REPUBLIC OF KENYA

NATIONAL OCCUPATIONAL STANDARDS

FOR

REFRIGERATION AND AIR CONDITIONING ARTISAN

LEVEL 4

TVET CDACC
P.O. BOX 15745-00100
NAIROBI

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Council Secretary/CEO
TVET Curriculum Development, Assessment and Certification Council
P.O. Box 15745–00100
Nairobi, Kenya
Email: info@tvetcdacc.go.ke

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 Kenya's development blue print and sustainable development goals.

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

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these Occupational Standards were developed for developing a competency-based curriculum for Air conditioning and Refrigeration level 4. These Occupational Standards will also be the bases for assessment of an individual for competence certification.

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

PRINCIPAL SECRETARY,
VOCATIONAL AND TECHNICAL TRAINING
MINISTRY OF EDUCATION

PREFACE

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

The Technical and Vocational Education and Training Act No. 29 of 2013 and 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 Mechanical Engineering Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for a Refrigeration and Air Conditioning artisan. These occupational standards will be the bases for development of competency-based curriculum for a Refrigeration and Air Conditioning level 4. These Standards will also be the bases 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, Mechanical Engineering SSAC and expert workers and all those who participated in the development of these occupational standards.

CHAIRPERSON,
TVET CDACC

ACKNOWLEDGMENT

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 Mechanical Engineering Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the validation of these Standards.

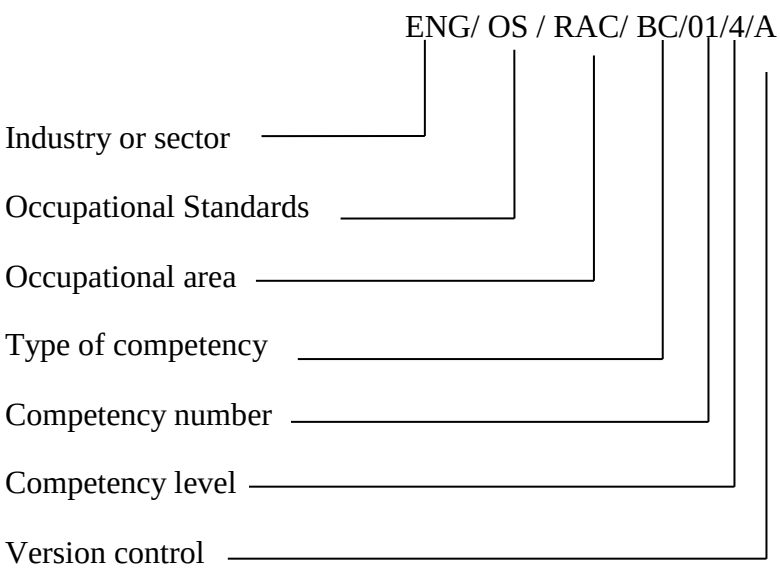
I acknowledge any other institution which in one way or another contributed to the success of development of these Standards but has not been mentioned.

CHAIRPERSON
MECHANICAL ENGINEERING SECTOR SKILLS ADVISORY COMMITTEE

ACRONYMS

A/C	Air condition
AC	Alternative current
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BC	Basic Competency
CC	Common competency
CDACC	Curriculum Development, Assessment and Certification Council
CR	Core Competency
ENG	Engineering
OS	Occupational Standards
OSHA	Occupation Safety and Health Act
OSHS	Occupation Safety and Health Standards
PC	Personal Computer
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
RAC	Refrigeration and air conditioning
SOPs	Standard Operating Procedures
SSAC	Sector Skills Advisory Committee
TVET	Technical and Vocational Education and Training

KEY TO UNIT CODE



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OVERVIEW

Air Conditioning and Refrigeration level 4 qualification consists of competencies that an individual must achieve to enable the individual install, service, troubleshoot and repair air-conditioning and refrigeration units.

The units of competency comprising air conditioning and refrigeration level 4 qualification include the following:

Basic Units of Competency

Unit Code	Unit Title
ENG/OS/RAC/BC/01//4/A	Demonstrate communication skills
ENG/OS/RAC/BC/02/4/A	Demonstrate numeracy skills
ENG/OS/RAC/BC/03/4/A	Demonstrate digital literacy
ENG/OS/RAC/BC/04/4/A	Demonstrate entrepreneurial skills
ENG/OS/RAC/BC/05/4/A	Demonstrate employability skills
ENG/OS/RAC/BC/06/4/A	Demonstrate environmental literacy
ENG/OS/RAC/BC/07/4/A	Demonstrate occupational safety and health practices

Common Units of Competency

Unit Code	Unit Title
ENG/OS/RAC/CC/01/4/A	Perform workshop practice
ENG/OS/RAC/CC/02/4/A	Apply basic mathematics
ENG/OS/RAC/CC/03/4/A	Perform electrical and electronic circuitry
ENG/OS/RAC/CC/04/4/A	Apply basic engineering science

Core Units of Competency

Unit Code	Unit Title
ENG/OS/RAC/CR/01/4/A	Install, service and repair domestic refrigeration units
ENG/OS/RAC/CR/02/4/A	Service and repair automobile air-conditioning units
ENG/OS/RAC/CR/03/4/A	Install, service and repair window type air-conditioning units

BASIC COMPETENCIES

DEMONSTRATE COMMUNICATION SKILLS

UNIT CODE: ENG/OS/RAC/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	3.1 Information sources are identified according to workplace procedures 3.2 ***Methods of communication*** are selected based on workplace guidelines

processes	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 is 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 NUMERACY SKILLS

UNIT CODE: ENG/OS/RAC/BC/02/4/A

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate numeracy skills. It involves identifying and using whole numbers and simple fractions, decimals and percentages for work, identifying, measuring and estimating familiar quantities for work, reading and using familiar maps, plans and diagrams for work, identifying and describing common 2D and some 3D shapes for work, constructing simple tables and graphs for work using familiar data and identifying and interpreting information in familiar tables, graphs and charts for work.

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 and use whole numbers and simple fractions, decimals and percentages for work	1.1 Simple fractions, decimals and percentages identified and interpreted as per standard operating procedures. 1.2 Understanding of place value by organising numbers from smallest to largest demonstrated as SOPs 1.3 Required numerical information located and decision made on appropriate method to solve a problem as per SOPs 1.4 Limited range of calculations performed using the four operations using SOPs 1.5 Links between operations described as per SOPs 1.6 Estimations made to check reasonableness of results of problem-solving process as SOPs 1.7 Numerical information recorded, and the result of the task communicated using informal and some formal language and symbolism as per workplace procedures

2. Identify, measure and estimate familiar quantities for work	2.1 Measurement information in workplace tasks and texts identified and interpreted as per workplace procedures. 2.2 Familiar units of measurement needed for tasks is identified as per measurements manuals/charts 2.3 Familiar and simple amounts estimated as per workplace procedures. 2.4 Appropriate measuring equipment selected as per SOPs 2.5 ***Simple measuring equipment*** graduated in familiar units to measure relevant quantities is used as per graduation manuals. 2.6 Calculation done using familiar units of measurement as per SOPs 2.7 Measurements and results checked against estimates as per job specifications. 2.8 Results are recorded or reported as per workplace procedures 2.9 Results relevant to the workplace task are communicated using informal and some formal mathematical and general language as per workplace procedures.
3. Read and use familiar maps, plans and diagrams for work	3.1 Items and places are in familiar maps, plans and diagrams as per SOPs 3.2 Common symbols and keys recognised in familiar maps, plans and diagrams as per SOPs 3.3 Understanding of direction and location demonstrated by describing the location of objects, or route to familiar places as per SOPs 3.4 Instructions to locate familiar objects or places are given and followed as per SOPs 3.5 Informal and some formal oral mathematical language and symbols are used as per SOPs
4. Identify and describe common 2D and some 3D shapes for work	4.1 ***Common 2D shapes and some common 3D shapes*** in familiar situations are identified and named as per job requirements 4.2 Common 2D shapes and designs are compared and classified as per SOPs

	4.3 Informal and some formal language used to describe common two-dimensional shapes and some common three-dimensional shapes in accordance with workplace procedures. 4.4 Simple items used to draw or construct common 2D shapes as per workplace procedures. 4.5 Common 3D shapes matched to their 2D sketches or nets as per SOPs
5. Construct simple tables and graphs for work using familiar data	5.1 Common types of graphs are identified and named as per SOPs 5.2 Familiar data to be collected is determined in accordance with job specifications. 5.3 A method to collect data is selected in accordance with workplace procedures. 5.4 A small amount of simple familiar data is collected as per workplace procedures 5.5 One or two variables determined from the data collected as per SOPs. 5.6 Data ordered and collated as per standard operating procedures. 5.7 A table is constructed and data entered as per SOPs 5.8 Graphs are constructed using data from table as per job specifications 5.9 Results are promptly checked as per workplace procedures 5.10 Graph information related to work is reported or discussed using informal and some formal mathematical and general language as per workplace procedures
6. Identify and interpret information in familiar tables, graphs and charts for work	6.1 Simple tables are identified in familiar texts and contexts in accordance with workplace procedures 6.2 Title, headings, rows and columns located in familiar tables as per SOPs 6.3 Information and data in simple tables identified and interpreted as per workplace procedures. 6.4 Information is related in accordance with workplace tasks

	6.5 Familiar graphs and charts are identified in familiar texts and contexts as per SOPs 6.6 Title, labels, axes, scale and key from familiar graphs and charts are located as per SOPs 6.7 Information and data in familiar graphs and charts are identified and interpreted as per job requirements 6.8 Information is related to relevant workplace tasks as per job requirements.

RANGE

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

Variable	**Range**
• Simple measuring equipment may include but not limited to:	• Rulers • Watches/clocks • Scales • Thermometers • AVO meter
• Common 2D shapes and common 3D shapes may include but not limited to:	• Round • Square • Rectangular • Triangle • Sphere • Cylinder • Cube • Polygons • Cuboids

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
- Logical thinking
- Computing
- Drawing of graphs

- Applying mathematical formulas
- Analytical

Required knowledge

The individual needs to demonstrate knowledge of:

- Types of common shapes
- Differentiation between two dimensional shapes / objects
- Formulae for calculating area and volume
- Types and purpose of measuring instruments
- Units of measurement and abbreviations
- Fundamental operations (addition, subtraction, division, multiplication)
- Rounding techniques
- Types of fractions
- Different types of tables and graphs
- Meaning of graphs, such as increasing, decreasing, and constant value
- Preparation of basic data, tables & graphs

EVIDENCE GUIDE

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

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Simple fractions, decimals and percentages are correctly identified and interpreted 1.2 Performed a limited range of calculations using the 4 operations 1.3 Performed calculations using familiar units of measurement 1.4 Recognised common symbols and keys in familiar maps, plans and diagrams 1.5 Constructed simple tables and graphs using familiar data 1.6 Identified and interpret information in familiar tables, graphs and charts
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 Test 3.2 Interview 3.3 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: ENG/OS/RAC//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: ENG/OS/RAC//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. 1 Generation and evaluation of business ideas is undertaken in accordance with the existing procedure 1. 2 Competencies are matched with business opportunities in accordance with business practices. 1. 3 Procedure for starting a small business is identified as per the legal requirements 1. 4 SWOT/ 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. 6 Quality assurance measures are implemented in accordance with the business practices. 1. 7 Good relations are maintained with staff/workers as per the workplace policies. 1. 8 Policies 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. 1 Good customer relations are maintained in accordance with office procedures 2. 2 New customers and markets are identified, explored and reached out to according to the marketing plan 2. 3 Promotions/Incentives are offered to loyal customers in accordance with office procedures 2. 4 Additional products and services are evaluated and tried in accordance with marketing strategy 2. 5 Customer 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: ENG/OS/RAC/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: ENG/OS/RAC/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 practices in relation to resource usage	4.1 Information on resource efficiency ***systems and 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. 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: ENG/OS/RAC/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

1. This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1. Arranged work area and items in accordance with 1.2. workplace procedures requirements 1.3. Followed work standards and procedures based on instructions 1.4. Applied ***Prevention and control measures*** based on instructions 1.5. Undertook orientations on ***OSH requirements and regulations*** in line with policy. 1.6. Provided feedback on occupational health and safety as per workplace instructions. 1.7. Adhered to workplace procedures for reporting hazards, incidents, injuries and sickness to as per workplace policy. 1.8. 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 COMPETENCIES

PERFORM WORKSHOP PRACTICE

UNIT CODE: ENG/OS/RAC/CC/01/4/A

UNIT DESCRIPTION

This unit describes the competencies required to perform workshop practices. It involves preparing material, tools and equipment, performing basic bench metalwork and applying basic brazing

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Prepare materials, tools and equipment	1.1 Working drawings are interpreted to determine job requirements 1.2 ***Tools, equipment*** and materials are identified and prepared according to job requirements 1.3 Materials are checked according to the required specifications 1.4 Tools and equipment conditions are checked according to the standard operating procedures (SOPs)
2. Perform basic bench metalwork	2.1 Appropriate ***PPEs*** and safety procedures are applied 2.2 ***Work instructions*** are adhered to base on task requirements 2.3 ***Basic bench metal works*** are performed according to task requirements 2.4 ***Dimensions*** are marked out according to task requirements 2.5 Dimensions are checked against the actual drawings 2.6 Work pieces are clamped in ***workholding device*** 2.7 Work pieces are cut, chipped or filed according to required measurements. 2.8 Drilling is performed according to the task requirements 2.9 Sheet bench metal work is performed as per job requirement 2.10 Joining is performed as per job requirements 2.11 Proper usage of ***materials*** is observed 2.12 Tools, equipment and recyclable materials are stored in accordance to work place procedures. 2.13 Housekeeping as per work place procedure
3. Apply basic brazing	3.1 Work pieces to be brazed are identified 3.2 Health and safety procedures are observed as per work place procedures

	3.3 Necessary materials, tools, equipment and instruments are identified 3.4 Brazing is carried out as per work place procedures 3.5 Housekeeping practices are carried out as per work place procedures

RANGE

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

1. Materials may include but not limited to:	• Steel brackets • Grinding disc • Drill bit • Flat/angle bars • Fastening screws • Sheet metal • Mild steel tubes • Rivets
2. Tools and equipment may include but not limited to:	• Portable grinder • Hacksaw • File • Scribers • Screw drivers • Ballpein hammers • Measuring tapes • Steel rule • PPEs • Portable electric drill • Wire brush • Tri-square • Chisels • Snips • Mallets
3. Dimensions may include but not limited to:	• Measurements • Tolerances
4. Work instructions may include but not limited to:	• Work plans • Drawings

	• Manufacturer's specifications
5. Personal Protective Equipment (PPE) may include but not limited to:	• Safety shoes • Gloves • Goggles
6. Basic metal works may include but not limited to:	• Cutting • Filing • Drilling • Measuring
7. Work holding device may include but not limited to:	• Pliers • Vice grip
8. Manual may include but not limited to:	• Procedures manual • Instructional manual

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Cutting
- Filing
- Drilling
- Folding
- Joining
- Work safety
- Preparing materials
- Proper handling of tools and equipment

Required Knowledge

The individual needs to demonstrate knowledge of:

- Measurements
- Dimensioning
- Unit conversion
- Basic Benchwork

- Usage of PPE
- Handling of tools, materials and equipment
- Good housekeeping

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Interpreted working drawings accordingly 1.2 Identified tools, equipment and materials correctly 1.3 Checked materials accordingly 1.4 Applied PPEs and safety correctly 1.5 Followed work instructions accordingly 1.6 Performed basic metal works accordingly 1.7 Marked out dimensions accordingly 1.8 Clamped work pieces in work holding device appropriately 1.9 Cut, chipped and filed work pieces accordingly 1.10 Performed drilling accordingly 1.11 Performed sheet metal work correctly 1.12 Observed proper usage of materials appropriately 1.13 Stored tools, equipment and recyclable materials correctly 1.14 Performed housekeeping correctly
2. Resource Implications	The following resources must be provided: 2.1 Workplace 2.2 Drawings 2.3 Materials, tools and equipment relevant to the proposed activity
3. Methods of Assessment	Competency may be assessed through: 3.1 Demonstration 3.2 Direct observation with oral questioning 3.3 Written tests 3.4 Portfolios 3.5 Third party reports
4. Context of Assessment	4.1 Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment or during industrial attachment.
5. Guidance information	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

for assessment	

APPLY BASIC MATHEMATICS

UNIT CODE: ENG/OS/RAC/CC/02/4/A

UNIT DESCRIPTION:
This unit describes the competencies required to apply basic mathematics. It involves applying fractions and decimals, basic algebra, carrying out mensuration, plotting simple graphs and applying ratios.

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 fractions and decimals	1.1 Calculations of proper fractions and mixed numbers as per the concept 1.2 Conversion of Mixed and improper fractions as per concept 1.3 Application of fractions as per concept 1.4 Conversion of fractions as per concept
2. Apply basic algebra	2.1 Calculations involving Indices are performed based on the concept 2.2 Linear equations are represented based on the concept 2.3 Simultaneous equations are performed based on mathematical rules 2.4 Simple algebraic equations are formed based on the concept 2.5 Simple algebraic equations are solved based on the concept
3. Carry out basic mensuration	3.1 Various ***units of measurements*** are identified based on the course requirements 3.2 Units are converted 3.3 Perimeter and areas of ***regular figures*** are obtained based on known formulae 3.4 Volume and Surface area of solids are obtained based on given formulae
4. Plot simple graphs	4.1 A ***graph*** is plotted for given set of data 4.2 Information from a given graph is interpreted based on data

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)***
5. Apply Ratios	5.1 Rational and irrational numbers are differentiated 5.2 Ratios are expressed as percentages 5.3 Problems involving direct and inverse proportions are solved

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. Units of measurement may include but not limited to:	• Millimetres • Centimetres • Metres • Kilometres • Grams • Kilograms
2. Regular Figures may include but not limited to	• Square • Rectangle • Triangle • Polygons • Circles
3. Graphs may include but not limited to	• Linear graphs • Bar graphs • 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:

- Problem solving
- Drawing

- sketching
- measuring skills
- calculations

Required knowledge

The individual needs to demonstrate knowledge of:

- Fundamental operations (addition, subtraction, division, multiplication)
- Calculating area, surface area and volume
- Types and purpose of measuring instruments
- Units of measurement and abbreviations
- Rounding techniques
- Types of fractions
- Types of tables and graphs
- Presentation

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 Calculated Proper fractions and mixed numbers 1.2 Converted Mixed and improper fractions Applied fractions 1.3 Converted fractions 1.4 Represented linear equations 1.5 Solved simultaneous equations 1.6 Formed simple algebraic equations 1.7 Solved simple algebraic equations 1.8 Identified various units of measurements 1.9 Converted units 1.10 Obtained perimeter and areas of regular figures 1.11 Obtained volume and Surface area of solids 1.12 Plotted graph for given set of data 1.13 Interpreted information from a given graph 1.14 Converted numbers from one base to another 1.15 Differentiated between rational and irrational numbers 1.16 Expressed ratios as percentages 1.17 Solved problems involving direct and inverse proportions

2. Resource Implications	The following resources should be provided: 2.1 Access to relevant or appropriate 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: 1.1 Written tests 1.2 Direct Observation 1.3 Demonstration with Oral Questioning
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution or 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 ELECTRICAL AND ELECTRONICS CIRCUITRY

UNIT CODE:ENG/OS/RAC/CC/02/4/A

UNIT DESCRIPTION

This unit describes the competencies required to perform electrical and electronic circuitry. It entails identifying electrical and electronic components, interpreting electrical and electronic circuits, troubleshooting faults in electrical and electronic circuits and applying concepts of DC and AC components and circuits.

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 electrical and electronics components	1.1 Safe working practices are observed throughout the task as per work place procedures 1.2 Basic ***SI unit***s in Electrical are identified 1.3 ***Electrical and electronic components*** are named 1.4 Power control ***safety devices*** are identified 1.5 Housekeeping is carried out as per work place procedure
2. Interpret technical drawings	2.1 Technical drawing symbols are identified 2.2 Technical drawing circuits are interpreted 2.3 Orthographic projections are identified 2.4 Orthographic projections are drawn
3. Interpret electrical and electronic circuits	3.1 Safe working practices are observed throughout the task as per work place procedures 3.2 Electrical, electronic and drawing symbols are interpreted 3.3 Building blocks of electrical and electronic circuits are identified 3.4 Manufacturers manuals and catalogues are used as per the task requirement 3.5 Housekeeping is carried out as per work place procedure
4. Troubleshoot electrical and electronic circuits faults	4.1 Safe working practices are observed throughout the task as per work place procedures 4.2 Electrical and electronic instruments are tested 4.3 Electrical and electronic faults are diagnosed 4.4 Methods for fault diagnosis are identified 4.5 Housekeeping is carried out as per work place procedure
5. Apply concepts	5.1 Safe working practices are observed as per work place procedures

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.***
of DC and AC components and circuits	5.2 DC and AC components are identified 5.3 DC and AC power sources are identified 5.4 DC and AC principles are applied 5.5 Housekeeping is carried as per work place 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. SI unit may include but not limited to:	• Power – Watts (W) • Current – Amperes (A) • Resistance – Ohms(Ω) • Voltage – Volts (V) • Capacitance –Farads(F) • Charge- Coulombs
2. Electrical and electronic components may include but not limited to:	• Switches • Circuit breakers • Fuses • Sensors • Transducers • Transistors • Rectifiers • Diodes
3. Safety devices may include but not limited to:	• Fuses • Circuit breakers • Switch fuse

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Use of basic electrical instruments
- Perform unit conversions of electrical quantities

- Performing electrical earthing
- Logical thinking
- Problem solving
- Using different measuring tools

Required knowledge

The individual needs to demonstrate knowledge of:

- Electrical and Electronic circuits
- SI units of various electrical and electronic parameters
- Earthing testing
- Types and purpose of measuring instruments
- Units of measurement and abbreviations
- Motor starting devices
- Power sources
- Electrical, electronic and drawing symbols

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 Observed safe working practices throughout the task accordingly 1.2 Identified basic SI units in electrical correctly 1.3 Named electrical and electronic components correctly 1.4 Identified power control safety devices correctly 1.5 Observed safe working practices throughout the task correctly 1.6 Named electrical, electronic and drawing symbols correctly 1.7 Named sensor circuits correctly 1.8 Named transducer circuits correctly 1.9 Used manufacturers manuals and catalogues accordingly 1.10 Tested electrical and electronic instruments correctly 1.11 Diagnosed electrical and electronic faults accordingly 1.12 Identified methods for fault diagnosis correctly 1.13 Identified D.C and A.C components correctly 1.14 Identified D.C and A.C power sources correctly 1.15 Applied D.C and A.C concepts accordingly 1.16 Performed housekeeping practices correctly
2. Resource	The following resources should be provided:

Implications	2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Measuring equipment and instruments 2.3 Materials relevant to the tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Direct Observation 3.2 Demonstration with Oral Questioning 3.3 Written tests
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution or 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 BASIC ENGINEERING SCIENCE

UNIT CODE: ENG/OS/RAC/CC/03/4/A

UNIT DESCRIPTION

This unit describes the competencies required to apply basic engineering science. It involves applying concepts of fluid mechanics and thermodynamics.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
1. Apply concepts of fluid mechanics	1.1 Defined fluid mechanics as applied in the concept 1.2 Identified ***properties of fluids*** as applied in fluid mechanics 1.3 Calculated density of fluids 1.4 Applied viscosity of fluids 1.5 Pressure of fluids is defined 1.6 Pascal's law is defined 1.7 ***Flow rate*** in pipes is measured
2. Apply concept of thermodynamics	2.1 Thermodynamics defined as it applied in refrigeration and air conditioning 2.2 Defined various ***modes of heat transfer***: 2.3 Applied various modes of heat transfer in 2.4 refrigeration and air conditioning 2.5 Defined thermodynamic systems 2.6 Defined the 1st law of thermodynamics and its application in refrigeration and air conditioning 2.7 Defined the 2nd law of thermodynamics and its application in refrigeration and air conditioning 2.8 Applied heat transfer as per the concept 2.9 Simple vapor compression cycle is applied in thermodynamics

RANGE

Variable	Range
1. Properties of fluids may include but is not limited to:	• Density • Viscosity • Temperature • Pressure • Specific volume • Specific weight
2. Flow rate may include	• Viscous flow • Turbulent flow

but is not limited to:	• Lamina flow
3. Modes of heat transfer may include but is not limited to:	• Radiation • Convection • Conduction

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

The individual needs to demonstrate the following skills:

- Interpretation of diagrams, drawings and charts
- Proper handling of materials, tools, equipment and instruments
- Carrying out calculations

Required knowledge

The individual needs to demonstrate knowledge of:

- Reading pressure gauges
- Calculating pressures
- Interpreting readings from pressure gauges
- Performing calculations on Pascal's law
- Properties of fluids
- Calculation of density of fluids
- Application of viscosity of fluids
- Flow rate in pipes
- Application of simple refrigeration cycles
- Modes of heat transfer

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 Applied concepts of fluid mechanics 1.2 Performed Pressure measurement 1.3 Was able to measure flow rate in pipes 1.4 Applied concepts of thermodynamics 1.5 Applied principles of heat transfer 1.6 Applied simple refrigeration cycles

2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Measuring equipment and instruments 2.3 Materials relevant to the tasks 2.4 Refrigeration and air conditioning equipment
3. Methods of Assessment	Competency may be assessed through: 3.1 Practical tests 3.2 Observation
4. Context of assessment	Competency may be assessed individually in the actual workplace or a simulated work place setting or 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 COMPETENCIES

INSTALL, SERVICE AND REPAIR DOMESTIC REFRIGERATION UNITS

UNIT CODE: ENG/OS/RAC/CR/01/4/A

UNIT DESCRIPTION

This unit covers the competencies required to install, service and repair domestic refrigeration units. It involves conducting site survey, installing domestic refrigeration units, service domestic refrigeration unit, identifying and repairing faults in domestic refrigeration units, carrying out Refrigeration unit refrigerant recovery, recycling and evacuation. It also entails charging domestic refrigeration unit, maintaining domestic refrigeration unit and test-running repaired and serviced domestic refrigeration unit.

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 site survey	1.1. Site conditions and installation requirements are assessed according to manufacturer's specification 1.2. ***Tools, equipment*** and ***materials*** needed for installation are determined according to site conditions and site installation requirements 1.3. Site survey report is prepared in accordance with work place procedures 1.4. Safety procedures are adhered to according to workplace procedures and OSHA
2. Install refrigeration unit	2.1 Tools, equipment and materials are assembled according to workplace procedures 2.2 ***Refrigeration unit*** and components are prepared based on work place procedures 2.3 Refrigeration unit base is leveled and unit positioned in line with manufacturer's specifications 2.4 Refrigeration unit is installed according to work place procedures and manufacturer's specifications 2.5 Safe handling techniques are employed in line with manufacturer's specifications and OSHA 2.6 Voltage and current are ascertained according to unit's ratings. 2.7 Hydrocarbon RAC systems are installed, serviced and

	maintained and decommissioned 2.8 Temperature settings are performed according to user requirements 2.9 Refrigeration unit is handed over to user as per work place procedures
3. Service refrigeration unit	3.1 Appropriate manuals are interpreted in line with the job requirements 3.2 Tools, equipment and materials are selected as per workplace procedures 3.3 Safe working practices are observed throughout the task as per work place procedures 3.4 ***Refrigeration unit components*** are serviced and maintained according to manufacturer's specifications and workplace procedures 3.5 Task is completed in line with workplace procedures and environmental requirements
4. Identify and repair faults in domestic refrigeration unit	4.1 Appropriate manuals are interpreted in line with the job requirements 4.2 Safe working practices are observed throughout the task as per work place procedures 4.3 Tools, equipment and instruments are selected and used in line with job requirements 4.4 Domestic ***refrigeration unit*** components are tested following manufacturer's manuals 4.5 Faulty components are repaired or replaced in line with manufacturer's manuals 4.6 Domestic refrigeration unit requiring recovery/recycling is identified 4.7 Refrigerant recovery/recycling is performed according to manufacturer's manuals 4.8 Refrigeration unit is repaired according to workplace procedures 4.9 Housekeeping is performed 4.10 Work is completed in line with workplace procedures and ***environmental requirements***
5. Carry out refrigerant evacuation, recovery and recycling	5.1 Identified unit for evacuation and recovery 5.2 Observed health, safety and environmental requirements as per work place procedures and applicable ISO standards 5.3 Identified necessary tools, equipment and instruments 5.4 Carried out refrigerant evacuation, recovery and recycling

	as per work place procedures 5.5 Carried out housekeeping 5.6 Work is completed in line with workplace procedures and environmental requirements
6. Charge refrigeration unit	6.1 Identified refrigeration unit to be charged 6.2 Observed health and safety requirements as per work place procedures and ISO 22712 standards and KS ISO 5149-4:2014 6.3 Identified necessary tools and equipment 6.4 Identified the relevant refrigerant as per the Refrigeration unit requirement 6.5 Carried out the charging as per the Refrigeration unit requirement and work place procedures 6.6 Carried out housekeeping 6.7 Work is completed in line with workplace procedures and environmental requirements
7. Commission serviced refrigeration unit	7.1 Identified unit to be commissioned 7.2 Observed health, safety and environmental requirements as per work place procedures and ISO 22172 standards 7.3 Identified necessary tools, equipment and instruments 7.4 Carried out unit test-running as per work place procedures 7.5 Operating parameters of the unit are confirmed as per work place procedures 7.6 Carried out housekeeping 7.7 Serviced unit is handed over to user as per work place procedures 7.8 Prepared service report as per work place procedures

RANGE

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

Variable	Range
1. Refrigeration unit may include but not limited to:	• Refrigerators • Freezers • Water dispensers • Wine chillers • Bottle coolers • Ice makers

2. Tools, equipment and instruments may include but not limited to:	• Pliers • Screwdrivers • Hammers • Chisels • Spirit levels • Phase testers • Files • Fin combs • Nut drivers • Brazing equipment • Multi-meters • Leak detectors • System analyzers • Recovery/recycling units • Weighing balance • Vacuum pumps • Refrigerant identifier • Clamp on ammeters • Lokring tools • Flaring tools • Swaging tools • Mallets • Vices • Punches • Adjustable spanner • Wire brush • Tube bender • Tube cutter • Capillary cutter • Combination pressure gauge set • Micrometer gauge • Vernier caliper • Amp-probe meter • Anemometer

3. Domestic refrigeration unit components may include but not limited to:	• Electrical controls
	  ○ Thermostats
	  ○ Defrost timers
	  ○ Defrost sensors

	○ Defrost heaters ○ Thermo discs ○ Relays ○ Switches • Compressors • Fan motors • Capacitors • Electronic control cards • Overload protectors
4. Environmental legislations may include but not limited to	• Environmental Management Coordination Act • ISO standards on environment 140001
5. Materials may include but not limited to	• Insulators • Socket outlets • Conduits and trunkings • Refrigerants • Lubricating oil • Copper tubes

EQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Use of PPEs
- Interpreting manufacturers manual
- Preparing materials
- Handling of tools, equipment and instruments
- Tube processing
- Safe handling of refrigerants and lubricants
- Recovering/recycling refrigerants
- Brazing
- Installation of domestic refrigeration units
- Troubleshooting
- Repairing of domestic units
- Servicing domestic units

Required Knowledge

The individual needs to demonstrate knowledge of:

- Personal protective equipment
- Uses and handling of tools, equipment and instruments
- Safety signs and symbols
- Housekeeping
- Interpretation of manufactures manual
- Uses and specifications of refrigerants, refrigeration oil and refrigeration components
- Basic electronics
- Electrical principles
- Technical drawing
- Heat transfer
- Refrigeration principles
- Recovery/recycling process
- Compressor types, operation and application
- Compressor operations
- Motor starters
- Motor protection
- Applicable Legislations

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 Adhered to safety procedures 1.2 Selected tools, equipment and materials 1.3 Diagnosed refrigeration unit faults 1.4 Recovered/recycled refrigerants 1.5 Repaired refrigeration unit 1.6 Tested domestic refrigeration unit 1.7 Performed housekeeping 1.8 Installed domestic refrigeration units 1.9 Prepared Refrigeration unit and components 1.10 Levelled and positioned Refrigeration unit base 1.11 Installed Refrigeration unit 1.12 Employed safe handling techniques 1.13 Ascertained voltage and current 1.14 Performed temperature settings 1.15 Serviced and maintained domestic refrigeration unit components 1.16 Interpreted manufacturers manuals

	1.17 Observed safe working practices 1.18 Tested domestic refrigeration unit components 1.19 Repaired or replaced faulty components 1.20 Identified domestic refrigeration unit requiring recovery/recycling 1.21 Performed refrigerant recovery/recycling 1.22 Completed work correctly 1.23 Evacuated domestic refrigeration unit 1.24 Observed health, safety and environmental requirement 1.25 Charged domestic refrigeration unit 1.26 Identified relevant refrigerant 1.27 Carried out charging 1.28 Refrigeration unit is maintained in line with manufacturer's manuals 1.29 Performed test-run on refrigeration unit 1.30 Commissioned and handed over refrigeration unit
2. Resource implications	The following resources must be provided: 2.1 Work place location and domestic refrigeration units 2.2 Tools, equipment and instruments for installing maintaining servicing and repairing domestic refrigeration units 2.3 Materials relevant to the task 2.4 Manufacturer's specifications and manuals relevant to the task
3. Methods of assessment	Competency may be assessed through: 3.1 Demonstration 3.2 Direct observation with oral questioning 3.3 Written tests 3.4 Portfolio 3.5 Third party reports
4. Context for assessment	Competency may be assessed individually on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the sector, workplace and job role is recommended.

SERVICE AND REPAIR AUTOMOBILE AIR-CONDITIONING UNITS

UNIT CODE: ENG/OS/RAC/CR/02/4/A

UNIT DESCRIPTION

This unit covers the competencies required to service and repair automobile air conditioning units. It involves servicing, identifying and repairing faults in automobile air conditioning units. It also entails carrying out refrigerant evacuation, recovery and recycling; charging, test-running and commissioning serviced automobile air conditioning unit.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Prepare for service of air conditioning components	1.1 Safe working practices are observed throughout the task as per work place procedures and applicable KS ISO standards 1.2 ***Tools and equipment*** are selected as per job requirements 1.3 Interpreted manufacturers manuals 1.4 Identified automobile system components and accessories 1.5 Identified type of refrigerant 1.6 Identified type of lubricant 1.7 Performed safe handling of refrigerants
2. Perform troubleshooting	2.1 Safe working practices are observed throughout the task as per work place procedures 2.2 Appropriate manufacturers manuals are interpreted per the job requirements 2.3 Appropriate materials, tools and equipment are selected based on job requirements 2.4 Trouble shooting is performed based on work place procedure
3. Identify and repair faults in air conditioning components	3.1 Safe working practices are observed as per work place procedures 3.2 ***Tools***, ***equipment*** and ***instruments*** are selected as per job requirements 3.3 ***Components*** with faults are tested according to manufacturer's manuals and work place procedures 3.4 Air-conditioning components requiring recovery/recycling are identified as per work place procedure 3.5 Repair action is taken as per manufacturer's specifications 3.6 Task is completed in accordance with workplace procedures

	and ***environmental legislations***
4. Perform refrigerant evacuation, recovery and recycling	4.1 Identified automobile A/C unit to be evacuated 4.2 Observed health, safety and environmental requirements as per work place procedures and applicable ISO standards and applicable KS ISO standards 4.3 Identified necessary tools, equipment and instruments 4.4 Carried out A/C unit recovery, recycling and evacuation as per work place procedure 4.5 Carried out housekeeping
5. Charge refrigeration unit	5.1 Identified refrigeration unit to be charged 5.2 Observed health and safety requirements as per work place procedures and applicable ISO standards and applicable KS ISO standards 5.3 Identified necessary tools and equipment 5.4 Identified the applicable refrigerant as per the Refrigeration unit requirement 5.5 Carried out the charging as per the Refrigeration unit requirement and work place procedures 5.6 Carried out housekeeping 5.7 Task is completed in line with workplace procedures and environmental requirements
6. Commissioned serviced unit	6.1 Identified unit to be commissioned 6.2 Observed health, safety and environmental requirements as per work place procedures and applicable ISO standards 6.3 Identified necessary tools, equipment and instruments 6.4 Carried out unit test-running as per work place procedures 6.5 Operating parameters of the unit are confirmed as per work place procedures 6.6 Carried out housekeeping 6.7 Serviced unit is handed over to user as per work place procedures 6.8 Prepared service report as per work place procedures

RANGE

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

Variable	**Range**
1. Tools, equipment and	• Pliers

instruments may include but not limited to:	• Screwdrivers • Hammers • Spirit levels • Phase testers • Files • Fin combs • Nut drivers • Socket wrenches • Brazing equipment • Arc welding equipment • Multi-meters • Leak detectors • System analyzers • Recovery/recycling units • Weighing balance • Refrigerant identifier • Vacuum pump • Blower

2. Components may include but not limited to:	• Electrical controls
	  ○ Thermostats
	  ○ Thermo discs
	  ○ Relays
	  ○ Switches
	  ○ Overload protector
	• Compressors
	• Magnetic clutch
	• Capacitors
	• Electronic control cards
	• Magnetic clutch
	• Sight glass
	• Receiver/drier
	• Belts
	• Hoses and pipes
	• Ducts
	• Air filters

3. Environmental legislations	• Environmental Management Coordination Act Environmental Protection Agency (EPA • KS ISO 5149-4:2014

	• ASHRAE

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:

- Interpreting manufacturers manuals
- Servicing and maintaining of automobile air conditioning components
- Preparing materials
- Proper handling of tools, equipment and instruments
- Tube processing
- Proper handling of refrigerant and refrigeration oil
- Recovery/recycling refrigerants

Required Knowledge

The individual needs to demonstrate knowledge of:

- Personal protective equipment
- Uses and handling of tools, equipment and instruments
- Safety signs and symbols
- Housekeeping
- Interpretation of manufactures manual
- Uses and specifications of refrigerants, refrigeration oil and refrigeration components
- Basic electronics
- Electrical principles
- Technical drawing
- Heat transfer
- Refrigeration principles
- Recovery/recycling process
- Compressor operations
- Applicable Legislations
- Air conditioning principles

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 Observed safe working practices 1.2 Interpreted manufacturers manuals 1.3 Selected materials, tools, equipment and instruments 1.4 Carried out troubleshooting 1.5 Tested components with faults 1.6 Carried out evacuation, recovery and recycling 1.7 Performed repairs 1.8 Carried out A/C unit recovery, recycling and evacuation 1.9 Carried out housekeeping 1.10 Carried out test-run of A/C unit 1.11 Handed over A/C unit to user 1.12 Prepared service report
2. Resource implications	The following resources must be provided: 2.1 Work place location and automobile A/C units 2.2 Tools, equipment and instruments for troubleshooting and repair 2.3 Materials relevant to the task 2.4 Manufacturers manual, specifications relevant to the task
3. Methods of assessment	Competency may be assessed through: 3.1 Demonstration 3.2 Direct observation with oral questioning 3.3 Written tests 3.4 Portfolio 3.5 Third party reports
4. Context for assessment	Competency may be assessed individually on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment or during industrial attachment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the sector, workplace and job role is recommended.

INSTALL, SERVICE AND REPAIR WINDOW TYPE AIR CONDITIONING UNITS

UNIT CODE: ENG/OS/RAC/CR/03/4/A

UNIT DESCRIPTION

This unit covers the competencies required to install, service and repair window type air conditioning units. It involves conducting site survey, installing, servicing, identifying and repairing faults in window type air conditioning units. It also entails carrying out refrigerant recovery, recycling and evacuation; charging, maintaining, test-running and commissioning serviced window type air conditioning unit.

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 site survey	1.1. Site conditions and installation requirements are assessed according to manufacturer's specifications 1.2. ***Tools, equipment*** and ***materials*** are determined according to installation requirements 1.3. Site survey report is prepared in accordance with work place procedures 1.4. Safety procedures are adhered to according to workplace procedures
2. Install air conditioning unit	2.1 Tools, equipment and materials are assembled according to workplace procedures 2.2 ***Air conditioning unit*** and components are prepared based on work place procedures 2.3 Air conditioning unit base is leveled and unit positioned in line with manufacturer's specifications 2.4 Air conditioning unit is installed according to work place procedures and manufacturer's specifications 2.5 Safe handling techniques are employed in line with manufacturer's specifications 2.6 Voltage and current are ascertained according to unit ratings.
3. Service air conditioning unit	3.1 Appropriate manuals are interpreted in line with the job requirements 3.2 Tools, equipment and materials are selected as per workplace procedures

	3.3 Safe working practices are observed throughout the task as per work place procedures 3.4 ***Air conditioning unit components*** are serviced according to manufacturer's specifications and workplace procedures 3.5 Temperature settings are performed according to user requirements 3.6 Air conditioning unit is handed over to user as per work place procedures 3.7 Task is completed in line with workplace procedures and environmental requirements
4. Identify and repair faults in air conditioning unit	4.1 Appropriate manuals are interpreted in line with the job requirements 4.2 Safe working practices are observed as per work place procedures 4.3 Tools, equipment and instruments are selected and used in line with job requirements 4.4 ***Air conditioning unit*** components are tested according to manufacturer's specifications 4.5 Faulty components are repaired or replaced in line with manufacturer's specifications 4.6 Air conditioning unit requiring recovery/recycling is identified 4.7 Refrigerant recovery/recycling is performed according to workplace procedures 4.8 Air conditioning unit is repaired according to workplace procedures 4.9 Housekeeping is performed 4.10 Task is completed in line with workplace procedures and ***environmental requirements***
5. Carry out refrigerant evacuation, recovery and recycling	5.1 Identified unit for evacuation and recovery 5.2 Observed health, safety and environmental requirements as per work place procedures 5.3 Identified necessary tools, equipment and instruments 5.4 Carried out refrigerant evacuation, recovery and recycling as per work place procedures 5.5 Carried out housekeeping 5.6 Task is completed in line with workplace procedures and environmental requirements
6. Carry out refrigerant charging	6.1 Identified air conditioning unit to be charged 6.2 Observed health and safety requirements as per work place

	procedures 6.3 Identified tools and equipment 6.4 Identified refrigerant as per the Air conditioning unit requirement 6.5 Carried out charging as per the Air conditioning unit requirement and work place procedures 6.6 Carried out housekeeping 6.7 Task is completed in line with workplace procedures and environmental requirements
7. Commission serviced air conditioning unit	7.1 Identified unit to be commissioned 7.2 Observed health, safety and environmental requirements as per work place procedures 7.3 Identified tools, equipment and instruments 7.4 Carried out unit test-running as per work place procedures 7.5 Operating parameters of the unit are confirmed as per work place procedures 7.6 Carried out housekeeping 7.7 Serviced unit is handed over to user as per work place procedures 7.8 Prepared service report as per work place procedures

RANGE

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

Variable	Range
1. Air conditioning unit may include but not limited to:	• window type
2. Tools, equipment and instruments	• Pliers • Screwdrivers • Hammers • Chisels • Spirit levels • Phase tester • Files • Fin combs • Brazing equipment • Multi-meter • Leak detector

	• System analyzer • Recovery/recycling unit • Weighing scale • Vacuum pump • Refrigerant identifier • Clamp on ammeter • Lokring tools • Flaring tools • Swaging tools • Mallets • Vices • Punches • Adjustable spanner • Wire brush • Tube bender • Tube cutter • Capillary cutter • Combination pressure gauge set • Micrometer gauge • Vernier caliper • Anemometer

3. ir conditioning unit components May include but not limited to:	• Electrical controls
	  ○ Thermostats
	  ○ Defrost heaters
	  ○ Relays
	  ○ Switches
	• Compressors
	• Fan motors
	• Capacitors
	• Electronic control cards
	• Overload protectors

4. nvironmental legislations may include but not limited to:	• Environmental Management Coordination Act • ISO standards on environment 140001
5. Materials may include but not limited to	• Insulators • Socket outlets

	• Conduits and trunkings • Refrigerants • Lubricating oil • Copper tubing

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Use of PPEs
- Interpreting manufacturers manual
- Preparing materials
- Handling of tools, equipment and instruments
- Tube processing
- Safe handling of refrigerants and lubricants
- Recovering/recycling refrigerants
- Brazing
- Installation of air conditioning units
- Troubleshooting
- Repairing of air conditioning units
- Servicing air conditioning units

Required Knowledge

The individual needs to demonstrate knowledge of:

- Personal protective equipment
- Uses and handling of tools, equipment and instruments
- Safety signs and symbols
- Housekeeping
- Interpretation of manufactures manual
- Uses and specifications of refrigerants, air conditioning oil and air conditioning components
- Basic electronics
- Electrical principles
- Technical drawing
- Heat transfer
- Air conditioning principles
- Recovery/recycling process
- Compressor operations

- Motor starters
- Motors protection
- Applicable Legislations

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 Adhered to safety procedures 1.2 Selected tools, equipment and materials 1.3 Diagnosed air conditioning unit faults 1.4 Recovered/recycled refrigerants 1.5 Repaired air conditioning unit 1.6 Tested air conditioning air conditioning unit 1.7 Performed housekeeping 1.8 Installed air conditioning air conditioning units 1.9 Prepared Air conditioning unit and components 1.10 Levelled and positioned Air conditioning unit base 1.11 Installed Air conditioning unit 1.12 Employed safe handling techniques 1.13 Ascertained voltage and current 1.14 Performed temperature settings 1.15 Serviced and maintained air conditioning air conditioning unit components 1.16 Interpreted manufacturers manuals 1.17 Observed safe working practices 1.18 Tested air conditioning air conditioning unit components 1.19 Repaired or replaced faulty components 1.20 Identified air conditioning air conditioning unit requiring recovery/recycling 1.21 Performed refrigerant recovery/recycling 1.22 Completed work correctly 1.23 Evacuated air conditioning unit 1.24 Observed health, safety and environmental requirement 1.25 Charged air conditioning unit 1.26 Identified relevant refrigerant 1.27 Carried out charging 1.28 Air conditioning unit is maintained in line with manufacturer's manuals

	1.29 Performed test-run on air conditioning unit 1.30 Commissioned and handed over air conditioning unit
2. Resource implications	The following resources must be provided: 2.1 Work place location and air conditioning units 2.2 Tools, equipment and instruments for installing maintaining servicing and repairing air conditioning units 2.3 Materials relevant to the task 2.4 Manufacturer's specifications and manuals relevant to the task
3. Methods of assessment	Competency may be assessed through: 3.1 Demonstration 3.2 Direct observation with oral questioning 3.3 Written tests 3.4 Portfolio 3.5 Third party reports
4. Context for assessment	Competency may be assessed individually on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment or during industrial attachment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the sector, workplace and job role is recommended.