and ancillary appliances in buildings. It involves interpreting working drawings, quantifying piping materials, supplies and ancillary appliances, preparing and assembling pipe works, installing water pipe works, testing the piping system and carrying out housekeeping practices.

This standard applies in the construction industry.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up **workplace function**.	**PERFORMANCE CRITERIA** These are **assessable** statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Interpret working drawing	1.1 Working drawing are interpreted based on technical drawings standards. 1.2 The scale of the drawing is read based on the legend 1.3 Imperial measurements are converted into metric measurements based on conversion table. 1.4 Symbols are identified based on technical drawings standards 1.5 Reference points are identified on the ground based on the site drawing.
2.Quantify piping materials and supplies	2.1 Materials required for piping are identified based on the working drawings and specifications. 2.2 ***Materials and supplies*** required are quantified based on working drawings and specifications. 2.3 A schedule of materials is created based on the working drawings and details.
3.Prepare and assemble pipe work	3.1 Occupational health and safety precautions are observed as per legal requirements. 3.2 Pipes are threaded based on best practices. 3.3 **Pipes** are ***joined*** in accordance with best practices and manufacturer's instructions.

	3.4 Pipes are cut based on type, drawing specifications and job requirements. 3.5 Pipe **bending** is done based on type, drawing specifications and requirements of the job.
4. Install water pipe works and ancillary appliances	4.1 Water supply system components are identified based on the working drawings. 4.2 Pipes works are prepared and fitted based on type and drawing **specifications.**
5.Test water supply system	5.1 ***Functionality tests*** are conducted based on set standards. 5.2 ***Faults*** in functionality are corrected based on set standards.
6.Carry out housekeeping activities	6.1 Wastes are segregated and disposed of in line with environment protection guidelines. 6.2 Tools and equipment are cleaned, maintained and stored as per manufacturers' instructions. 6.3 Surplus materials and supplies are stored as per manufacturers' instructions. 6.4 Records are kept as per workplace policy 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.

Variables	Range
1. Materials and Supplies may include but not limited to:	• Various types of pipes • Various types and sizes of fittings • Caulking supplies • Various types of pipe supports • Threading oil • Thread tape

	• Electric heater • Cisterns • Pumps • Solar water heater • Various types of valves • Water tanks
2. Specifications may include but not limited to:	• Gradient • Level • Plumpness
3. Functionality tests may include but not limited to:	• Smoke test • Water test • Air test • Pressure test
4. Pipes may include but not limited to:	• PPR • PVC • CPVC • GI • UPVC • HDPE
5. Joining methods may include but not limited to:	• Electrofusion • Welding • Adhesives • Threading
6. Bending methods may include but not limited to:	• Bending machines for GI and PVC pipes • Burning for PVC pipes • Sanding for PVC pipes
7. Faults in pipe work may include but not limited to:	• Leakages • Air lock • Water hammer • Blockages

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:

- Interpersonal skills
- Communication skills
- Sketching skills
- Interpretation skills
- Problem-solving skills
- Organizing skills
- Measuring skills
- Numeracy skills
- Cutting skills
- Threading skills
- Bending skills
- Entrepreneurial skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Interpretation of symbols
- Conversion of units
- Types of pipes
- Piping materials and supplies
- Piping tools and equipment
- Joining and jointing of pipes
- Bending
- Mensuration
- Piping systems
- Faults in pipe work
- Functionality tests

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Interpreted the working drawings correctly. 1.2 Used piping tools and equipment appropriately. 1.3 Quantified required supplies and materials accurately. 1.4 Fitted pipes based on drawing specifications. 1.5 Installed water supply systems correctly. 1.6 Tested water supply system and work correctly. 1.7 Conducted housekeeping of work area appropriately.

	1.8 Observed health and safety practices.
2. Resource Implications	The following resources must be provided: 2.1 A functional workshop with basic plumbing tools, equipment, materials and supplies. 2.2 References and manuals including construction working drawings 2.3 Personal protective equipment
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written 3.4 Third party report 3.5 Interviewing 3.6 Portfolio
4. Context of Assessment	Assessment may be done: 4.1 On-the-job, 4.2 Off-the-job or 4.3 During Work placement.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

INSTALL RAINWATER HARVESTING SYSTEMS

UNIT CODE: CON/OS/PL/CR/02/4/A

UNIT DESCRIPTION

This unit covers the competencies required to install rainwater harvesting systems. It involves interpreting the working drawings, quantifying materials and supplies, installing and testing of rainwater harvesting system and carrying out housekeeping practices.

This standard applies in construction industry.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up **workplace function**.	**PERFORMANCE CRITERIA** These are **assessable** statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Interpret working drawing	1.1 Working drawing are interpreted based on technical drawings standards. 1.2 The scale of the drawing is read based on the legend. 1.3 Imperial measurements are converted into metric measurements based on scale. 1.4 Symbols are identified based on technical drawings standards. 1.5 Reference points are identified on the ground based on the site drawing.
2. Quantify rainwater harvesting materials and supplies	2.1 ***Rainwater harvesting materials*** required are identified based on the drawings and specifications. 2.2 ***Supplies*** are identified based on specifications. 2.3 Materials and supplies required are measured and counted based on working drawings and specifications 2.4 A schedule of materials is created based on the drawing.
3. Install rainwater harvesting goods	3.1 ***Rainwater harvesting goods*** are identified based on the drawing 3.2 Measurements are taken and marking out is done based on the drawing

	3.3 Material is cut based on drawings. 3.4 Pieces are joined based on specifications 3.5 Pieces are assembled based on working drawing 3.6 Rain water goods is installed based on working drawing 3.7 Safety and health practices are observed based on OSHA
4. Test rainwater harvesting system	4.1 Water test is conducted based on best practices. 4.2 Faults in structure and functionality of rainwater harvesting system are corrected based on best practice.
5. Carryout housekeeping activities	5.1 Wastes are segregated and disposed of in line with environment protection guidelines. 5.2 Tools and equipment are cleaned and storage as per manufacturers' instructions. 5.3 Surplus materials and supplies are stored as per manufacturers' instructions. 5.4 Records are kept 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.

Variables	Range
1. Rainwater harvesting materials include but not limited to:	• Down pipes • Gutters • Brackets • Hopper head • Rainwater shoe • Assorted rainwater storage tanks

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:

- Interpersonal skills
- Communication skills
- Sketching skills
- Interpretation skills
- Problem-solving skills
- Critical thinking skills
- Organizing skills
- Measuring skills
- Numeracy skills
- Cutting skills
- Threading skills
- Bending skills
- Interpersonal Relationship skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Interpretation of symbols
- Conversion of units
- Materials and supplies
- Rainwater goods tools and equipment's
- Methods of jointing
- Bending methods
- Mensuration
- Faults in rainwater goods

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Interpreted the working drawing correctly. 1.2 Used rainwater goods tools and equipment correctly. 1.3 Quantified required supplies and materials accurately. 1.4 Installed rainwater systems appropriately 1.5 Tested rain water systems and work correctly. 1.6 Conducted housekeeping on work area correctly 1.7 Observed safety and health practises appropriately

2. Resource Implications	The following resources must be provided: 2.1 A functional workshop with basic plumbing tools, equipment, materials and supplies. 2.2 References and manuals including construction working drawings 2.3 Personal protective equipment
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Oral questions 3.3 Written tests 3.4 Interviewing 3.5 Third party report 3.6 Portfolio
4. Context of Assessment	Assessment may be done: 4.1 On-the-job, 4.2 Off-the-job or 4.3 During Work placement.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

INSTALL DRAINAGE SYSTEM

UNIT CODE: CON/OS/PL/CR/03/4/A

UNIT DESCRIPTION

This unit covers the competencies required to install drainage systems. It involves interpreting the working drawings, setting out the drainage system, quantifying drainage system components and supplies, mounting and testing of drainage systems and carrying out housekeeping practices.

This standard applies in the construction industry.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up **workplace function**.	**PERFORMANCE CRITERIA** These are **assessable** statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Interpret working drawing	1.1 Working drawing are differentiated based on technical drawings standards. 1.2 The scale of the drawing is read based on the legend 1.3 Imperial measurements are converted into metric measurements based on conversion table. 1.4 Symbols are identified based on technical drawings standards 1.5 Reference points are identified on the ground based on the site drawing.
2. Quantify materials for drainage system	2.1 ***Materials for drainage system*** are identified based on the drawings. 2.2 Supplies are identified based on specifications. 2.3 A schedule of materials is developed based on the drawing.
3. Set out Drainage systems	3.1 Measurements are transferred to the ground based on drawing 3.2 Joint positions are identified based on the drawing 3.3 Invert levels are taken based on the drawing.

4. Mount drainage system	4.1 Safety and health practises are observed based on OSHA 4.2 Above ground drainage components are laid based on the levels 4.3 Excavation for underground drainage components is carried out based on the layout. 4.4 Drainage pipeline base is stabilized based on drawings. 4.5 Underground drainage pipes are laid based on the levels 4.6 Drainage pipe work is protected based on specifications. 4.7 Inspection chambers and manholes are constructed according to specifications. 4.8 Drainage traps mounted based on specifications. 4.9 Drainage system is cured as per job requirements.
5. Test drainage system	5.1 ***Functionality tests*** are conducted based on best practices 5.2 ***Faults in drainage system*** are corrected based on best practice.
6. Carryout housekeeping activities	6.1 Backfilling and making-good is carried out based on best practice. 6.2 Drainage signage is placed based on legal requirements 6.3 Wastes are segregated and disposed of in line with environment protection guidelines. 6.4 Tools and equipment are cleaned and storage as per manufacturers' instructions. 6.5 Surplus materials and supplies are stored as per manufacturers' instructions. 6.6 Records are kept 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.

Variables	Range
1. Materials for drainage system may include but not limited to:	• Various types and sizes of fittings • Caulking tools • Various types of pipe supports • Clay pipes • UPVC • Cast iron • Concrete
2. Functionality tests may include but not limited to:	• Smoke test • Water test • Air test • Pressure test • Dye test
3. Faults in drainage system may include but not limited to:	• Leakages • Air lock • Water hammer • Blockages

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:

- Interpersonal skills
- Communication skills
- Sketching skills
- Interpretation skills
- Problem-solving skills
- Critical thinking skills
- Joining and jointing skills
- Organizing skills
- Measuring skills
- Numeracy skills
- Cutting skills
- Threading skills

- Bending skills
- Interpersonal Relationship skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Interpretation of symbols
- Conversion of units
- Levelling
- Drainage materials and supplies
- Drainage tools and equipment
- Types of pipes
- Materials and supplies
- Joining and jointing
- Mensuration
- Drainage systems
- Faults in drainage system
- Functionality tests

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Interpreted the working drawing correctly. 1.2 Used drainage tools and equipment appropriately. 1.3 Quantified required supplies and materials accurately. 1.4 Set out drainage system correctly 1.5 Installed above ground drainage system correctly 1.6 Installed below ground drainage system appropriately 1.7 Tested drainage system and work correctly 1.8 Conducted housekeeping on work area appropriately 1.9 Observed safety and health practises appropriately

2. Resource Implications	The following resources must be provided: 2.1 A functional workshop with basic plumbing tools, equipment, materials and supplies. 2.2 References and manuals including construction working drawings 2.3 Personal protective equipment
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Oral questions 3.3 Written tests 3.4 Interviewing 3.5 Third party report 3.6 Portfolio
4. Context of Assessment	Assessment may be done: 4.1 On-the-job, 4.2 Off-the-job or 4.3 During Work placement.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

INSTALL SANITARY APPLIANCES

UNIT CODE: CON/OS/PL/CR/04/4/A

UNIT DESCRIPTION

This unit covers the competencies required to install sanitary appliances. It involves interpreting working and manufacturers' drawings, quantifying sanitary appliance, mounting sanitary appliances, testing the working of sanitary appliances and carrying out housekeeping activities.

This standard applies in the construction sector.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up **workplace function**.	**PERFORMANCE CRITERIA** These are **assessable** statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Interpret working drawing	1.1 Working drawing are interpreted based on technical drawings standards. 1.2 The scale of the drawing is read based on the legend 1.3 Imperial measurements are converted into metric measurements based on conversion table. 1.4 Symbols are identified based on technical drawings standards 1.5 Reference points are identified on the ground based on the site drawing.
2. Interpret manufacturers drawings	2.1 Manufacturers drawing of sanitary appliances are interpreted as presented. 2.2 Assembling of sanitary appliances is identified and interpreted as per manufacturers' drawing.
3. Quantify sanitary appliances	3.1 **Materials** required for fixing are identified based on requirements of the job. 3.2 **Supplies** required for fixing are identified based on the drawings. 3.3 Materials and supplies required are measured and counted based on working drawings and specifications 3.4 **Schedule** of sanitary appliances is prepared based on the drawing.

4. Mount sanitary appliances	4.1 **Tools and equipment** needed for mount appliances are identified based on the type of sanitary appliance. 4.2 Appliance **positioning** is determined based on working drawings. 4.3 Tools and equipment are used based best practices. 4.4 **Support** for sanitary appliances are put in place based on manufacturers' instructions. 4.5 Sanitary appliances are mounted based on best practices. 4.6 ***Parameter checks*** are done in accordance to industry standards.
5. Test working of sanitary appliances	5.1 Functionality of the appliance is tested based on best practices. 5.2 **Faults** in appliance functionality are corrected based on best practices 5.3 The works are commissioned in accordance to job requirements
6. Carryout housekeeping activities	6.1 Wastes are segregated and disposed of in line with environment protection guidelines. 6.2 Tools and equipment are cleaned and storage as per manufacturers' instructions. 6.3 Surplus materials and supplies are stored as per manufacturers' instructions. 6.4 Records are kept 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.

Variables	Range
1. Materials may include but not limited to:	• Screws • Adhesives • Cement • Sand • Pipes • Traps • Gutters • Electric cables

	• Caulking material
2. Positioning may include but not limited to:	• standard positioning • special positioning
3. Faults may include but not limited to:	• installation faults • manufacturer's faults
4. Parameter checks may include but not limited to:	• Levelness • Plumpness • Accuracy of measurements

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:

- Drawing and interpretation skills
- Problem-solving skills
- Critical-thinking skills
- Organizing skills
- Measuring skills
- Numeracy skills
- Cutting skills
- Threading skills
- Bending skills
- Joining and jointing skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Interpretation of symbols

- Conversion of units
- Measurement
- Types of drawings
- Types of scales
- Joining and jointing
- Bending methods
- Mensuration
- Materials and supplies
- Types of caulking materials
- Types of valves
- Types of sanitary appliances
- Types of traps
- Testing methods.
- Faults.
- Special appliances
- New technologies

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: 1.1 Interpreted working drawings correctly. 1.2 Quantified materials, supplies and appliances accurately. 1.3 Positioned appliances based on specifications. 1.4 Fixed functional sanitary appliances correctly. 1.5 Tested functionality of sanitary appliances correctly 1.6 Conducted housekeeping on work area appropriately 1.7 Observed safety and health practise correctly
2. Resource Implications	The following resources must be provided: 2.1 A functional workshop with basic plumbing tools, instruments and equipment 2.2 Materials and supplies necessary for the tasks 2.3 Reference and maintenance manuals 2.4 Personal protective equipment

3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Written test 3.3 Third party report 3.4 Portfolio 3.5 Oral questioning 3.6 Interviewing
4. Context of Assessment	4.1 On-the-job 4.2 Off-the-job 4.3 Work placement
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

INSTALL WATER STORAGE SYSTEMS AND ANCILLARY APPLIANCES

UNIT CODE: CON/OS/PL/CR/05/4/A

UNIT DESCRIPTION

This unit covers the competencies required to install storage systems and ancillary appliances. It involves interpreting working, quantifying materials and supplies, mounting and testing of water storage systems and ancillary appliances as well as carrying out housekeeping practices.

This standard applies in the construction industry.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up **workplace function**.	**PERFORMANCE CRITERIA** These are **assessable** statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Interpret working drawing	1.1 Working drawing are interpreted based on technical drawings standards. 1.2 The scale of the drawing is read based on the legend/key. 1.3 Imperial measurements are converted into metric measurements based on conversion table. 1.4 Symbols are identified based on technical drawings standards 1.5 Reference points are identified on the ground based on the site drawing.
2. Quantify storage and ancillary appliances supplies and materials required	2.1 Materials required for installing storage and ***ancillary appliances*** are identified based on requirements of the job. 2.2 ***Supplies*** required for installation of storage and ancillary appliances are identified based on requirements of the job. 2.3 ***Types of storage*** and ***types of pumps*** required are enumerated based on the drawing. 2.4 Materials and supplies required are measured and counted based on working drawings and specifications 2.5 Schedules of storage and pumps are prepared based on working drawings

3. Mount water storage structures and ancillary appliances	3.1 **Tools and equipment** needed for fixing storage and ancillary appliances are identified based on the job requirements. 3.2 Tools and equipment are used based manufacturer's instructions. 3.3 ***Positioning*** of Storage and ancillary appliances is determined based on drawings. 3.4 **Support** for Storage and ancillary appliances are put in place based manufacturers' instructions. 3.5 Storage and ancillary appliances are mounted based job requirements and manufacturer's installation manual. 3.6 Personal Protective Equipment is used in line with occupational safety and health regulations. 3.7 Housekeeping is conducted on work area based on work place procedure 3.8 Safety and health practices are observed based on OSHA.
4. Test storage and ancillary appliances	4.1 Functionality of the Storage and ancillary appliances are tested based on manufacturer's manual and requirements. 4.2 **Faults** in Storage and ancillary appliances functionality are corrected based on workplace policy. 4.3 Commission the storage system as per the client's/ contract requirements.
5. Carryout housekeeping activities	5.1 Wastes are segregated and disposed of in line with environment protection guidelines. 5.2 Tools and equipment are cleaned and storage as per manufacturers' instructions. 5.3 Surplus materials and supplies are stored as per manufacturers' instructions. 5.4 Records are kept 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.

Variables	Range
1. Ancillary appliances may include but not limited to:	• Pipes • Various type of Valves • Fittings • Various types of tanks • Various types of pumps • Various types of taps • Strainers • Various pumps and controllers • Solar storage / tanks and collectors • Flanges • Solar water heaters • Pumps and controllers • Instant water heaters • Washing machines (connections) • Water purifiers
2. Tools and equipment may include but not limited to:	• Pipe wrench • Pipe cutter • Hacksaw • Pipe Threading Equipment • Vice - Bench • Tap and Punch • Files • Screwdrivers • Drill with various sizes of bits • Mallet • Ball hammer • Masonry chisel • PPR machine / Heat Fusion equipment • Pipe bender • Sealant gun

3. Supplies may include but not limited to:	• Fittings • Gaskets and O-rings • Caulking agents • Sealant and glue • Water proofing agents
4. Types of storage may include but not limited to:	• Plastic tanks (PE) • Steel tanks • Concrete tanks • Masonry tanks • Rubber tanks • Aluminium Alloy tanks • Fibre Reinforced Plastics (FRP) tanks • Insulated tanks
5. Types of pumps may include but not limited to:	• Sump pumps • Submersible pumps • Centrifugal pumps • Booster pumps • Various types of controllers
6. Positioning may include but not limited to:	• Underground • on-ground • above ground (elevated)
7. Support may include but not limited to:	• Steel Pipes • Concrete • Timber • Masonry • Compact Earth
8. Faults may include but not limited to:	• Low and high pressure • Air locks • Leaks • Clogged system • Control valve problems • Pump faults

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:

- Drawing and interpretation skills
- Problem-solving skills
- Critical thinking skills
- Communication skills
- Interpersonal relationship skills
- Organizing skills
- Measuring skills
- Numeracy skills
- Cutting skills
- Threading skills
- Bending skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Drawing and drawing interpretation
- Mensuration
- Basic fluid mechanics
- Storage systems
- Pumping systems
- Support system for elevated storage
- Plumbing ancillary systems
- Solar water heating systems
- Septic storage systems

EVIDENCE GUIDE

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

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Interpreted working drawing correctly. 1.2 Quantified storage and ancillary appliances supplies and materials required accurately. 1.3 Installed storage systems and ancillary appliances according to work requirements properly. 1.4 Tested storage and ancillary appliances to functionality according to manuals.

	1.5 Conducted housekeeping on work area appropriately 1.6 Observed safety and health practise appropriately
2. Resource implications	The following resources must be provided: 2.5 A functional workshop with basic plumbing tools, instruments and equipment 2.6 Materials and supplies necessary for the tasks 2.7 Reference and maintenance manuals 2.8 Personal protective equipment
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Written test 3.3 Third party report 3.4 Portfolio 3.5 Oral questioning 3.6 Interviewing
4. Context of Assessment	4.1 On-the-job 4.2 Off-the-job 4.3 Work placement
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended

MAINTAIN PLUMBING SYSTEMS

UNIT CODE: CON/OS/PL/CR/06/4/A

UNIT DESCRIPTION

This unit specifies the competencies required to maintain plumbing systems. It involves detecting faults in plumbing systems, quantifying requirements for repair, fixing plumbing system faults and testing functionality of plumbing system as well as carrying out housekeeping practices.

This standard applies in the construction industry.

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. Detect faults in plumbing systems	1.1 Faults in plumbing systems are identified based on functionality 1.2 Possible causes of the plumbing faults are listed based on routine maintenance reports, design purpose, manufacturer's manual and best practice. 1.3 Solution for the fault is identified based on best practice.
2. Quantify requirements for repair	2.1 ***Materials*** required for plumbing fault repair are identified based on requirements of the job. 2.2 Supplies required for plumbing fault repair are identified based on requirements of the job. 2.3 Materials and supplies required are measured and counted based on working drawings and specifications 2.4 ***Appliances*** that need replacement are identified based on the requirements of the job.
3. Fix plumbing system faults	3.1 Notice for maintenance operation are issued as per standard operating procedure. 3.2 Affected areas are closed/isolated based on best practice

	3.3 ***Tools and equipment*** are identified and used based on job requirements. 3.4 Faulty area is dis-assembled as per standard operating procedure. 3.5 Fault is repaired based on specifications and working drawings. 3.6 Work area is cleared as per standard operating procedure or best practice. 3.7 ***Personal Protective Equipment*** is used in line with occupational safety and health regulations. 3.8 Safety and health practices are observed based on OSHA.
4. Test functionality of plumbing system	4.1 Functionality of the plumbing system is tested based on expected outcome. 4.2 Repair work area is returned to initial condition as per workplace policy 4.3 Normal supply is reinstated as per the design
5. Carryout housekeeping activities	5.1 Wastes are segregated and disposed of in line with environment protection guidelines. 5.2 Tools and equipment are cleaned and storage as per manufacturers' instructions. 5.3 Surplus materials and supplies are stored as per manufacturers' instructions. 5.4 Records are kept 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.

Variables	**Range**

1. Materials for repair may include but not limited to:	• Screws • Adhesives • Cement • Sand • Pipes • Traps • Electric cables • Caulking material • Fittings
2. Appliances may include but not limited to:	• Wash hand basin • Water closet • Bath tub • Urinal • Bidet • Kitchen sink • Jacuzzi • Shower head • Solar water heaters • Rain water harvester • Cisterns • Pumps • Instant Showers • Water Filters
3. Personal Protective Equipment may include but not limited to:	• Helmet • Gloves • Dustcoat / overall • Dust mask • Safety shoes / boots
4. Tools and equipment may include but not limited to:	• Pipe wrench • Pipe cutter • Hacksaw • Pipe Threading Equipment • Bench Vice • Taps • Punch • Files

	• Screwdrivers • Drill with various sizes of bits • Portable drill • Mallet • Ball pein hammer • Mason chisel • PPR machine / Heat Fusion equipment • Pipe bender • Trowel • De-clogging wire / de-clogging machine • Toilet pump

Required Skills

The individual needs to demonstrate the following skills:

- Analytical skills
- Drawing skills
- Problem-solving skills
- Critical thinking skills
- Organizing skills
- Measuring skills
- Numeracy skills
- Cutting skills
- Threading skills
- Bending skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Trouble shooting process
- Preventive maintenance of all systems
- Corrective maintenance of all systems
- Plumbing systems
- Types of fitting and appliances
- Maintenance of each type of fitting and appliance

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Detected plumbing systems faults correctly 1.2 Quantified requirements for repair accurately 1.3 Fixed plumbing faults correctly 1.4 Tested functionality of plumbing systems according to standards 1.5 Conducted housekeeping on work area appropriately 1.6 Observed safety and health practise correctly
2. Resource Implications	The following resources must be provided: 2.1 A functional workshop with basic plumbing tools, instruments and equipment 2.2 Materials and supplies necessary for the tasks 2.3 Reference and maintenance manuals 2.4 Personal protective equipment
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Written test 3.3 Third party report 3.4 Portfolio 3.5 Oral questioning 3.6 Interviewing
4. Context of Assessment	4.1 On-the-job 4.2 Off-the-job 4.3 Work placement
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended