



**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**REFRIGERATION AND AIR CONDITIONING CRAFTSPERSON**

**LEVEL 5**



**TVET CDACC**  
**P.O. BOX 15745-00100**  
**NAIROBI**

First published 2018  
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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](mailto:info@tvetcdacc.go.ke)**

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## **FOREWORD**

The provision of quality education and training is fundamental to the Government's overall strategy for social economic development. Quality education and training will contribute to achievement 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 (Sessional Paper No. 4 of 2016). A key feature of this policy is the radical change in the design and delivery of the TVET training. 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 5. 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 the Sessional Paper No. 4 of 2016 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for 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 labor 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 an Air conditioning and refrigeration Craftsperson level 5. These occupational standards will be the bases for development of competency based curriculum for Air conditioning and refrigeration level 5. 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.

My gratitude also goes to CAP Youth Empowerment Institute who cooperated with TVET CDACC in financing the development 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.

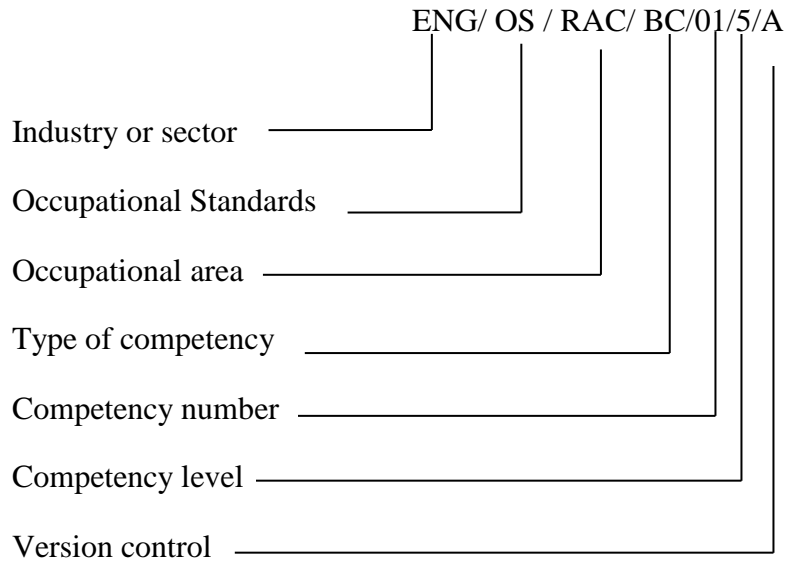
**CHAIRPERSON**  
**MECHANICAL ENGINEERING SECTOR SKILLS ADVISORY COMMITTEE**

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## ABBREVIATION AND ACRONYMS

BC	Basic Competency
CC	Common competency
CDACC	Curriculum Development, Assessment and Certification Council
CR	Core Competency
ENG	Engineering
KCSE	Kenya Certificate of secondary Education
KNQA	Kenya National Qualifications Authority
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 5 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 5 qualification include the following:

### Basic Units of Competency

Unit Code	Unit Title
ENG/OS/RAC/BC/01/5/A	Demonstrate communication skills
ENG/OS/RAC/BC/02/5/A	Demonstrate digital literacy
ENG/OS/RAC/BC/03/5/A	Demonstrate entrepreneurial skills
ENG/OS/RAC/BC/04/5/A	Demonstrate employability skills
ENG/OS/RAC/BC/05/5/A	Demonstrate environmental literacy
ENG/OS/RAC/BC/06/5/A	Demonstrate occupational safety and health practices

### Common Units of Competency

Unit Code	Unit Title
ENG/OS/RAC/CC/01/5/A	Perform workshop practice
ENG/OS/RAC/CC/02/5/A	Perform electrical installation
ENG/OS/RAC/CC/03/5/A	Apply engineering mathematics
ENG/OS/RAC/CC/04/5/A	Apply electrical principles
ENG/OS/RAC/CC/05/5/A	Prepare and interpret technical drawings

### Core Units of Competency

Unit Code	Unit Title
ENG/OS/RAC/CR/01/5/A	Install, service and repair refrigeration units
ENG/OS/RAC/CR/02/5/A	Install, service and repair air-conditioning units
ENG/OS/RAC/CR/03/5/A	Service and repair automobile air-conditioning units

## **BASIC COMPETENCIES**

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## DEMONSTRATE COMMUNICATION SKILLS

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

### UNIT DESCRIPTION

This unit covers the competencies required to demonstrate communication skills. It involves meeting communication needs of clients and colleagues, contributing to the development of communication strategies, conducting workplace interviews, facilitating group discussions and representing the organization

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Meet communication needs of clients and colleagues	1.1 Specific communication needs of clients and colleagues are identified and met based on workplace requirements 1.2 Different communication approaches are identified and applied according to clients' needs 1.3 Conflict is identified and addressed as per the standards of the organization
2. Contribute to the development of communication strategies	2.1 Strategies for internal and external dissemination of information are developed, promoted, implemented and reviewed as per organizations' strategic plan 2.2 Channels of communication are established and reviewed based on the workplace needs 2.3 Communication training needs are identified and provided according to SOPs 2.4 Work related network and relationship are maintained based on workplace requirements 2.5 Negotiation and conflict resolution strategies are maintained as per the workplace procedures
3. Conduct workplace interviews	3.1 <i><b>Communication strategies</b></i> are identified and employed in <i><b>interview situations</b></i> based on workplace requirements 3.2 Records of interviews are made and maintained in accordance with organizational procedures 3.3 Effective questioning, listening and nonverbal communication techniques are used based on needs
4. Facilitate group discussions	4.1 Mechanisms to enhance <i><b>effective group interaction</b></i> are identified and implemented according to workplace requirements

	<p>4.2 Strategies to encourage group participation are identified and used as per organizations' procedures</p> <p>4.3 Meetings objectives and agenda are set and followed based on workplace requirements</p> <p>4.4 Relevant information is provided and feedback obtained according to set protocols</p> <p>4.5 Evaluation of group communication strategies is undertaken in accordance with workplace guidelines</p> <p>4.6 Specific communication needs of individuals are identified and addressed as per individual needs</p>
5. Represent the organization	<p>5.1 Relevant presentation are researched and presented based on internal or external communication forums requirements Presentation is delivered in a clear and sequential manner as per the predetermined time</p> <p>5.2 Presentation is made as per appropriate media</p> <p>5.3 Difference views are respected based on workplace procedures</p> <p>5.4 Written communication is done as per organizational standards</p> <p>5.5 Inquiries are responded according to organizational standard</p>

## 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. Communication strategies may include but not limited to:	<ul style="list-style-type: none"> <li>• Language switch</li> <li>• Comprehension check</li> <li>• Repetition</li> <li>• Asking confirmation</li> <li>• Paraphrase</li> <li>• Clarification request</li> <li>• Translation</li> <li>• Restructuring</li> <li>• Approximation</li> <li>• Generalization</li> </ul>
2. Effective group interaction may include but not limited to:	<ul style="list-style-type: none"> <li>• Identifying and evaluating what is occurring within an interaction in a non-judgmental way</li> <li>• Using active listening</li> </ul>

	<ul style="list-style-type: none"> <li>• Making decision about appropriate words, behavior</li> <li>• Putting together response which is culturally appropriate</li> <li>• Expressing an individual perspective</li> <li>• Expressing own philosophy, ideology and background and exploring impact with relevance to communication</li> <li>• Openness and flexibility in communication</li> </ul>
3. Interview situations may include but not limited to:	<ul style="list-style-type: none"> <li>• Establishing rapport</li> <li>• Eliciting facts and information</li> <li>• Facilitating resolution of issues</li> <li>• Developing action plans</li> <li>• Diffusing potentially difficult situations</li> </ul>

### REQUIRED SKILLS AND KNOWLEDGE

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

#### Required Skills

The individual needs to demonstrate the following skills:

- Active listening
- Giving/receiving feedback
- Interpretation of information
- Role boundaries setting
- Negotiation
- Communication

#### Required Knowledge

The individual needs to demonstrate knowledge of:

- Communication process
- Dynamics of groups and different styles of group leadership
- Communication skills relevant to client groups
- Flexibility in communication

### 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	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Met communication needs of clients and colleagues</li> <li>1.2 Contributed to the development of communication strategies</li> <li>1.3 Conducted interviews</li> <li>1.4 Facilitated group discussions</li> <li>1.5 Represented the organization</li> </ul>
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 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
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.

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## DEMONSTRATE DIGITAL LITERACY

**UNIT CODE:** ENG/OS/RAC/BC/02/5/A

### UNIT DESCRIPTION

This unit covers the competencies required to demonstrate digital literacy. It involves identifying appropriate computer software and hardware, applying security measures to data, hardware, and software in automated environment, applying computer software in solving tasks, applying internet and email in communication at workplace, applying desktop publishing in official assignment and preparing presentation packages.

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Identify appropriate computer software and hardware	1.1 Concepts of ICT are determined in accordance with computer equipment 1.2 Classifications of computers are determined in accordance with manufacturers specification 1.3 <i><b>Appropriate computer software</b></i> is identified according to manufacturer's specification 1.4 <i><b>Appropriate computer hardware</b></i> is identified according to manufacturer's specification 1.5 Functions and commands of operating system are determined in accordance with manufacturer's specification
2. Apply security measures to data, hardware, software in automated environment	2.1 <i><b>Data security and privacy are classified</b></i> in accordance with the prevailing technology 2.2 <i><b>Security threats</b></i> are identified, <i><b>and control measures</b></i> are applied in accordance with laws governing protection of ICT 2.3 Computer threats and crimes are detected in accordance with 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 <i><b>Word processing concepts</b></i> are applied in resolving workplace tasks, report writing and documentation as per job requirements

	<p>3.2 <b>Word processing utilities</b> are applied in accordance with workplace procedures</p> <p>3.3 Worksheet layout is prepared in accordance with work procedures</p> <p>3.4 Worksheet is build and data manipulated in the worksheet in accordance with workplace procedures</p> <p>3.5 Continuous data manipulated on worksheet is undertaken in accordance with work requirements</p> <p>3.6 Database design and manipulation is undertaken in accordance with office procedures</p> <p>3.7 Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures</p>
4. Apply internet and email in communication at workplace	<p>4.1 Electronic mail addresses are opened and applied in workplace communication in accordance with office policy</p> <p>4.2 Office internet functions are defined and executed in accordance with office procedures</p> <p>4.3 <b>Network configuration</b> is determined in accordance with office operations procedures</p> <p>4.4 Official World Wide Web is installed and managed according to workplace procedures</p>
5. Apply desktop publishing in official assignments	<p>5.1 Desktop publishing functions and tools are identified in accordance with manufactures specifications</p> <p>5.2 Desktop publishing tools are developed in accordance with work requirements</p> <p>5.3 Desktop publishing tools are applied in accordance with workplace requirements</p> <p>5.4 Typeset work is enhanced in accordance with workplace standards</p>
6. Prepare presentation packages	<p>6.1 Types of presentation packages are identified in accordance with office requirements</p> <p>6.2 Slides are created and formulated in accordance with workplace procedures</p> <p>6.3 Slides are edited and run in accordance with work procedures</p> <p>6.4 Slides and handouts are printed according to work requirements</p>



## 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. Appropriate computer hardware may include but not limited to:	<ul style="list-style-type: none"><li>• Computer case</li><li>• Monitor</li><li>• keyboard</li><li>• mouse</li></ul>
2. Data security and privacy may include but not limited to:	<ul style="list-style-type: none"><li>• Confidentiality of data</li><li>• Cloud computing</li><li>• Integrity -but-curious data surfing</li></ul>
3. Security and control measures may include but not limited to:	<ul style="list-style-type: none"><li>• Counter measures against cyber terrorism</li><li>• Risk reduction</li><li>• Cyber threat issues</li><li>• Risk management</li><li>• Pass wording</li></ul>
4. Security threats may include but not limited to:	<ul style="list-style-type: none"><li>• Cyber terrorism</li><li>• Hacking</li></ul>

## REQUIRED SKILLS AND KNOWLEDGE

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

### Required Skills

The individual needs to demonstrate the following skills:

- Analytical skills
- Interpretation
- Typing
- Communication
- Basic ICT skills

### Required Knowledge

The individual needs to demonstrate knowledge of:

- Software concept
- Functions of computer software and hardware
- Data security and privacy
- Computer security threats and control measures
- Technology underlying cyber-attacks and networks

- Cyber terrorism
- Computer crimes
- Detection and protection of computer crimes
- Laws governing protection of ICT
- Microsoft suite

## EVIDENCE GUIDE

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

<p>1. Critical Aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Identified and controlled security threats</li> <li>1.2 Detected and protected computer crimes</li> <li>1.3 Applied word processing in office tasks</li> <li>1.4 Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures</li> <li>1.5 Opened electronic mail for office communication as per workplace procedure</li> <li>1.6 Installed internet and World Wide Web for office tasks in accordance with office procedures</li> <li>1.7 Integrated emerging issues in computer ICT applications</li> <li>1.8 Applied laws governing protection of ICT</li> </ul>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1 Tablets</li> <li>2.2 Laptops</li> <li>2.3 Desktop computers</li> <li>2.4 Calculators</li> <li>2.5 Internet</li> <li>2.6 Smart phones</li> <li>2.7 Operation Manuals</li> </ul>
<p>3. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>3.1 Written Test</li> <li>3.2 Observation</li> <li>3.3 Practical assignment</li> <li>3.4 Interview/Oral Questioning</li> </ul>
<p>4. Context of Assessment</p>	<p>Competency may be assessed in:</p> <ul style="list-style-type: none"> <li>4.1 Off the job</li> <li>4.2 On the job setting</li> <li>4.3 Industrial attachment</li> </ul>
<p>5. Guidance information for assessment</p>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

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## DEMONSTRATE ENTREPRENEURIAL SKILLS

**UNIT CODE :** ENG/OS/RAC/BC/03/5/A

### UNIT DESCRIPTION

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship, and self-employment, identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation, developing business innovative strategies and developing business plan.

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
<p>These describe the key outcomes which make up workplace function</p>	<p>These are assessable statements that specify the required level of performance for each of the elements.</p> <p><b><i>Bold and italicized terms are elaborated in the Range</i></b></p>
<p>1. Demonstrate understanding of an Entrepreneur</p>	<p>1.1 Entrepreneurs and Businesspersons are distinguished as per principles of entrepreneurship</p> <p>1.2 <b><i>Types of entrepreneurs</i></b> are identified as per principles of entrepreneurship</p> <p>1.3 Ways of becoming an Entrepreneur are identified as per principles of Entrepreneurship</p> <p>1.4 <b><i>Characteristics of Entrepreneurs</i></b> are identified as per principles of Entrepreneurship</p> <p>1.5 Factors affecting Entrepreneurship development are explored as per principles of Entrepreneurship</p>
<p>2. Demonstrate understanding of Entrepreneurship and self-employment</p>	<p>2.1 Entrepreneurship and self-employment are distinguished as per principles of entrepreneurship</p> <p>2.2 Importance of self-employment is analysed based on business procedures and strategies</p> <p>2.3 <b><i>Requirements for entry into self-employment</i></b> are identified according to business procedures and strategies</p> <p>2.4 Role of an Entrepreneur in business is determined according to business procedures and strategies</p> <p>2.5 Contributions of Entrepreneurs to National</p>

	<p>development are identified as per business procedures and strategies</p> <p>2.6 Entrepreneurship culture in Kenya is explored as per business procedures and strategies</p> <p>2.7 Born or made Entrepreneurs are distinguished as per entrepreneurial traits</p>
3. Identify Entrepreneurship opportunities	<p>3.1 Sources of business ideas are identified as per business procedures and strategies</p> <p>3.2 Business ideas and opportunities are generated as per business procedures and strategies</p> <p>3.3 Business life cycle is analysed as per business procedures and strategies</p> <p>3.4 Legal aspects of business are identified as per procedures and strategies</p> <p>3.5 Product demand is assessed as per market strategies</p> <p>3.6 Types of <b>business environment</b> are identified and evaluated as per business procedures</p> <p>3.7 Factors to consider when evaluating business environment are explored based on business procedure and strategies</p> <p>3.8 Technology in business is incorporated as per best practice</p>
4. Create entrepreneurial awareness	<p>4.1 <b>Forms of businesses</b> are explored as per business procedures and strategies</p> <p>4.2 Sources of business finance are identified as per business procedures and strategies</p> <p>4.3 Factors in selecting source of business finance are identified as per business procedures and strategies</p> <p>4.4 <b>Governing policies</b> on Small Scale Enterprises (SSEs) are determined as per business procedures and strategies</p> <p>4.5 Problems of starting and operating SSEs are explored as per business procedures and strategies</p>
5. Apply entrepreneurial motivation	<p>5.1 <b>Internal and external motivation</b> factors are determined in accordance with motivational theories</p> <p>5.2 Self-assessment is carried out as per</p>

	<p>entrepreneurial orientation</p> <p>5.3 Effective communications are carried out in accordance with communication principles</p> <p>5.4 Entrepreneurial motivation is applied as per motivational theories</p>
6. Develop innovative business strategies	<p>6.1 Business innovation strategies are determined in accordance with the organization strategies</p> <p>6.2 Creativity in business development is demonstrated in accordance with business strategies</p> <p>6.3 <b>Innovative business strategies</b> are developed as per business principles</p> <p>6.4 Linkages with other entrepreneurs are created as per best practice</p> <p>6.5 ICT is incorporated in business growth and development as per best practice</p>
7. Develop Business Plan	<p>7.1 Identified Business is described as per business procedures and strategies</p> <p>7.2 Marketing plan is developed as per business plan format</p> <p>7.3 Organizational/Management plan is prepared in accordance with business plan format</p> <p>7.4 Production/operation plan in accordance with business plan format</p> <p>7.5 Financial plan is prepared in accordance with the business plan format</p> <p>7.6 Executive summary is prepared in accordance with business plan format</p> <p>7.7 Business plan is presented as per best practice</p>

### 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. Types of entrepreneurs may include but not limited to:	<ul style="list-style-type: none"> <li>• Innovators</li> <li>• Imitators</li> <li>• Craft</li> <li>• Opportunistic</li> <li>• Speculators</li> </ul>
2. Characteristics of Entrepreneurs	<ul style="list-style-type: none"> <li>• Creative</li> </ul>

may include but not limited to:	<ul style="list-style-type: none"> <li>• Innovative</li> <li>• Planner</li> <li>• Risk taker</li> <li>• Networker</li> <li>• Confident</li> <li>• Flexible</li> <li>• Persistent</li> <li>• Patient</li> <li>• Independent</li> <li>• Future oriented</li> <li>• Goal oriented</li> </ul>
3. Requirements for entry into self-employment may include but not limited to	<ul style="list-style-type: none"> <li>• Technical skills</li> <li>• Management skills</li> <li>• Entrepreneurial skills</li> <li>• Resources</li> <li>• Infrastructure</li> </ul>
4. Internal and external motivation may include but not limited to:	<ul style="list-style-type: none"> <li>• Interest</li> <li>• Passion</li> <li>• Freedom</li> <li>• Prestige</li> <li>• Rewards</li> <li>• Punishment</li> <li>• Enabling environment</li> <li>• Government policies</li> </ul>
5. Business environment may include but not limited to:	<ul style="list-style-type: none"> <li>• External</li> <li>• Internal</li> <li>• Intermediate</li> </ul>
6. Forms of businesses may include but not limited to:	<ul style="list-style-type: none"> <li>• Sole proprietorship</li> <li>• Partnership</li> <li>• Limited companies</li> <li>• Cooperatives</li> </ul>
7. Governing policies may include but not limited to:	<ul style="list-style-type: none"> <li>• Increasing scope for finance</li> <li>• Promoting cooperation between entrepreneurs and private sector</li> <li>• Reducing regulatory burden on entrepreneurs</li> <li>• Developing IT tools for entrepreneurs</li> </ul>
8. Innovative business strategies may include but not limited to:	<ul style="list-style-type: none"> <li>• New products</li> </ul>

	<ul style="list-style-type: none"> <li>• New methods of production</li> <li>• New markets</li> <li>• New sources of supplies</li> <li>• Change in industrialization</li> </ul>
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## REQUIRED SKILLS AND KNOWLEDGE

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

### Required Skills

The individual needs to demonstrate the following skills:

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

### Required Knowledge

The individual needs to demonstrate knowledge of:

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



- Government and regulatory processes
- Local and international business environment
- Relevant developments in other industries
- Regional/ County business expansion strategies

## EVIDENCE GUIDE

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

<p>1. Critical Aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Distinguished entrepreneurs and business persons correctly</li> <li>1.2 Identified ways of becoming an entrepreneur appropriately</li> <li>1.3 Explored factors affecting entrepreneurship development appropriately</li> <li>1.4 Analysed importance of self-employment accurately</li> <li>1.5 Identified requirements for entry into self-employment correctly</li> <li>1.6 Identified sources of business ideas correctly</li> <li>1.7 Generated Business ideas and opportunities correctly</li> <li>1.8 Analysed business life cycle accurately</li> <li>1.9 Identified legal aspects of business correctly</li> <li>1.10 Assessed product demand accurately</li> <li>1.11 Determined Internal and external motivation factors appropriately</li> <li>1.12 Carried out communications effectively</li> <li>1.13 Identified sources of business finance correctly</li> <li>1.14 Determined Governing policy on small scale enterprise appropriately</li> <li>1.15 Explored problems of starting and operating SSEs effectively</li> <li>1.16 Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly</li> <li>1.17 Prepared executive summary correctly</li> <li>1.18 Determined business innovative strategies appropriately</li> <li>1.19 Presented business plan effectively</li> </ul>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1 Access to relevant workplace where assessment can take place</li> <li>2.2 Appropriately simulated environment where assessment can take place</li> </ul>
<p>3. Methods of</p>	<p>Competency may be assessed through:</p>

Assessment	<ul style="list-style-type: none"> <li>3.1 Written tests</li> <li>3.2 Oral questions</li> <li>3.3 Third party report</li> <li>3.4 Interviews</li> <li>3.5 Portfolio</li> </ul>
4. Context of Assessment	<p>Competency may be assessed:</p> <ul style="list-style-type: none"> <li>4.1 On-the-job</li> <li>4.2 Off-the –job</li> <li>4.3 During Industrial attachment</li> </ul>
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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## DEMONSTRATE EMPLOYABILITY SKILLS

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

### UNIT DESCRIPTION

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading small teams, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing workplace ethics.

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
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 interpersonal communication	2.1 Writing skills are demonstrated as per communication policy 2.2 Negotiation and persuasion skills are demonstrated as per communication policy 2.3 Internal and external stakeholders' needs are identified and interpreted as per the communication policy 2.4 Communication networks are established based on workplace policy 2.5 Information is shared as per communication policy

<p>3. Demonstrate critical safe work habits</p>	<p>3.1 Stress is managed in accordance with workplace policy.</p> <p>3.2 Punctuality and time consciousness is demonstrated in line with workplace policy.</p> <p>3.3 Personal objectives are integrated with organization goals based on organization’s strategic plan.</p> <p>3.4 <b>Resources</b> are utilized in accordance with workplace policy.</p> <p>3.5 Work priorities are set in accordance to workplace goals and objectives.</p> <p>3.6 Leisure time is recognized and utilized in line with personal objectives.</p> <p>3.7 <b>Drugs and substances of abuse</b> are identified and avoided based on workplace policy.</p> <p>3.8 HIV and AIDS prevention awareness is demonstrated in line with workplace policy.</p> <p>3.9 Safety consciousness is demonstrated in the workplace based on organization safety policy.</p> <p>3.10 <b>Emerging issues</b> are identified and dealt with in accordance with organization policy.</p>
<p>4. Lead small teams</p>	<p>4.1 Performance targets for the <b>team</b> are set based on organization’s objectives</p> <p>4.2 Duties are assigned in accordance with the organization policy.</p> <p>4.3 <b>Forms of communication</b> in a team are established according to organization’s policy.</p> <p>4.4 Team performance is evaluated based on set targets as per workplace policy.</p> <p>4.5 Conflicts are resolved between team members in line with organization policy.</p> <p>4.6 Gender related issues are identified and mainstreamed in accordance workplace policy.</p> <p>4.7 Human rights and fundamental freedoms are identified and respected as Constitution of Kenya 2010.</p> <p>4.8 Healthy relationships are developed and maintained in line with workplace.</p>
<p>5. Plan and organize work</p>	<p>5.1 Task requirements are identified as per the workplace objectives</p> <p>5.2 Task is interpreted in accordance with safety (OHS), environmental requirements and quality requirements</p> <p>5.3 Work activity is organized with other involved personnel as per the SOPs</p>

	<p>5.4 Resources are mobilized, allocated and utilized to meet project goals and deliverables.</p> <p>5.5 Work activities are monitored and evaluated in line with organization procedures.</p> <p>5.6 Job planning is documented in accordance with workplace requirements.</p> <p>5.7 Time is managed achieve workplace set goals and objectives.</p>
6. Maintain professional growth and development	<p>6.1 Personal training needs are identified and assessed in line with the requirements of the job.</p> <p>6.2 <b>Training and career opportunities</b> are identified and utilized based on job requirements.</p> <p>6.3 Resources for training are mobilized and allocated based organizations and individual skills needs.</p> <p>6.4 Licensees and certifications relevant to job and career are obtained and renewed as per policy.</p> <p>6.5 Work priorities and personal commitments are balanced and managed based on requirements of the job and personal objectives.</p> <p>6.6 Recognitions are sought as proof of career advancement in line with professional requirements.</p>
7. Demonstrate workplace learning	<p>7.1 Learning opportunities are sought and managed based on job requirement and organization policy.</p> <p>7.2 Improvement in performance is demonstrated based on courses attended.</p> <p>7.3 Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job</p> <p>7.4 Time and effort is invested in learning new skills based on job requirements</p> <p>7.5 Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy.</p> <p>7.6 New systems are developed and maintained in accordance with the requirements of the job.</p> <p>7.7 Awareness of personal role in workplace <b>innovation</b> is demonstrated based on requirements of the job.</p>
8. Demonstrate problem solving skills	<p>8.1 Creative, innovative and practical solutions are developed based on the problem</p> <p>8.2 Independence and initiative in identifying and solving problems is demonstrated based on requirements of the job.</p> <p>8.3 Team problems are solved as per the workplace guidelines</p> <p>8.4 Problem solving strategies are applied as per the workplace</p>

	<p>guidelines</p> <p>8.5 Problems are analysed and assumptions tested as per the context of data and circumstances</p>
9. Demonstrate workplace ethics	<p>9.1 Policies and guidelines are observed as per the workplace requirements</p> <p>9.2 Self-worth and professionalism is exercised in line with personal goals and organizational policies</p> <p>9.3 Code of conduct is observed as per the workplace requirements</p> <p>9.4 Integrity is demonstrated as per legal requirement</p>

### 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. Drug and substance abuse may include but not limited to:	<p>Commonly abused</p> <ul style="list-style-type: none"> <li>• Alcohol</li> <li>• Tobacco</li> <li>• Miraa</li> <li>• Over-the-counter drugs</li> <li>• Cocaine</li> <li>• Bhang</li> <li>• Glue</li> </ul>
2. Feedback may include but not limited to:	<ul style="list-style-type: none"> <li>• Verbal</li> <li>• Written</li> <li>• Informal</li> <li>• Formal</li> </ul>
3. Relationships may include but not limited to:	<ul style="list-style-type: none"> <li>• Man/Woman</li> <li>• Trainer/trainee</li> <li>• Employee/employer</li> <li>• Client/service provider</li> <li>• Husband/wife</li> <li>• Boy/girl</li> <li>• Parent/child</li> <li>• Sibling relationships</li> </ul>
4. Forms of communication may include but not limited to:	<ul style="list-style-type: none"> <li>• Written</li> <li>• Visual</li> <li>• Verbal</li> </ul>

	<ul style="list-style-type: none"> <li>• Non verbal</li> <li>• Formal and informal</li> </ul>
5. Team may include but not limited to:	<ul style="list-style-type: none"> <li>• Small work group</li> <li>• Staff in a section/department</li> <li>• Inter-agency group</li> </ul>
6. Personal growth may include but not limited to:	<ul style="list-style-type: none"> <li>• Growth in the job</li> <li>• Career mobility</li> <li>• Gains and exposure the job gives</li> <li>• Net workings</li> <li>• Benefits that accrue to the individual as a result of noteworthy performance</li> </ul>
7. Personal objectives may include but not limited to:	<ul style="list-style-type: none"> <li>• Long term</li> <li>• Short term</li> <li>• Broad</li> <li>• Specific</li> </ul>
8. Trainings and career opportunities may include but not limited to	<ul style="list-style-type: none"> <li>• Participation in training programs</li> <li>• Technical</li> <li>• Supervisory</li> <li>• Managerial</li> <li>• Continuing Education</li> <li>• Serving as Resource Persons in conferences and workshops</li> </ul>
9. Resource may include but not limited to:	<ul style="list-style-type: none"> <li>• Human</li> <li>• Financial</li> <li>• Hardware</li> <li>• Software</li> </ul>
10. Innovation may include but not limited to:	<ul style="list-style-type: none"> <li>• New ideas</li> <li>• Original ideas</li> <li>• Different ideas</li> <li>• Methods/procedures</li> <li>• Processes</li> <li>• New tools</li> </ul>
11. Emerging issues may include but not limited to:	<ul style="list-style-type: none"> <li>• Terrorism</li> <li>• Social media</li> <li>• National cohesion</li> <li>• Open offices</li> </ul>
12. Range of media for learning may include but not limited	<ul style="list-style-type: none"> <li>• Mentoring</li> </ul>

to:	<ul style="list-style-type: none"> <li>• peer support and networking</li> <li>• IT and courses</li> </ul>
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## **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
- Critical thinking
- Observation
- Organizing
- Negotiation
- Monitoring
- Evaluation
- Record keeping
- Problem solving
- Decision Making
- Resource utilization
- Resource mobilization

### **Required Knowledge**

The individual needs to demonstrate knowledge of:

- Work values and ethics
- Company policies
- Company operations, procedures and standards
- Occupational Health and safety procedures
- Fundamental rights at work
- Personal hygiene practices
- Workplace communication
- Concept of time
- Time management
- Decision making
- Types of resources
- Work planning
- Resources and allocating resources
- Organizing work
- Monitoring and evaluation
- Record keeping
- Workplace problems and how to deal with them



- Gender mainstreaming
- HIV and AIDS
- Drug and substance abuse
- Leadership
- 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	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Conducted self-management</li> <li>1.2 Demonstrated interpersonal communication</li> <li>1.3 Demonstrated critical safe work habits</li> <li>1.4 Led small teams</li> <li>1.5 Planned and organized work</li> <li>1.6 Maintained professional growth and development</li> <li>1.7 Demonstrated workplace learning</li> <li>1.8 Demonstrated problem solving skills</li> <li>1.9 Demonstrated workplace ethics</li> </ul>
2. Resource Implications	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1 Access to relevant workplace where assessment can take place</li> <li>2.2 Appropriately simulated environment where assessment can take place</li> </ul>
3. Methods of Assessment	<p>Competency in this unit may be assessed through:</p> <ul style="list-style-type: none"> <li>3.1 Oral questioning</li> <li>3.2 Portfolio of evidence</li> <li>3.3 Third Party Reports</li> <li>3.4 Written tests</li> </ul>
4. Context of Assessment	<p>Competency may be assessed:</p> <ul style="list-style-type: none"> <li>4.1 On-the-job</li> <li>4.2 Off-the –job</li> <li>4.3 During Industrial attachment</li> </ul>
5. Guidance	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

information assessment	for	
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## DEMONSTRATE ENVIRONMENTAL LITERACY

**UNIT CODE:** ENG/OS/RAC/BC/05/5/A

### UNIT DESCRIPTION

This unit describes the competencies required to demonstrate understanding of environmental literacy. It involves controlling environmental hazard, controlling control environmental pollution, complying with workplace sustainable resource use, evaluating current practices in relation to resource usage, identifying environmental legislations/conventions for environmental concerns, implementing specific environmental programs and monitoring activities on environmental protection/programs.

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
These describe the key outcomes that make up workplace function.	These assessable statements specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Control environmental hazard	1.1 <i><b>Storage methods</b></i> for environmentally <i><b>hazardous</b></i> materials are strictly followed according to environmental regulations and OSHS. 1.2 <i><b>Disposal methods</b></i> of hazardous wastes are followed always according to environmental regulations and OSHS. 1.3 <i><b>PPE</b></i> is used according to OSHS.
2. Control environmental Pollution control	2.1 Environmental pollution <i><b>control measures</b></i> are compiled following standard protocol. 2.2 Procedures for solid waste management are observed according to Environmental Management and Coordination Act 1999 2.3 Methods for minimizing <i><b>noise pollution</b></i> is complied with based on Noise and Excessive Vibration <i><b>Pollution and Control Regulations, 2009</b></i>
3. Demonstrate sustainable resource use	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 and reducing resource consumption are practiced as per the Environmental Management and Coordination Act 1999
4. Evaluate current practices in relation to resource usage	4.1 Information on resource efficiency <i><b>systems and procedures</b></i> are collected and provided to the work group where appropriate. 4.2 Current resource usage is measured and recorded by members of the work group.

	<p>4.3 Current purchasing strategies are analyzed and recorded according to industry procedures.</p> <p>4.4 Current work processes to access information and data is analyzed following enterprise protocol.</p>
5. Identify Environmental legislations/conventions for environmental concerns	<p>5.1 Environmental <i>legislations/conventions</i> and local ordinances are identified according to the different <i>environmental aspects/impact</i></p> <p>5.2 <i>Industrial standard/environmental practices</i> are described according to the different environmental concerns</p>
6. Implement specific environmental programs	<p>6.1 Programs/Activities are identified according to organizations policies and guidelines.</p> <p>6.2 Individual roles/responsibilities are determined and performed based on the activities identified.</p> <p>6.3 Problems/constraints encountered are resolved in accordance with organizations' policies and guidelines</p> <p>6.4 Stakeholders are consulted based on company guidelines</p>
7. Monitor activities on Environmental protection/Programs	<p>7.1 Activities are periodically monitored and evaluated according to the objectives of the environmental Program</p> <p>7.2 Feedback from stakeholders are gathered and considered in proposing enhancements to the program based on consultations</p> <p>7.3 Data gathered are analyzed based on evaluation requirements</p> <p>7.4 Recommendations are submitted based on the findings</p> <p>7.5 Management support systems are set/established to sustain and enhance the program</p> <p>7.6 Environmental incidents are monitored and reported to concerned/proper authorities</p>

### 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
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1. PPE may include but not limited to:	<ul style="list-style-type: none"> <li>• Mask</li> <li>• Gloves</li> <li>• Goggles</li> <li>• Safety hat</li> <li>• Overall</li> <li>• Hearing protector</li> <li>• Safety boots</li> </ul>
2. Environmental pollution control measures may include but not limited to:	<ul style="list-style-type: none"> <li>• Methods for minimizing or stopping spread and ingestion of airborne particles</li> <li>• Methods for minimizing or stopping spread and ingestion of gases and fumes</li> <li>• Methods for minimizing or stopping spread and ingestion of liquid wastes</li> </ul>
3. Waste management procedures may include but not limited to:	<ul style="list-style-type: none"> <li>• Sorting</li> <li>• Storing of items</li> <li>• Recycling of items</li> <li>• Disposal of items</li> </ul>
4. Resources may include but not limited to:	<ul style="list-style-type: none"> <li>• Electric</li> <li>• Water</li> <li>• Fuel</li> <li>• Telecommunications</li> <li>• Supplies</li> <li>• Materials</li> </ul>
5. Workplace environmental hazards may include but not limited to:	<ul style="list-style-type: none"> <li>• Biological hazards</li> <li>• Chemical and dust hazards</li> <li>• Physical hazards</li> </ul>
6. Organizational systems and procedures may include but not limited to:	<ul style="list-style-type: none"> <li>• Supply chain, procurement and purchasing</li> <li>• Quality assurance</li> <li>• Making recommendations and seeking approvals</li> </ul>

## 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:

- Observation
- Measuring
- Writing

- Communication
- Analytical
- Monitoring
- Evaluation

### **Required Knowledge**

The individual needs to demonstrate knowledge of:

- Storage methods of environmentally hazardous materials
- Disposal methods of hazardous wastes
- Usage of PPE Environmental regulations
- OSHS
- Types of pollution
- Environmental pollution control measures
- Different solid wastes
- Solid waste management
- Different noise pollution
- Methods of minimizing noise pollution
- Solid Waste Act
- Methods of minimizing wastage
- Waste management procedures
- Economizing of resource consumption
- 3Rs principle
- Types of resources
- Techniques in measuring current usage of resources
- Calculating current usage of resources
- Types of workplace environmental hazards
- Environmental regulations
- Environmental regulations applying to the enterprise.
- Measurement and recording of current resource usage
- Analysis current work processes to access information and data Analysis of data and information
- Identification of areas for improvement
- Resource consuming processes
- Determination of quantity and nature of resource consumed
- Analysis of resource flow of different parts of the resource flow process
- Use/conversion of resources
- Causes of low efficiency of use
- Increasing the efficiency of resource use
- Inspection of resource use plans

- Regulations/licensing requirements
- Determine benefit/cost for alternative resource sources
- Benefit/costs for different alternatives
- Components of proposals
- Criteria on ranking proposals
- Regulatory requirements
- Proposals for improving resource efficiency
- Implementation of resource efficiency plans
- Procedures in monitor implementation
- Adjustments of implementation plan
- Inspection of new resource usage

## EVIDENCE GUIDE

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

<p>1. Critical Aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Controlled environmental hazard</li> <li>1.2 Controlled environmental pollution</li> <li>1.3 Demonstrated sustainable resource use</li> <li>1.4 Evaluated current practices in relation to resource usage</li> <li>1.5 Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns.</li> <li>1.6 Described industrial standard environmental practices according to the different environmental issues/concerns.</li> <li>1.7 Resolved problems/ constraints encountered based on management standard procedures</li> <li>1.8 Implemented and monitored environmental practices on a periodic basis as per company guidelines</li> <li>1.9 Recommended solutions for the improvement of the Program</li> <li>1.10 Monitored and reported to proper authorities any environmental incidents</li> </ul>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1 Workplace with storage facilities</li> <li>2.2 Tools, materials and equipment relevant to the tasks (ex. Cleaning tools, cleaning materials, trash bags, etc.)</li> <li>2.3 PPE</li> <li>2.4 Manuals and references</li> <li>2.5 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection</li> </ul>

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

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## DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENG/OS/RAC/BC/06/5/A

### UNIT DESCRIPTION

This unit specifies the competencies required to identify workplace hazards and risk, identify and implement appropriate control measures and implement OSH programs, procedures and policies/guidelines

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Identify workplace hazards and risk	1.1 <i><b>Hazards</b></i> in the workplace are identified <i><b>based their indicators</b></i> 1.2 Risks and hazards are evaluated based on legal requirements. 1.3 <i><b>OSH concerns</b></i> raised by workers are addressed as per legal requirements.
2. Control OSH hazards	2.1 Hazard prevention <i><b>and control measures</b></i> are implemented as per legal requirement. 2.2 Risk assessment is conducted and a risk matrix developed based on likely impact. 2.3 <i><b>Contingency measures</b></i> , including <i><b>emergency procedures</b></i> during workplace <i><b>incidents and emergencies</b></i> are recognized and established in accordance with organization procedures.
3. Implement OSH programs	3.1 Company OSH program are identified, evaluated and reviewed based on legal requirements. 3.2 Company OSH programs are implemented as per legal requirements. 3.3 Workers are capacity built on OSH standards and procedures as per legal requirements 3.4 <i><b>OSH-related records</b></i> are maintained as per legal 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.

<b>Variable</b>	<b>Range</b>
1. Hazards may include but are not limited to:	<ul style="list-style-type: none"> <li>• Physical hazards</li> <li>• Biological hazards</li> <li>• Chemical hazards</li> <li>• Ergonomics</li> <li>• Psychological factors</li> <li>• Physiological factors</li> <li>• Safety hazards</li> <li>• Unsafe workers' act</li> </ul>
2. Indicators may include but are not limited to:	<ul style="list-style-type: none"> <li>• Increased of incidents of accidents, injuries</li> <li>• Increased occurrence of sickness or health complaints/symptoms</li> <li>• Common complaints of workers related to OSH</li> <li>• High absenteeism for work-related reasons</li> </ul>
3. Evaluation and/or work environment measurements may include but are not limited to:	<ul style="list-style-type: none"> <li>• Health Audit</li> <li>• Safety Audit</li> <li>• Work Safety and Health Evaluation</li> <li>• Work Environment Measurements of Physical and Chemical Hazards</li> </ul>
4. OSH issues and/or concerns may include but are not limited to:	<ul style="list-style-type: none"> <li>• Workers' experience/observance on presence of work hazards</li> <li>• Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks)</li> <li>• Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines</li> </ul>
5. Prevention and control measures may include but are not limited to:	<ul style="list-style-type: none"> <li>• Eliminate the hazard</li> <li>• Isolate the hazard</li> <li>• Substitute the hazard with a safer alternative</li> <li>• Use administrative controls to reduce the risk</li> <li>• Use engineering controls to reduce the risk</li> <li>• Use personal protective equipment</li> <li>• Safety, Health and Work Environment Evaluation</li> <li>• Periodic and/or special medical examinations of workers</li> </ul>

<p>6. Safety gears /PPE (Personal Protective Equipment's) may include but are not limited to:</p>	<ul style="list-style-type: none"> <li>• Arm/Hand guard, gloves</li> <li>• Eye protection (goggles, shield)</li> <li>• Hearing protection (ear muffs, ear plugs)</li> <li>• Hair Net/cap/bonnet</li> <li>• Hard hat</li> <li>• Face protection (mask, shield)</li> <li>• Apron/Gown/coverall/jump suit</li> <li>• Anti-static suits</li> <li>• High-visibility reflective vest</li> </ul>
<p>7. Appropriate risk controls</p>	<ul style="list-style-type: none"> <li>• Eliminate the hazard altogether</li> <li>• Isolate the hazard from anyone who could be harmed</li> <li>• Substitute the hazard with a safer alternative</li> <li>• Use administrative controls to reduce the risk</li> <li>• Use engineering controls to reduce the risk</li> <li>• Use personal protective equipment</li> </ul>
<p>8. Contingency measures may include but are not limited to:</p>	<ul style="list-style-type: none"> <li>• Evacuation</li> <li>• Isolation</li> <li>• Decontamination</li> <li>• Emergency personnel</li> </ul>
<p>9. Emergency procedures may include but are not limited to:</p>	<ul style="list-style-type: none"> <li>• Fire drill</li> <li>• Earthquake drill</li> <li>• Basic life support/CPR</li> <li>• First aid</li> <li>• Spillage control</li> <li>• Decontamination of chemical and toxic</li> <li>• Disaster preparedness/management</li> <li>• Set of fire-extinguisher</li> </ul>
<p>10. Incidents and emergencies may include but are not limited to:</p>	<ul style="list-style-type: none"> <li>• Chemical spills</li> <li>• Equipment/vehicle accidents</li> <li>• Explosion</li> <li>• Fire</li> <li>• Gas leak</li> <li>• Injury to personnel</li> <li>• Structural collapse</li> <li>• Toxic and/or flammable vapors emission.</li> </ul>

11. OSH-related Records may include but are not limited to:	<ul style="list-style-type: none"> <li>• Medical/Health records</li> <li>• Incident/accident reports</li> <li>• Sickness notifications/sick leave application</li> <li>• OSH-related trainings obtained</li> </ul>
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### 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
- Presentation
- Risk assessment
- Evaluation
- Critical thinking
- Problem solving
- Negotiation

#### Required Knowledge

The individual needs to demonstrate knowledge of:

- General OSH Principles
- Occupational hazards/risks recognition
- OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM)
- National OSH regulations; company OSH policies and protocols
- Systematic gathering of OSH issues and concerns
- General OSH principles
- National OSH regulations
- Company OSH and recording protocols, procedures and policies/guidelines
- Training and/or counselling methodologies and strategies

### EVIDENCE GUIDE

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

1. Critical Aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Identified hazards in the workplace based their indicators</li> <li>1.2 Evaluated workplace hazards based on legal requirements.</li> <li>1.3 Addressed OSH concerns raised by workers as per legal requirements.</li> <li>1.4 Implemented hazard prevention and control measures as per legal requirement.</li> </ul>
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		<p>1.5 Conducted risk assessment as per legal requirement.</p> <p>1.6 Developed risk matrix based on likely impact.</p> <p>1.7 Recognized and established contingency measures in accordance with organization procedures.</p> <p>1.8 Identified, evaluated and reviewed company OSH program based on legal requirements.</p> <p>1.9 Implemented company OSH programs as per legal requirements.</p> <p>1.10 Capacity built workers on OSH standards and procedures as per legal requirements</p> <p>1.11 Maintained OSH-related records as per legal requirements.</p>
2. Resource Implications		<p>The following resources should be provided:</p> <p>2.1 Access to relevant workplace where assessment can take place</p> <p>2.2 Appropriately simulated environment where assessment can take place</p>
3. Methods of Assessment	of	<p>Competency in this unit may be assessed through:</p> <p>3.1 Observation</p> <p>3.2 Oral questioning</p> <p>3.3 Written test</p> <p>3.4 Portfolio of Evidence</p> <p>3.5 Interview</p> <p>3.6 Third party report</p>
4. Context Assessment	of	<p>Competency may be assessed:</p> <p>4.1 On-the-job</p> <p>4.2 Off-the –job</p> <p>4.3 During Industrial attachment</p>
5. Guidance information assessment	for	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

## COMMON COMPETENCIES

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## PERFORM WORKSHOP PRACTICE

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

### UNIT DESCRIPTION

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

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These assessable statements specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Prepare materials, tools and equipment	1.1 Working drawings are interpreted to determine job requirements 1.2 <b>Tools, equipment</b> 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 following the standard operating procedures (SOPs)
2. Perform required basic metal works	2.1 Appropriate <b>PPE</b> and safety procedures are applied 2.2 <b>Work instructions</b> are followed to ensure work safety requirements 2.3 <b>Basic metal works</b> are performed applying knowledge on safety procedures and according to job requirements 2.4 <b>Dimensions</b> are marked out according to job requirements 2.5 Dimensions are checked against the actual drawings 2.6 Work pieces are clamped in <b>workholding device</b> to avoid damage and accidents 2.7 Work pieces are cut, chipped or filed according to required measurements, tolerance specified in the working drawings and free from burrs and sharp edges 2.8 Drilling is performed according to recommended sequence and specifications 2.9 Joining is performed as per job requirements 2.10 Proper usage of materials is observed 2.11 Tools, equipment and recyclable materials are stored in accordance to work place procedures. 2.12 Worksite is cleaned and cleared in accordance with OSH regulations

## RANGE

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

1. Materials may include but not limited to:	<ul style="list-style-type: none"><li>• Steel brackets</li><li>• Grinding disc</li><li>• Drill bit</li><li>• Flat/angle bars</li><li>• Fastening screws</li><li>• Sheet metal</li><li>• Mild steel tubes</li><li>• Rivets</li></ul>
2. Tools and equipment may include but not limited to:	<ul style="list-style-type: none"><li>• Portable grinder</li><li>• Hacksaw</li><li>• File</li><li>• Scribers</li><li>• Screw drivers</li><li>• Ballpein hammers</li><li>• Measuring tapes</li><li>• Steel rule</li><li>• PPE</li><li>• Portable electric drill</li><li>• Brush wire</li><li>• Tri-square</li><li>• Chisels</li><li>• Snips</li><li>• Mallets</li></ul>
3. Dimensions may include but not limited to:	<ul style="list-style-type: none"><li>• Measurements</li><li>• Tolerances</li></ul>
4. Work instructions may include but not limited to:	<ul style="list-style-type: none"><li>• Work plans</li><li>• Drawings</li><li>• Manufacturer's specifications</li></ul>
5. Personal Protective Equipment (PPE) may include but not limited to:	<ul style="list-style-type: none"><li>• Safety shoes</li><li>• Gloves</li><li>• Goggles</li></ul>



6. Basic metal works may include but not limited to:	<ul style="list-style-type: none"> <li>• Cutting</li> <li>• Filing</li> <li>• Drilling</li> <li>• Measuring</li> </ul>
7. Work holding device may include but not limited to:	<ul style="list-style-type: none"> <li>• Pliers</li> <li>• Vice grip</li> </ul>
8. Manual may include but not limited to:	<ul style="list-style-type: none"> <li>• Procedures manual</li> <li>• Instructional manual</li> </ul>

## REQUIRED SKILLS AND KNOWLEDGE

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

### Required Skills

The individual needs to demonstrate the following skills:

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

### Required Knowledge

The individual needs to demonstrate knowledge of:

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

## EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Interpreted drawings to determine job requirements 1.2 Identified and prepared materials, tools and equipment in accordance with job requirements 1.3 Selected and used appropriate processes, tools and equipment to carry out task 1.4 Marked out and checked dimensions in accordance with job requirements and within the tolerances 1.5 Followed work instructions 1.6 Performed benchworks in accordance with job requirements 1.7 Cleaned worksite in accordance with OSH regulations
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 for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## PERFORM ELECTRICAL INSTALLATION

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

### UNIT DESCRIPTION

This unit covers the competencies needed to prepare materials, tools and equipment, Select correct types and sizes of cables, Perform cable jointing and termination test electrical components and perform basic electrical repair based on the required performance standards.

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Prepare tools, equipment and instruments	1.1 Drawings are interpreted to determine job requirements 1.2 Tools, <i><b>equipment and instruments</b></i> are identified and prepared according to job requirements 1.3 Instruments are checked and tested for conditions and calibrated as required
2. Select correct types and sizes of cables	2.1 Drawings are read and interpreted to determine job requirements 2.2 Correct type, size and quantity of cables and related consumables are determined in line with job requirements 2.3 Correct PPE are identified and selected in line with safety requirements
3. Perform cable jointing and termination	3.1 Correct PPE are identified and selected in line with safety requirements 3.2 IEE regulations are adhered to. 3.3 Various types of cable joints are performed 3.4 Various types of cable termination are conducted
4. Perform installation of electrical circuits	4.1 Correct PPE are identified and selected in line with safety requirements 4.2 IEE regulations are adhered to. 4.3 Draw and interpreted simple electrical circuits 4.4 Carried out installation of simple electrical circuits 4.5 Electrical circuits are tested
5. Test power supply and electrical	5.1 Safety precautions are adhered to. 5.2 Power supply and electrical components are checked in accordance with manufacturer's specifications

components	5.3 Defects of power supply and electrical components are identified and recorded
6. Perform basic electrical repair	6.1 <b>Work instructions</b> are followed to ensure safety 6.2 Loose connections are tightened 6.3 Defective electrical components are tested and replaced or repaired 6.4 Tools and equipment are stored in accordance with work place procedures. 6.5 Work place is cleaned in line with OSH regulations

### 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. Materials may include but not limited to:	<ul style="list-style-type: none"> <li>• Solid wires</li> <li>• Stranded wires</li> <li>• Power outlets</li> <li>• Service plug</li> <li>• Soldering lead</li> <li>• Terminal clips</li> <li>• Fuses</li> <li>• PVC</li> <li>• Electrical tapes</li> </ul>
2. Tools, equipment and instruments may include but not limited to:	<ul style="list-style-type: none"> <li>• Clamp ammeters</li> <li>• Multi-meters</li> <li>• Phase testers</li> <li>• Insulation testers</li> <li>• PPEs</li> <li>• Soldering guns</li> <li>• Wire strippers</li> <li>• Measuring tapes</li> <li>• Scribers</li> <li>• Crimping tools</li> <li>• Screw drivers</li> <li>• Pliers</li> <li>• Drills</li> </ul>
3. Work instructions may include but not limited to:	<ul style="list-style-type: none"> <li>• Work plans</li> <li>• Working drawings</li> <li>• Schematic diagrams</li> </ul>

	• Installation instructions
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**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:

- Installing and repairing electrical components
- Communicating effectively
- Planning and organizing
- Working safely
- Proper handling of materials, tools, equipment and instruments
- Preparing materials, tools, equipment and instruments
- Wiring electrical components
- Testing power supply and electrical components

**Required Knowledge**

The individual needs to demonstrate knowledge of:

- Measurements
- Dimensioning
- Unit conversion
- Basic electrical principles
- Basic electrical repair
- Usage of PPEs
- Handling of tools, equipment and instruments
- 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.

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <p>1.1 Adhered to safety procedures</p> <p>1.2 Interpreted work plan to determine job requirements</p> <p>1.3 Selected and used appropriate processes, tools and equipment to carry out task</p> <p>1.4 Tested electrical instruments</p> <p>1.5 Replaced defective tools and instruments</p>
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	<p>1.6 Checked power supply and electrical components</p> <p>1.7 Cleaned work place in line with OSH regulations</p> <p>1.8 Communicated effectively</p> <p>1.9 Planned and organized work effectively</p>
2. Resource implications	<p>The following resources must be provided:</p> <p>2.1 Work plans</p> <p>2.2 Working drawings</p> <p>2.3 Materials, tools, equipment and instruments relevant to the proposed activity</p>
3. Methods of assessment	<p>Competency may be assessed through:</p> <p>3.1 Demonstration</p> <p>3.2 Direct observation and oral questioning</p> <p>3.3 Written tests</p>
4. Context of assessment	<p>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.</p>
5. Guidance information for assessment	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

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# APPLY ENGINEERING MATHEMATICS

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

## UNIT DESCRIPTION

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

## ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range.</b></i>
1. Apply Algebra	1.1 Calculations involving Indices are performed as per the concept 1.2 Calculations involving Logarithms are performed as per the concept 1.3 Scientific calculator is used in solving mathematical problems in line with manufacturer's manual 1.4 Simultaneous equations are performed as per the rules 1.5 Quadratic equations are calculated as per the concept 1.6 Ratios and proportions are worked out
2. Apply Coordinate Geometry	3.1 Graphs of given polar equations are drawn using the Cartesian plane 3.2 Polar equations are calculated using coordinate geometry 3.3 Normal and tangents are determined using coordinate geometry
3. Apply trigonometric functions	3.1 Trigonometric rules are stated and derived 3.2 Calculations are performed using trigonometric rules
4. Carry out mensuration	4.1 Perimeter and areas of figures are obtained 4.2 Volume and surface area are obtained 4.3 Area of irregular figures are obtained

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range.</b></i>
5. Apply Statistics	5.1 Mean, median, mode and Standard deviation are obtained from given data  5.2 Sampling methods are applied in data collection
6. Apply Matrix	6.1 Determinant and inverse of 2x2 matrix are obtained  6.2 Solutions of simultaneous equations are obtained
7. Apply Vectors	7.1 Vectors and scalar quantities are obtained in two dimensions  7.2 <i><b>Operations</b></i> on vectors are performed  7.3 Position of vectors is obtained

### **RANGE**

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

<b>Variable</b>	<b>Range</b>
1. Operations may include but not limited to:	<ul style="list-style-type: none"> <li>• Addition</li> <li>• Subtraction</li> </ul>

### **REQUIRED SKILLS AND KNOWLEDGE**

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

#### **Required Skills**

The individual needs to demonstrate the following skills:

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



## Required knowledge

The individual needs to demonstrate knowledge of:

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

## EVIDENCE GUIDE

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

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Applied Trigonometry functions 1.2 Applied algebraic equations 1.3 Carried out mensuration 1.4 Applied Vector theory 1.5 Applied Matrix
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 instruments and equipment 2.3 Scientific calculator 2.4 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.

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## APPLY ELECTRICAL PRINCIPLES

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

### UNIT DESCRIPTION

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

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
These describe the key outcomes which make up workplace function.	These are assessable statements which specify the required level of performance for each of the elements. <b><i>Bold and italicized terms are elaborated in the Range.</i></b>
1. Use the concept of basic Electrical quantities	1.1 Basic <b><i>SI units</i></b> in Electrical are identified 1.2 <b><i>Quantities</i></b> of Charge, force, work and power are identified 1.3 Perform calculations involving Ohm's law i.e. Current, Resistance and voltage
2. Apply concepts of D.C and A.C circuits in electrical installation	2.1 Calculations involving parallel and series circuits are performed 2.2 Calculations involving DC and AC are performed using Kirchhoff's laws
3. Perform earthing in Electrical installations	3.1 Earthing types are identified 3.2 Earthing points on Electrical installation are identified 3.3 Test on an earthing system is performed in line with the IEE regulations
4. Apply Electrostatics	4.1 Sources of Electrostatic fields are identified 4.2 Types of capacitors are identified 4.3 Concept of charge and electrostatic field is established

## RANGE

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

Variable	Range
1. SI unit may include but not limited to:	<ul style="list-style-type: none"><li>• Power – Watts (W)</li><li>• Current – Amperes (A)</li><li>• Resistance – Ohms(<math>\Omega</math>)</li><li>• Voltage – Volts (V)</li></ul>
2. Quantities may include but not limited to:	<ul style="list-style-type: none"><li>• Charge</li><li>• Force</li><li>• Work</li><li>• Power</li></ul>

## REQUIRED SKILLS AND KNOWLEDGE

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

### Required Skills

The individual needs to demonstrate the following skills:

- Apply basic electrical formulae
- 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 power calculations
- Ohm's law and Kirchoff's laws
- Electrical formulae
- SI units of various electrical parameters
- Earthing testing

- Types and purpose of measuring instruments
- Units of measurement and abbreviations

### EVIDENCE GUIDE

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

<p>1 Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <p>1.1 Applied the correct SI units of Electrical quantities</p> <p>1.2 Stated, Calculated and related the quantities in Ohm’s law</p> <p>1.3 Identified the components of an earthing system</p> <p>1.4 Stated and applied Ohms and Kirchoff’s laws in Electrical system</p> <p>1.5 Differentiated between AC and DC</p> <p>1.6 Adhered to safety procedures</p> <p>1.7 Observed good housekeeping</p>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <p>2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place</p> <p>2.2 Measuring equipment and instruments</p> <p>2.3 Materials relevant to the tasks</p>
<p>3. Methods of Assessment</p>	<p>Competency in this unit may be assessed through:</p> <p>3.1 Direct Observation</p> <p>3.2 Demonstration with Oral Questioning</p> <p>3.3 Written tests</p>
<p>4. Context of Assessment</p>	<p>Competency may be assessed individually in the actual workplace or through accredited institution or during industrial attachment</p>
<p>5. Guidance information for assessment</p>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

# PREPARE AND INTERPRET TECHNICAL DRAWINGS

UNIT CODE: ENG/OS/RAC/CC/05/5/A

## UNIT DESCRIPTION

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

## ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA ( <i>Bold and italicised terms are elaborated in the Range</i> )
1. Use and maintain drawing equipment and materials	1.1 <b>Drawing equipment</b> and <b>drawing materials</b> are identified and gathered according to task requirements 1.2 Drawing equipment are used and maintained as per manufacturer's instructions 1.3 Drawing materials are used as per workplace procedures 1.4 Waste materials are disposed in accordance with workplace procedures and <b>environmental legislations</b> 1.5 1.6 <b>Personal Protective Equipment</b> are used according to occupational safety and health regulations
2. Produce plane geometry drawings	2.1 Different types of lines used in drawing and their meanings are identified according to standard drawing conventions 2.2 Different types of <b>geometric forms</b> are constructed according to standard conventions 2.3 Different types of angles are constructed according to principles of trigonometry 2.4 Different types of angles are measured using appropriate measuring tools 2.5 Angles are bisected according to standard conventions 2.6 Freehand sketching of different types of geometric forms, tools, equipment, diagrams is conducted
3. Produce solid geometry	3.1 Drawings of patterns are interpreted according to

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>(Bold and italicised terms are elaborated in the Range)</i>
drawings	standard conventions 3.2 Patterns are developed in accordance with standard conventions
4. Produce electrical drawings	4.1 Electrical symbols and abbreviations are identified and their meaning interpreted according to BS 3939 4.2 <b>Electrical drawings</b> are produced in accordance with BS 3939

### **RANGE**

<b>Variable</b>	<b>Range</b>
1. Drawing equipment may include but not limited to:	Drawing boards, T and set squares, drawing sets
2. Drawing materials may include but not limited to:	Drawing papers, pencils, erasers, masking tapes, paper clips
3. Environmental legislations may include but not limited to:	EMCA 1999
4. Personal Protective Equipment may include but not limited to:	Dust coats, closed leather shoes
5. Geometric forms may include but not limited to:	Circles, triangles, rectangles, parallelogram, polygons, pyramids, conic sections, prisms, loci
6. Standard conventions may include but not limited to:	<ul style="list-style-type: none"> <li>• Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends)</li> <li>• Drawing scale (paper size and drawing symbols)</li> <li>• International drawing standards</li> </ul>
7. Electrical drawings may include but not	<ul style="list-style-type: none"> <li>• Block, schematic, circuit, line and wiring diagrams</li> </ul>

limited to:	
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**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Applied and adhered to safety procedures
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	<p>1.2 Cared and maintained drawing equipment</p> <p>1.3 Interpreted circuit, assembly and lay out diagrams</p> <p>1.4 Applied appropriate technical standards, used proper tools and equipment for a given task</p> <p>1.5 Produced sketches and drawings</p>
2. Resource Implications	<p>Resources the same as that of workplace are advised to be applied.</p> <p>2.1 Drawing room</p> <p>2.2 Drawing equipment and materials</p>
3. Methods of Assessment	<p>Competency may be assessed through:</p> <p>3.1 Practical tests</p> <p>3.2 Observation</p>
4. Context of assessment	<p>Competency may be assessed individually in the actual workplace or a simulated work place setting or during industrial attachment</p>
5. Guidance information for assessment	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

## **CORE COMPETENCIES**

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# INSTALL, SERVICE AND REPAIR REFRIGERATION UNITS

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

## UNIT DESCRIPTION

This unit covers the competencies required to install, service and maintain refrigeration units. It also covers competencies for identifying and repairing faults, performing refrigerant recovery/recycling and retrofitting on refrigeration units as well as performing test-run on installed/repaired units.

## ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
<p>These describe the key outcomes which make up workplace function.</p>	<p>These are assessable statements which specify the required level of performance for each of the elements.</p> <p><b><i>Bold and italicized terms are elaborated in the Range</i></b></p>
<p>1. Conduct site survey</p>	<p>1.1. <b><i>Site conditions</i></b> and <b><i>installation requirements</i></b> are assessed according to manufacturer's specification</p> <p>1.2. <b><i>Tools, equipment</i></b> and <b><i>materials</i></b> needed for installation are determined according to site conditions and site installation requirements</p> <p>1.3. Site survey report is prepared in accordance with work place procedures</p> <p>1.4. Safety procedures are adhered to according to workplace procedures and OSHA</p>
<p>2. Install electrical wiring for refrigeration unit</p>	<p>2.1 Electrical cabling and <b><i>wiring devices</i></b> are selected and safely installed in line with manufacturer's instructions and IEE regulations</p> <p>2.2 Electrical circuit is tested in accordance with IEE regulations</p>
<p>3. Install refrigeration unit</p>	<p>3.1 Tools equipment and materials are assembled according to workplace procedures</p> <p>3.2 <b><i>Unit</i></b> and components are prepared based on work place procedures</p> <p>3.4 Unit is installed according to work place procedures and manufacturer's specifications.</p> <p>3.5 Unit is positioned and leveled in line with manufacturer's specifications</p> <p>3.6 Safe handling techniques are employed in line with manufacturer's specifications and OSHA</p> <p>3.7 Voltage and current are ascertained according to unit's ratings.</p>

	<p>3.8 Temperature settings are performed according to user requirements</p> <p>3.9 Unit is handed over to user as per work place procedures</p> <p>3.10 <b>Installation report</b> is prepared in line with workplace procedures.</p>
4. Service refrigeration unit	<p>4.1 <b>Tools, equipment</b> and <b>materials</b> are selected as per workplace procedures</p> <p>4.2 <b>Refrigeration unit components</b> are serviced and maintained according to manufacturer's specifications</p>
5. Identify and repair faults in refrigeration unit	<p>5.1 Appropriate diagrams, charts and manuals are interpreted in line with the job requirements</p> <p>5.2 Safe working practices are observed throughout the task as per work place procedures</p> <p>5.3 <b>Tools, equipment</b> and <b>instruments</b> are selected and used in line with job requirements</p> <p>5.4 Refrigeration unit components are tested following manufacturer's manuals</p> <p>5.5 Faulty components are repaired or replaced in line with manufacturer's manuals</p> <p>5.6 Refrigeration unit requiring recovery/recycling is identified</p> <p>5.7 Refrigerant recovery/recycling is performed according to manufacturer's manuals</p> <p>5.8 Retrofitting/conversion is performed according to manufacturer's manuals</p> <p>5.9 Housekeeping is performed</p> <p>5.10 Work is completed in line with workplace procedures and <b>environmental legislations</b></p>
6. Test-run installed/ repaired unit	<p>6.1 Unit is tested in line with manufacturer's specifications</p> <p>6.2 Report is prepared in line with work place procedures</p> <p>6.3 Unit is commissioned and handed over to the user according to workplace procedures</p>

## 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	<ul style="list-style-type: none"> <li>• Refrigerators</li> </ul>

include but not limited to:	<ul style="list-style-type: none"> <li>• freezers</li> <li>• Water dispensers</li> <li>• Wine chillers</li> <li>• Bottle coolers</li> <li>• Ice makers</li> </ul>
2. Tools, equipment and instruments may include but not limited to:	<ul style="list-style-type: none"> <li>• Pliers</li> <li>• Screwdrivers</li> <li>• Hammers</li> <li>• Chisels</li> <li>• Spirit levels</li> <li>• Phase testers</li> <li>• Files</li> <li>• Fin combs</li> <li>• Nut drivers</li> <li>• Socket wrenches</li> <li>• Brazing equipment</li> <li>• Arc welding equipment</li> <li>• Multi-meters</li> <li>• Leak detectors</li> <li>• System analyzers</li> <li>• Recovery/recycling units</li> <li>• Weighing balance</li> <li>• Vacuum pumps</li> <li>• Refrigerant identifier</li> <li>• Clamp on ammeters</li> <li>• Lock ring tools</li> </ul>
3. Refrigeration unit components may include but not limited to:	<ul style="list-style-type: none"> <li>• Electrical controls <ul style="list-style-type: none"> <li>• Thermostats</li> <li>• Defrost timers</li> <li>• Defrost sensors</li> <li>• Thermo discs</li> <li>• Relays</li> <li>• Switches</li> </ul> </li> <li>• Compressors</li> <li>• Fan motors</li> <li>• Capacitors</li> <li>• Electronic control cards</li> <li>• Defrost heaters</li> </ul>

	<ul style="list-style-type: none"> <li>• Overload protectors</li> </ul>
4. Environmental legislations may include but not limited to:	<ul style="list-style-type: none"> <li>• Environmental Management Coordination Act</li> <li>• ISO standards on environment 140001</li> </ul>
5. Materials may include but not limited to:	<ul style="list-style-type: none"> <li>• Insulators</li> <li>• Cables</li> <li>• Socket outlets</li> <li>• Conduits and trunkings</li> <li>• Refrigerants</li> <li>• Lubricating oil</li> </ul>

## 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 diagrams
- Preparing materials
- Handling of tools, equipment and instruments
- Testing electrical systems
- Tube processing
- Safe handling of refrigerants and lubricants
- Recovering/recycling refrigerants
- Retrofitting and conversion
- Brazing
- Installation of refrigeration units
- Troubleshooting

### 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 diagrams
- Uses and specifications of refrigerants, refrigeration oil and refrigeration components

- Fundamentals of electrical installation
- Basic electronics
- Refrigeration principles
- Recovery/recycling process
- Retrofitting and conversion process
- Motor insulation testing procedure
- Wiring resistance testing procedure
- Compressor operations
- Motor starters
- Motors protection
- Relevant legislation

### 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: <ul style="list-style-type: none"> <li>1.1 Adhered to safety procedures</li> <li>1.2 Diagnosed refrigeration faults</li> <li>1.3 Recovered/recycled refrigerants</li> <li>1.4 Repaired and retrofitted refrigeration unit</li> <li>1.5 Tested and commissioned refrigeration unit</li> <li>1.6 Observed good housekeeping</li> <li>1.7 Installed refrigeration units</li> <li>1.8 Prepared installation and service reports</li> </ul>
2. Resource implications	The following resources must be provided: <ul style="list-style-type: none"> <li>2.1 Work place location and refrigeration systems</li> <li>2.2 Tools, equipment and instruments for installing, servicing and repairing refrigeration system</li> <li>2.3 Materials relevant to the task</li> <li>2.4 Diagrams, manufacturer's specifications and manuals relevant to the task</li> </ul>
3. Methods of assessment	Competency may be assessed through: <ul style="list-style-type: none"> <li>3.1 Demonstration</li> <li>3.2 Direct observation with oral questioning</li> <li>3.3 Written tests</li> <li>3.4 Portfolio</li> <li>3.5 Third party reports</li> </ul>

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.

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# INSTALL, SERVICE AND REPAIR AIR CONDITIONING UNITS

**UNIT CODE:** ENG/OS/RAC/CR/02/5/A

## UNIT DESCRIPTION

This unit covers the competencies required to safely install, service and repair air conditioning units. It includes competencies for conducting survey for air conditioning unit, installation of the unit as well as testing and commissioning the installed unit.

## ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Conduct site survey	1.1. <i>Site conditions</i> and <i>installation requirements</i> are assessed according to manufacturer's specification 1.2. <i>Tools, equipment</i> and <i>materials</i> needed for installation are determined according to site conditions and site installation requirements 1.3. Survey report is prepared in accordance with work place policies and procedures 1.4. Safety procedures are adhered to according to OSHA
2. Install electrical wiring for air conditioning unit	2.1. Electrical cabling and <i>wiring devices</i> are selected and safely installed in line with manufacturer's instructions and IEE regulations 2.2. Electrical circuit is tested in accordance with IEE regulations
3. Install air conditioning unit	3.1. Tools equipment and materials are assembled according to work place procedures 3.2. <i>Unit</i> and components are prepared based on work place procedures 3.3. Brackets, hangers and frames are installed in accordance with manufacturer's specifications 3.4. Unit is positioned and leveled in line with manufacturer's specifications 3.5. <i>Sealing materials</i> are installed in line with manufacturer's instructions and specifications 3.6. <i>Condensate drain</i> is installed in accordance with manufacturer's instructions and specifications

	3.7. Safe handling techniques are employed in line with manufacturer's specifications and OSHA
4. Service air conditioning unit	4.1. <b>Tools, equipment</b> and <b>materials</b> are selected as per standard operating procedures (SOPs) 4.2. <b>Air conditioning unit components</b> are serviced and maintained according to manufacturer's specifications
5. Identify and repair faults in air conditioning units	5.1 Appropriate diagrams, charts and manuals are interpreted in line with the job requirements 5.2 Safe working practices are observed throughout the task as per work place procedures 5.3 <b>Tools, equipment</b> and <b>instruments</b> are selected and used in line with job requirements 5.4 <b>Components</b> are tested following manufacturer's manuals 5.5 Faulty components are repaired or replaced in line with manufacturer's manuals 5.6 Refrigerant recovery/recycling is performed according to manufacturer's manuals 5.7 Retrofitting/conversion is performed according to manufacturer's manuals where applicable 5.8 Housekeeping is performed 5.9 Work is completed in line with workplace procedures and <b>environmental legislations</b>
6. Test-run the installed/ repaired unit	6.1. Voltage and current are checked according to unit rated requirements. 6.2. Temperature and velocity of air are measured based on unit specifications. 6.3. Sound and vibration are checked based on unit specifications 6.4. Housekeeping is performed 6.5. System is handed over to user as per work place procedures 6.6. <b>Report</b> is prepared in line with work place 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.

VARIABLE	RANGE
1. Site conditions may include but not limited	<ul style="list-style-type: none"> <li>Availability of power source and unit's electrical provisions</li> </ul>

to:	<ul style="list-style-type: none"> <li>• Wall and floor finishing provisions</li> <li>• Drainage provisions</li> <li>• Air circulation/ ventilation provisions</li> </ul>
2. Installation requirements may include but not limited to:	<ul style="list-style-type: none"> <li>• Location</li> <li>• Wall and floor finishing</li> <li>• Electrical requirements <ul style="list-style-type: none"> <li>• A/C plug and outlet</li> <li>• Wire size</li> <li>• Protection devices</li> <li>• Earthing</li> </ul> </li> </ul>
3. Tools and equipment may include but not limited to:	<ul style="list-style-type: none"> <li>• Measuring tools</li> <li>• Spirit levels</li> <li>• Plumb lines</li> <li>• Clear/transparent water hose</li> <li>• Screw drivers</li> <li>• Pliers</li> <li>• Multi meters</li> <li>• Clamp meters</li> <li>• Anemometers</li> <li>• Chisels</li> <li>• Hammers (claw and ball pein)</li> <li>• Hacksaws</li> <li>• Files</li> <li>• Grinders</li> <li>• Electric drills</li> <li>• Drill bits</li> <li>• Cross cut saws</li> <li>• Rip saws</li> <li>• Arc welding equipment</li> <li>• Brazing equipment</li> <li>• Lok ring tools</li> <li>• Masonry tools (e.g. trowel, spade, level, etc.)</li> <li>• Refrigerant identifier</li> <li>• System analyzer</li> </ul>
4. Materials may include but not limited to:	<ul style="list-style-type: none"> <li>• Expansion bolts</li> <li>• Brazing rods</li> <li>• Welding electrodes</li> </ul>

	<ul style="list-style-type: none"> <li>• Sealants</li> <li>• Electrical cables</li> <li>• Convenience outlets</li> <li>• Conduits and trunkings</li> <li>• Circuit breakers</li> <li>• Switches</li> <li>• Masonry materials (e.g. cement, sand)</li> </ul>
5. Wiring devices may include but not limited to:	<ul style="list-style-type: none"> <li>• Service earthing</li> <li>• Socket outlets</li> <li>• Top plugs</li> </ul>
6. Unit may include but not limited to:	<ul style="list-style-type: none"> <li>• Window type air conditioner</li> <li>• Split type air conditioner</li> </ul>
7. Sealing materials may include but not limited to:	<ul style="list-style-type: none"> <li>• Rubber gasket</li> <li>• Armaflex</li> <li>• Foam</li> <li>• Plastic</li> <li>• Silicone</li> <li>• Fibre glass</li> </ul>
8. Report may include but not limited to:	<ul style="list-style-type: none"> <li>• Installation report</li> <li>• Inspection report</li> <li>• Testing report</li> <li>• Commissioning report</li> </ul>

## 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:

- Communicating effectively
- Interpreting plans and details

- Preparing materials
- Proper handling of tools and equipment
- Working safely
- Installing window-type and split-type air-conditioning units
- Testing power supply
- Connecting power circuit
- Operating window-type and split-type air-conditioning unit

### **Required Knowledge**

The individual needs to demonstrate knowledge of:

- Personal protective equipment/safety gears
- Handling of tools, equipment and accessories
- Safety signs and symbols
- Good housekeeping
- Linear measurements
- Ratio and proportion
- Unit conversion
- Electrical plans, symbols and abbreviations
- Types of sealant
- Types of insulation
- Types of wires, conduits and fittings
- Types of wiring devices
- Basic refrigeration cycle
- Air conditioning components
- Electrical installation systems
- Basic masonry
- Basic carpentry
- Basic plumbing
- Basic arc welding
- Preventive maintenance
- Relevant 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	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> <li>1.1. Adhered to safety procedures</li> <li>1.2. Identified tools, equipment and materials</li> <li>1.3. Assessed site conditions for air conditioning system</li> <li>1.4. Installed electrical wiring for air conditioning system</li> <li>1.5. Installed air conditioning system</li> <li>1.6. Serviced air conditioning units</li> <li>1.7. Repaired a faulty air conditioning unit</li> <li>1.8. Tested air conditioning system</li> <li>1.9. Commissioned air conditioning system</li> <li>1.10. Carried out housekeeping</li> </ol>
2. Resource implications	<p>The following resources must be provided:</p> <ol style="list-style-type: none"> <li>2.1 Work place location/installation area</li> <li>2.2 Tools and equipment appropriate for the task</li> <li>2.3 Materials relevant to the task</li> <li>2.4 Drawings, manuals and specifications relevant to the task</li> </ol>
3. Methods of assessment	<p>Competency may be assessed through:</p> <ol style="list-style-type: none"> <li>3.1. Demonstration</li> <li>3.2. Direct observation with oral questioning</li> <li>3.3. Written tests</li> <li>3.4. Portfolio</li> <li>3.5. Third party reports</li> </ol>
4. Context for assessment	<p>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.</p>
5. Guidance information for assessment	<p>Holistic assessment with other units relevant to the sector, workplace and job role is recommended.</p>

# SERVICE AND REPAIR AUTOMOBILE AIR-CONDITIONING UNITS

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

## UNIT DESCRIPTION

This unit covers the competencies required to service, identify and analyze faults found in automobile air conditioning units. It also covers competencies for identifying and repairing faults, performing refrigerant recovery/recycling and retrofitting on automobile air-conditioning units as well as performing test-run on repaired units.

## ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Service automobile air conditioning components	1.1 <i><b>Tools and equipment</b></i> are selected as per job requirements 1.2 <i><b>Components</b></i> are checked for damage and replaced if required in line with manufacturer's specifications
2. Prepare for troubleshooting and repair	2.1 Appropriate diagrams, charts and manuals are interpreted in line with the job requirements 2.2 Appropriate materials, tools and equipment are selected based on job requirements 2.3 Power supply is checked to ensure compliance with manufacturer's specifications
3. Identify and repair faults in automobile air conditioning systems	3.1 Safe working practices are observed throughout the task as per work place procedures 3.2 <i><b>Tools, equipment and instruments</b></i> are selected and used in line with job requirements 3.3 <i><b>Components</b></i> are tested following manufacturer's manuals and work place troubleshooting policy 3.4 Components with faults are diagnosed in line with manufacturer's manuals and work place troubleshooting policy 3.5 Air-conditioning system requiring recovery/recycling is identified 3.6 Refrigerant recovery/recycling is performed according to manufacturer's manuals 3.7 Retrofitting/conversion is performed according to manufacturer's manuals where applicable

	<p>3.8 Remedial action is taken to overcome faults in line with manufacturer's manuals and work place troubleshooting policy</p> <p>3.9 Work is completed in line with workplace safety guidelines and <i>environmental legislations</i></p>
4. Test-run repaired unit	<p>4.1 <b>Unit</b> is tested in line with manufacturer's manual and work place procedures</p> <p>4.2 Report is prepared in line with manufacturer's manual and work place procedures</p> <p>4.3 Unit is handed over to the user according to work place procedures</p> <p>4.4 Report is prepared in line with work place procedures</p>
5. Prepare service and maintenance reports	Report writing

### 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 instruments may include but not limited to:	<ul style="list-style-type: none"> <li>• Pliers</li> <li>• Screwdrivers</li> <li>• Hammers</li> <li>• Chisels</li> <li>• Spirit levels</li> <li>• Phase testers</li> <li>• Files</li> <li>• Fin combs</li> <li>• Nut drivers</li> <li>• Socket wrenches</li> <li>• Brazing equipment</li> <li>• Arc welding equipment</li> <li>• Multi-meters</li> <li>• Leak detectors</li> <li>• System analyzers</li> <li>• Recovery/recycling units</li> <li>• Weighing balance</li> <li>• Refrigerant identifier</li> </ul>



	<ul style="list-style-type: none"> <li>• Vacuum pumps</li> </ul>
2. Components may include but not limited to:	<ul style="list-style-type: none"> <li>• Electrical controls <ul style="list-style-type: none"> <li>○ Thermostats</li> <li>○ Defrost timers</li> <li>○ Defrost heaters</li> <li>○ Defrost sensors</li> <li>○ Thermo discs</li> <li>○ Relays</li> <li>○ Switches</li> <li>○ Overload protector</li> </ul> </li> <li>• Compressors</li> <li>• Blowers</li> <li>• Capacitors</li> <li>• Electronic control cards</li> <li>• Magnetic clutch</li> </ul>
3. Environmental legislations may include but not limited to:	<ul style="list-style-type: none"> <li>• Environmental Management Coordination Act</li> <li>• Environmental Protection Agency (EPA)</li> </ul>
4. Unit may include but not limited to:	<ul style="list-style-type: none"> <li>• Air conditioning system</li> <li>• Automobile</li> </ul>

## 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 schematic diagrams
- Servicing and maintaining of automobile air conditioning components
- Preparing materials
- Proper handling of tools, equipment and instruments
- Repairing and testing electrical system
- Tube processing
- Proper handling of refrigerant and refrigeration oil
- Recovery/recycling refrigerants
- Retrofitting and conversion

### Required Knowledge

The individual needs to demonstrate knowledge of:

- Protective personal equipment/safety gears
- Handling of tools, equipment and accessories
- Safety signs and symbols
- Good housekeeping
- Interpretation of schematic diagrams
- Types of equipment
- Basic electricity
- Basic electronics
- Air conditioning principles
- Recovery/Recycling
- Retrofitting and conversion
- Motor insulation testing procedure
- Air conditioning system testing procedure
- Compressor operations
- Relevant legislations

### EVIDENCE GUIDE

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

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Adhered to safety procedures</li> <li>1.2 Diagnosed automobile air conditioning faults</li> <li>1.3 Serviced automobile air conditioning system</li> <li>1.4 Recovered/Recycled refrigerants</li> <li>1.5 Repaired/retrofitted automobile air conditioning system</li> <li>1.6 Tested and commissioned the repaired unit</li> <li>1.7 Carried out housekeeping</li> <li>1.8 Prepared service report</li> </ul>
<p>2. Resource implications</p>	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> <li>2.1 Work place location and units</li> <li>2.2 Tools, equipment and instruments for troubleshooting and repair</li> <li>2.3 Materials relevant to the task</li> <li>2.4 Diagrams, specifications and manuals relevant to the task</li> </ul>

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.

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