

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS FOR**

**AUTOMOTIVE TECHNICIAN LEVEL 6**

TVET CDACC

P.O BOX 15745-00100

NAIROBI

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**Council Secretary/CEO**

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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. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these Occupational Standards were developed for the purpose of developing a competency-based curriculum for Automotive Engineering Level 6. These Occupational Standards will also be the basis for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards will play a great role towards development of competent human resource for the Engineering sector‟s growth and 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 Sessional Paper No. 4 of 2016 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification in TVET. This called for shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Engineering Sector Skills Advisory Committee (SSAC), have developed these Occupational Standards for a Automotive Technician. These standards will be the basis for development of competency-based curriculum for Automotive Engineering level 6.

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

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

I acknowledge all other institutions which in one way or another contributed to the development of these Standards.

**CHAIRPERSON ENGINEERING SECTOR SKILLS ADVISORY COMMITTEE**

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**ABBREVIATIONS AND ACRONYMS**

AC Air conditioning

AIDS Acquired Immunodeficiency Syndrome

BC Basic Competency

CBET Competency Based Education and Training

CC Common Competency

CDACC Curriculum Development Assessment Certification Council

CEO Council Secretary

CI Compression ignition

CPU Central Processing Unit

CR Core Unit

CV Constant velocity joint

DTI Dial test indicator

FOT Fixed orifice tube

GPS Global positioning system

HIV Acquired Immunodeficiency Virus

ICT Information Communication Technology

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualification Authority

KNQF Kenya National Qualification Framework

KPI King Pin inclination

OBD On-board diagnostics

OS Occupational Standard

OSH Occupational Safety and Health

PESTEL Political Environmental Social Technological Economic Legal

PPE Personal Protective Equipment

SI Spark ignition

SOPStandard Operating Procedure

SSAC Sector Skills Advisory Committee

SWOT Strength Weakness Opportunity Threat

TVET Technical and Vocational Education and Training

TXV Thermal expansion valve

UJ Universal joint

# KEY TO UNIT CODE

**ENG/OS /AUT /BC /01/6 A**

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Version control

# OVERVIEW

Automotive Engineering Level 6 qualification consists of competencies that a person must achieve to enable him/her to service and repair vehicle engines components, service vehicle fuel systems, vehicle transmission system, vehicle steering systems, vehicle suspension systems, vehicle braking systems and vehicle electrical systems

This course consists of the following basic, common and core units of competency as shown below:

**Basic Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/AUT/BC/01/6 | Demonstrate Communication Skills. |
| ENG/OS/AUT/BC/02/6 | Demonstrate Digital Literacy. |
| ENG/OS/AUT/BC/03/6 | Demonstrate Entrepreneurial Skills. |
| ENG/OS/AUT/BC/04/6 | Demonstrate Employability Skills. |
| ENG/OS/AUT/BC/05/6 | Demonstrate environmental Literacy. |
| ENG/OS/AUT/BC/06/6 | Demonstrate Occupational Safety and Health Practices. |

**Common Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/AUT/CC/01/6 | Technical Drawing |
| ENG/OS/AUT/CC/02/6 | Apply Engineering Mathematics |
| ENG/OS/AUT/CC/03/6 | Applying Automotive Engineering Science Principles |
| ENG/OS/AUT/CC/04/6 | Applying Workshop Technology Principles |

**Core Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/AUT/CR/01/6 | Service And Repair Motor Vehicle |
| ENG/OS/AUT/CR/02/6 | Service And Repair Vehicle Engines Components |
| ENG/OS/AUT/CR/03/6 | Service Vehicle Fuel Systems |
| ENG/OS/AUT/CR/04/6 | Service Vehicle Transmission System |
| ENG/OS/AUT/CR/05/6 | Service Vehicle Steering Systems |
| ENG/OS/AUT/CR/06/6 | Service Vehicle Suspension Systems |
| ENG/OS/AUT/CR/07/6 | Service Vehicle Braking Systems |
| ENG/OS/AUT/CR/08/6 | Service Vehicle Electrical Systems |
| ENG/OS/AUT/CR/09/6 | Service And Repair Motor Vehicle |

# BASIC UNITS OF COMPETENCY

# DEMONSTRATE COMMUNICATION SKILLS

**UNIT CODE: ENG**/OS/AUT/BC/01/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate communication skills. It involves meeting communication needs of clients and colleagues, developing communication strategies, establishing and maintaining communication pathways, conducting interviews, facilitating group discussion and representing the organization.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Meet communication needs of clients and colleagues | 1. Specific communication needs of clients and colleagues are identified and met based on workplace requirements 2. Different communication approaches are identified and applied according to clients’ needs 3. Conflict is identified and addressed as per the standards of the organization |
| 1. Develop communication strategies | * 1. Strategies for effective internal and external dissemination of information are developed as per organization’s requirements   2. Special communication needs are considered in developing strategies according workplace procedures   3. ***Communication strategies*** are analyzed, evaluated and revised based the workplace needs |
| 1. Establish and maintain communication pathways | * 1. Pathways of communication are established as per organization policy   2. Pathways are maintained and reviewed according to organization procedures |
| 1. Promote use of communication strategies | * 1. Information is provided to all areas of the organization as per strategy requirements   2. Effective communication techniques are articulated and modeled according work requirements   3. Personnel are given guidance about adapting communication strategies as per organization procedures |
| 1. Conduct interview | 1. A range of appropriate communication strategies are employed in ***interview situations*** based on the workplace requirements 2. Records of interviews are made and maintained in accordance with organizational procedures 3. Effective questioning, listening and nonverbal communication techniques are used as per needs |
| 1. Facilitate group discussion | 1. Mechanisms to enhance ***effective group interaction*** are identified and implemented according to workplace requirements 2. Strategies to encourage group participation are identified and used as per organizations’ procedures 3. Meetings objectives and agenda are set and followed based on workplace requirements 4. Relevant information is provided and feedback obtained according to set protocols 5. Evaluation of group communication strategies is undertaken in accordance with workplace guidelines 6. Specific communication needs of individuals are identified and addressed as per individual needs |
| 1. Represent the organization | 1. 7Relevant presentation are researched and presented based on internal or external communication forums requirements 2. Presentation is delivered in a clear and sequential manner as per the predetermined time 3. Presentation is made as per appropriate media 4. Difference views are respected based on workplace procedures 5. Written communication is done as per organizational standards 6. Inquiries are responded according to organizational standard |

**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: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrase * Clarification request * Translation * Restructuring * Approximation * Generalization |
| 1. Effective group interaction may include but not limited to: | * Identifying and evaluating what is occurring within an interaction in a nonjudgmental way * Using active listening * Making decision about appropriate words, behavior * Putting together response which is culturally appropriate * Expressing an individual perspective * Expressing own philosophy, ideology and background and exploring impact with relevance to communication |
| 1. Situations may include but not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * Developing action plans * Diffusing potentially difficult situations |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Active listening
* Interpretation
* Negotiation
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups
* Styles of group leadership
* Key elements of communications strategy

**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. Developed communication strategies to meet the organization requirements and applied in the workplace 2. Established and maintained communication pathways for effective communication in the workplace 3. Used communication strategies involving exchanges of complex oral information |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Direct observation 2. Oral questioning 3. Written texts |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**DEMONSTRATE DIGITAL LITERACY**

**UNIT CODE:** ENG/OS/AUT/BC/02/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Identify appropriate computer software and hardware | * 1. Concepts of ICT are determined in accordance with computer equipment   2. Classifications of computers are determined in accordance with manufacturers specification   3. Appropriate computer software is identified according to manufacturer’s specification   4. Appropriate computer hardware is identified according to manufacturer’s specification   5. Functions and commands of operating system are determined in accordance with manufacturer’s specification |
| 1. Apply security measures to data, hardware, software in automated environment | * 1. ***Data security and privacy are classified*** in accordance with the prevailing technology   2. ***Security threats*** reidentified ***and control measures*** are applied in accordance with laws governing protection of ICT   3. Computer threats and crimes are detected in accordance to Information Management security guidelines   4. Protection against computer crimes is undertaken in accordance with laws governing protection of ICT |
| 1. Apply computer software in solving tasks | * 1. ***Word processing concepts*** are applied in resolving workplace tasks, report writing and documentation as per the job requirements   2. ***Word processing utilities*** are applied in accordance with workplace procedures   3. Worksheet layout is prepared in accordance with work procedures   4. Worksheet is built and data manipulated in the worksheet in accordance with workplace procedures   5. Continuous data manipulated on worksheet is undertaken in accordance with work requirements   6. Database design and manipulation is undertaken in accordance with office procedures   7. Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures |
| 1. Apply internet and email in communication at workplace | * 1. Electronic mail addresses are opened and applied in workplace communication in accordance with office policy   2. Office internet functions are defined and executed in accordance with office procedures   3. ***Network configuration*** is determined in accordance with office operations procedures   4. Official World Wide Web is installed and managed according to workplace procedures |
| 1. Apply Desktop publishing in official assignments | * 1. Desktop publishing functions and tools are identified in accordance with manufactures specifications   2. Desktop publishing tools are developed in accordance with work requirements   3. Desktop publishing tools are applied in accordance with workplace requirements   4. Typeset work is enhanced in accordance with workplace standards |
| 1. Prepare presentation packages | * 1. Types of presentation packages are identified in accordance with office requirements   2. Slides are created and formulated in accordance with workplace procedures   3. Slides are edited and run-in accordance with work procedures   4. Slides and handouts are printed according to work requirements |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Appropriate computer hardware may include but not limited to: | Collection of physical parts of a computer system such as:   * Computer case, monitor, keyboard, and mouse * All the parts inside the computer case, such as the hard disk drive, motherboard and video card |
| 1. Data security and privacy may include but not limited to: | * Confidentiality of data * Cloud computing * Integrity -but-curious data surfing |
| 1. Security and control measures may include but not limited to: | * Counter measures against cyber terrorism * Risk reduction * Cyber threat issues * Risk management * Pass-wording |
| 1. Security threats may include but not limited to: | * Cyber terrorism * Hacking |

**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
* Computing (applying fundamental operations such as addition, subtraction, division and multiplication)
* Using calculator
* 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
* Word processing;
* Functions and concepts of word processing.
* Documents and tables creation and manipulations
* Mail merging
* Word processing utilities
* Spread sheets;
* Meaning, formulae, function and charts, uses and layout
* Data formulation, manipulation and application to cells
* Database;
* Database design, data manipulation, sorting, indexing, storage retrieval and security
* Desktop publishing;
* Designing and developing desktop publishing tools
* Manipulation of desktop publishing tools
* Enhancement of typeset work and printing documents
* Presentation Packages;
* Types of presentation Packages
* Creating, formulating, running, editing, printing and presenting slides and handouts
* Networking and Internet;
* Computer networking and internet.
* Electronic mail and world wide web
* Emerging trends and issues in ICT;
* Identify and integrate emerging trends and issues in ICT
* Challenges posed by emerging trends and issues

**EVIDENCE** **GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified and controlled security threats   2. Detected and protected computer crimes   3. Applied word processing in office tasks   4. Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures   5. Opened electronic mail for office communication as per workplace procedure   6. Installed internet and World Wide Web for office tasks in accordance with office procedures   7. Integrated emerging issues in computer ICT applications   8. Applied laws governing protection of ICT |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**DEMONSTRATE ENTREPRENEURIAL SKILLS**

**UNIT CODE :** ENG/OS/AUT/BC/03/6/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**

|  |  |
| --- | --- |
| **ELEMENT** | **PERFORMANCE CRITERIA** |
| 1. Demonstrate understanding of an Entrepreneur | 1. Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship 2. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 3. Ways of becoming an Entrepreneur are identified as per principles of Entrepreneurship 4. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 5. Factors affecting Entrepreneurship development are explored as per principles of Entrepreneurship |
| 1. Demonstrate understanding of Entrepreneurship and self-employment | 1. Entrepreneurship and self-employment are distinguished as per principles of entrepreneurship 2. Importance of self-employment is analysed based on business procedures and strategies 3. ***Requirements for entry into self-employment*** are identified according to business procedures and strategies 4. Role of an Entrepreneur in business is determined according to business procedures and strategies 5. Contributions of Entrepreneurs to National development are identified as per business procedures and strategies 6. Entrepreneurship culture in Kenya is explored as per business procedures and strategies 7. Born or made Entrepreneurs are distinguished as per entrepreneurial traits |
| 1. Identify Entrepreneurship opportunities | 1. Sources of business ideas are identified as per business procedures and strategies 2. Business ideas and opportunities are generated as per business procedures and strategies 3. Business life cycle is analysed as per business procedures and strategies 4. Legal aspects of business are identified as per procedures and strategies 5. Product demand is assessed as per market strategies 6. Types of ***business environment*** are identified and evaluated as per business procedures 7. Factors to consider when evaluating business environment are explored based on business procedure and strategies 8. Technology in business is incorporated as per best practice |
| 1. Create entrepreneurial awareness | 1. ***Forms of businesses*** are explored as per business procedures and strategies 2. Sources of business finance are identified as per business procedures and strategies 3. Factors in selecting source of business finance are identified as per business procedures and strategies 4. ***Governing policies*** on Small Scale Enterprises (SSEs) are determined as per business procedures and strategies 5. Problems of starting and operating SSEs are explored as per business procedures and strategies |
| 1. Apply entrepreneurial motivation | 1. ***Internal and external motivation*** factors are determined in accordance with motivational theories 2. Self-assessment is carried out as per entrepreneurial orientation 3. Effective communications are carried out in accordance with communication principles 4. Entrepreneurial motivation is applied as per motivational theories |
| 1. Develop innovative business strategies | 1. Business innovation strategies are determined in accordance with the organization strategies 2. Creativity in business development is demonstrated in accordance with business strategies 3. ***Innovative business strategies*** are developed as per business principles 4. Linkages with other entrepreneurs are created as per best practice 5. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Identified Business is described as per business procedures and strategies 2. Marketing plan is developed as per business plan format 3. Organizational/Management plan is prepared in accordance with business plan format 4. Production/operation plan in accordance with business plan format 5. Financial plan is prepared in accordance with the business plan format 6. Executive summary is prepared in accordance with business plan format 7. Business plan is presented as per best practice |

**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: | * Innovators * Imitators * Craft * Opportunistic * Speculators |
| 1. Characteristics of Entrepreneurs may include but not limited to: | * Creative * Innovative * Planner * Risk taker * Networker * Confident * Flexible * Persistent * Patient * Independent * Future oriented * Goal oriented |
| 1. Requirements for entry into self-employment may include but not limited to | * Technical skills * Management skills * Entrepreneurial skills * Resources * Infrastructure |
| 1. Internal and external motivation may include but not limited to: | * Interest * Passion * Freedom * Prestige * Rewards * Punishment * Enabling environment * Government policies |
| 1. Business environment may include but not limited to: | * External * Internal * Intermediate |
| 1. Forms of businesses may include but not limited to: | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| 1. Governing policies may include but not limited to: | * Increasing scope for finance * Promoting cooperation between entrepreneurs and private sector * Reducing regulatory burden on entrepreneurs * Developing IT tools for entrepreneurs |
| 1. Innovative business strategies may include but not limited to: | * New products * New methods of production * New markets * New sources of supplies * Change in industrialization |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Decision making
* Business communication
* Change management
* Competition
* Risk
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care 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.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | 1. Assessment requires evidence that the candidate: 2. Distinguished entrepreneurs and businesspersons correctly 3. Identified ways of becoming an entrepreneur appropriately 4. Explored factors affecting entrepreneurship development appropriately 5. Analysed importance of self-employment accurately 6. Identified requirements for entry into self-employment correctly 7. Identified sources of business ideas correctly 8. GeneratedBusiness ideas and opportunities correctly 9. Analysed business life cycle accurately 10. Identified legal aspects of business correctly 11. Assessed product demand accurately 12. Determined Internal and external motivation factors appropriately 13. Carried out communications effectively 14. Identified sources of business finance correctly 15. Determined Governing policy on small scale enterprise appropriately 16. Explored problems of starting and operating SSEs effectively 17. Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 18. Prepared executive summary correctly 19. Determined business innovative strategies appropriately 20. Presented business plan effectively |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | 1. Written tests 2. Oral questions 3. Third party report 4. Interviews 5. Portfolio of Evidence |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE EMPLOYABILITY SKILLS

**UNIT CODE:** ENG/OS/AUT/BC/04/6/A

**UNIT DESCRIPTON**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Conduct self-management | 1. Personal vision, mission and goals are formulated based on potential and in relation to organization objectives 2. Emotional intelligence is demonstrated as per workplace requirements. 3. Individual performance is evaluated and monitored according to the agreed targets. 4. Assertiveness is developed and maintained based on the requirements of the job. 5. Accountability and responsibility for own actions are demonstrated based on workplace instructions. 6. Self-esteem and a positive self-image are developed and maintained based on values. 7. Time management, attendance and punctuality are observed as per the organization policy. 8. Goals are managed as per the organization’s objective 9. Self-strengths and weaknesses are identified based on personal objectives |
| 1. Demonstrate interpersonal communication | 1. Writing skills are demonstrated as per communication policy 2. Negotiation and persuasion skills are demonstrated as per communication policy 3. Internal and external stakeholders’ needs are identified and interpreted as per the communication policy 4. Communication networks are established based on workplace policy 5. Information is shared as per communication policy |
| 1. Demonstrate critical safe work habits | * 1. Stress is managed in accordance with workplace policy.   2. Punctuality and time consciousness is demonstrated in line with workplace policy.   3. Personal objectives are integrated with organization goals based on organization’s strategic plan.   4. ***Resources*** are utilized in accordance with workplace policy.   5. Work priorities are set in accordance to workplace goals and objectives.   6. Leisure time is recognized and utilized in line with personal objectives.   7. ***Drugs and substances of abuse*** are identified and avoided based on workplace policy.   8. HIV and AIDS prevention awareness is demonstrated in line with workplace policy.   9. Safety consciousness is demonstrated in the workplace based on organization safety policy.   10. ***Emerging issues*** are identified and dealt with in accordance with organization policy. |
| 1. Lead a workplace team | 1. Performance targets for the ***team*** are set based on organization’s objectives 2. Duties are assigned in accordance with the organization policy. 3. ***Forms of communication*** in a team are established according to organization’s policy. 4. Team performance is evaluated based on set targets as per workplace policy. 5. Conflicts are resolved between team members in line with organization policy. 6. Gender related issues are identified and mainstreamed in accordance workplace policy. 7. Human rights and fundamental freedoms are identified and respected as Constitution of Kenya 2010. 8. Healthy relationships are developed and maintained in line with workplace. |
| 1. Plan and organize work | 1. Work plans are prepared based on activities and budget. 2. Assigned tasks are interpreted and expectations identified as per the workplace instructions. 3. Task occupational safety and health requirements are identified and observed regulations. 4. Work resources are identified, mobilized, allocated and utilized based on organization work plans. 5. Work activities are monitored and evaluated in line with work plans and workplace policy. 6. Work plans are reviewed based on target and available resources. |
| 1. Maintain professional growth and development | * 1. Personal training needs are identified and assessed in line with the requirements of the job.   2. ***Training and career opportunities*** are identified and utilized based on job requirements.   3. Resources for training are mobilized and allocated based organizations and individual skills needs.   4. Licensees and certifications relevant to job and career are obtained and renewed as per policy.   5. Work priorities and personal commitments are balanced and managed based on requirements of the job and personal objectives.   6. Recognitions are sought as proof of career advancement in line with professional requirements. |
| 1. Demonstrate workplace learning | * 1. Learning opportunities are sought and managed based on job requirement and organization policy.   2. Improvement in performance is demonstrated based on courses attended.   3. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job   4. Time and effort is invested in learning new skills based on job requirements   5. Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy.   6. New systems are developed and maintained in accordance with the requirements of the job.   7. Awareness of personal role in workplace ***innovation*** is demonstrated based on requirements of the job. |
| 1. Demonstrate problem solving skills | * 1. Creative, innovative and practical solutions are developed based on the problem   2. Independence and initiative in identifying and solving problems is demonstrated based on requirements of the job.   3. Team problems are solved as per the workplace guidelines   4. Problem solving strategies are applied as per the workplace guidelines   5. Problems are analyzed and assumptions tested as per the context of data and circumstances |
| 1. Manage ethical performance | * 1. Policies and guidelines are observed as per the workplace requirements   2. Self-worth and professionalism is exercised in line with personal goals and organizational policies   3. Code of conduct is observed as per the workplace requirements   4. Integrity is demonstrated as per legal requirement |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Drug and substance abuse may include but not limited to: | Commonly abused   * Alcohol * Tobacco * Miraa * Over-the-counter drugs * Cocaine * Bhang * Glue |
| 1. Feedback may include but not limited to: | * Verbal * Written * Informal * Formal |
| 1. Relationships may include but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| 1. Forms of communication may include but not limited to: | * Written * Visual * Verbal * Non verbal * Formal and informal |
| 1. Team may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| 1. Personal growth may include but not limited to: | * Growth in the job * Career mobility * Gains and exposure the job gives * Net workings * Benefits that accrue to the individual as a result of noteworthy performance |
| 1. Personal objectives may include but not limited to: | * Long term * Short term * Broad * Specific |
| 1. Trainings and career opportunities may includes but not limited to | * Participation in training programs * Serving as Resource Persons in conferences and workshops |
| 1. Resource may include may but not limited to: | * Human * Financial * Technology |
| 1. Innovation may include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| 1. Emerging issues may include but not limited to: | * Terrorism * Social media * National cohesion * Open offices |
| 1. Range of media for learning may include but not limited to: | * Mentoring * peer support and networking * IT and courses |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Interpersonal
* Communication
* Critical thinking
* Organizational
* 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
* Workplace communication
* Concept of time
* Time management
* Decision making
* Types of resources
* Work planning
* Organizing work
* Monitoring and evaluation
* Record keeping
* Gender mainstreaming
* HIV and AIDS
* Drug and substance abuse
* Professional growth and development
* Technology in the workplace
* Innovation
* Emerging issues

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Conducted self-management   2. Demonstrated interpersonal communication   3. Demonstrated critical safe work habits   4. Demonstrated the ability to lead a workplace team   5. Planned and organized work   6. Maintained professional growth and development   7. Demonstrated workplace learning   8. Demonstrated problem solving skills   9. Demonstrated the ability to manage performance ethically |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE ENVIRONMENTAL LITERACY

**UNIT CODE:** ENG/OS/AUT/BC/05/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to demonstrate environmental literacy. It involves, controlling environmental hazard and environmental pollution, demonstrating sustainable resource use, evaluating current practices in relation to resource usage, identifying environmental legislations/conventions for environmental concerns, implementing specific environmental programs, monitoring activities on environmental protection/Programs , analyzing resource use and developing resource conservation plans

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Control environmental hazard | 1. Storage methods for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS. 2. Disposal methods of hazardous wastes are followed according to environmental regulations and OSHS. 3. ***PPE*** is used according to OSHS. |
| 1. Control environmental Pollution | * 1. Environmental pollution ***control measures*** are implemented in accordance with international protocols.   2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999   3. Methods for minimizing noise pollution is complied with based on Noise and Excessive Vibration Pollution and Control Regulations, 2009 |
| 1. Demonstrate sustainable resource use | * 1. Methods for minimizing wastage are complied with based on organizational waste management guide   2. Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle)   3. Methods for economizing and reducing resource consumption are practiced as per the Constitution of Kenya 2010 Article 69 . |
| 1. Evaluate current practices in relation to resource usage | * 1. Information on resource efficiency systems and procedures are collected and provided as per work groups/sector   2. Current resource usage is measured and recorded as per work group   3. Current purchasing strategies are analyzed and recorded according to industry procedures.   4. Current work processes to access information and data is analyzed following enterprise protocol. |
| 1. Identify environmental legislations/conventions for environmental concerns | 1. Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 2. Industrial standard/environmental practices are described according to the different environmental concerns |
| 1. Implement specific environmental programs | 1. Programs/Activities are identified according to organizations policies and guidelines. 2. Individual roles/responsibilities are determined and performed based on the activities identified. 3. Problems/constraints encountered are resolved in accordance with organizations’ policies and guidelines 4. Stakeholders are consulted based on company guidelines |
| 1. Monitor activities on Environmental protection/Programs | 1. Activities are periodically monitored and Evaluated according to the objectives of the environmental program 2. Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations 3. Data gathered are analyzed based on Evaluation requirements 4. Recommendations are submitted based on the findings 5. Management support systems are set/established to sustain and enhance the program 6. Environmental incidents are monitored and reported to 7. concerned/proper authorities |
| 1. Analyze resource use | 1. All resource consuming processes are Identified as per the organizational work plan 2. Quantity and nature of resource consumed is determined based on processes 3. Resource flow is analyzed as per different parts of the process. 4. Wastes are classified according to NEMA regulations on waste management. |
| 1. Develop resource Conservation plans | 9.1. Efficiency of use/conversion of resources is determined according to industry protocol.  9.2. Causes of low efficiency of use of resources are Determined based on industry protocol.  9.3. Plans for increasing the efficiency of resource use are developed based on findings. |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. PPE may include but not limited to | * + Mask   + Gloves   + Goggles   + Safety hat   + Overall * Hearing protector |
| 1. Control measures may include but not limited to | * Methods for minimizing or stopping spread and ingestion of airborne particles * Methods for minimizing or stopping spread and ingestion of gases and fumes * Methods for minimizing or stopping spread and ingestion of liquid wastes |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Measuring
* Recording
* Analytical
* Monitoring
* Communication
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* PPEs
* Environmental regulations
* OSHS
* Pollution
* Waste management
* Principle of 3Rs
* Types of resources
* Techniques in measuring current usage of resources
* Environmental hazards
* Regulatory requirements

**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. Controlled environmental hazard   2. Controlled environmental pollution   3. Demonstrated sustainable resource use   4. Evaluated current practices in relation to resource usage   5. Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns.   6. Described industrial standard environmental practices according to the different environmental issues/concerns.   7. Resolved problems/ constraints encountered based on management standard procedures   8. Implemented and monitored environmental practices on a periodic basis as per company guidelines   9. Recommended solutions for the improvement of the program   10. Monitored and reported to proper authorities any environmental incidents |
| 1. Resource Implications | The following resources should be provided:   * 1. Workplace with storage facilities   2. Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags)   3. PPE, manuals and references   4. Legislation, policies, procedures, protocols and local ordinances relating to environmental protection   5. Case studies/scenarios relating to environmental Protection |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENG/OS/AUT/BC/06/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to demonstrate occupational health and safety practices. It involves identifying workplace hazards and risks, identifying and implementing appropriate control measures to hazards and risks and implementing OSH programs, procedures and policies/guidelines.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Identify workplace hazards and risk | 1.1 ***Hazards*** in the workplace are identified ***based their indicators***  1.2 Risks and hazards are evaluated based on legal requirements.  1.3 ***OSH concerns*** raised by workers are addressed as per legal requirements. |
| 1. Control OSH hazards | 2.1 Hazard prevention ***and control measures*** are implemented as per legal requirement.  2.2 Risk assessment is conductedand a risk matrix developed based on likely impact.  2.3 ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures. |
| 1. 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 ***OSH-related records*** 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.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Hazards may include but not limited to: | * Physical hazards – impact, illumination, pressure, noise, * vibration, extreme temperature, radiation * Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects * Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors * Ergonomics * Psychological factors – over exertion/ excessive force,   awkward/static positions, fatigue, direct pressure,   * varying metabolic cycles * Physiological factors – monotony, personal relationship, work out cycle * Safety hazards (unsafe workplace condition) –confined space, excavations, falling objects, gas leaks, electrical, poor storage of materials and waste, spillage, waste and debris   Unsafe workers’ act (Smoking in off-limited areas, Substance and alcohol abuse at work) |
| 1. Indicators may include but not limited to: | * Increased of incidents of accidents, injuries * Increased occurrence of sickness or health complaints/ symptoms * Common complaints of workers related to OSH   High absenteeism for work-related reasons |
| 1. OSH concerns may include but not limited to: | * Workers’ experience/observance on presence of work hazards * Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks)   Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines |
| 1. Safety gears /PPE (Personal Protective Equipment) may include but not limited to: | * Arm/Hand guard, gloves * Eye protection (goggles, shield) * Hearing protection (ear muffs, ear plugs) * Hair Net/cap/bonnet * Hard hat * Face protection (mask, shield) * Apron/Gown/coverall/jump suit * Anti-static suits   High-visibility reflective vest |
| 1. Appropriate risk controls   may include but not limited to: | * Appropriate risk controls in order of impact are as follows: * Eliminate the hazard altogether (i.e., get rid of the dangerous machine) * Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off) * Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) * Use administrative controls to reduce the risk (i.e., train workers how to use equipment safely; train workers about the risks of harassment; issue signage) * Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users) * Use personal protective equipment (i.e., wear   gloves and goggles when using the machine) |
| 1. Contingency measures may include but not limited to: | * Evacuation * Isolation * Decontamination   (Calling designed) emergency personnel |
| 1. Incidents and emergencies may include but not limited to: | * Chemical spills * Equipment/vehicle accidents * Explosion * Fire * Gas leak * Injury to personnel * Structural collapse   Toxic and/or flammable vapors emission. |
| OSH-related Records may include but not limited to: | * Medical/Health records * Incident/accident reports * Sickness notifications/sick leave application   OSH-related trainings obtained |

**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 counseling 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 | Assessment requires evidence that the candidate:   1. Identified hazards in the workplace based their indicators 2. Evaluated workplace hazards based on legal requirements. 3. Addressed OSH concerns raised by workers as per legal requirements. 4. Implemented hazard prevention and control measures as per legal requirement. 5. Conducted risk assessment as per legal requirement. 6. Developed risk matrix based on likely impact. 7. Recognized and established contingency measures in accordance with organization procedures. 8. Identified, evaluated and reviewed company OSH program based on legal requirements. 9. Implemented company OSH programs as per legal requirements. 10. Capacity built workers on OSH standards and procedures as per legal requirements 11. Maintained OSH-related records as per legal requirements. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# COMMON UNITS OF COMPETENCY

# PREPARE AND INTERPRET TECHNICAL DRAWINGS

**UNIT CODE:** ENG/OS/AUT/CC/03/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to prepare and interpret technical drawings. It involves selecting, using and maintaining drawing equipment and materials, producing plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings and applying Computer Aided Design (CAD) packages.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Use and maintain drawing equipment and materials | 1.1 ***Drawing equipment*** are identified and gathered according to task requirements  1.2 ***Drawing materials*** are identified and gathered according to task requirements  1.3 Drawing equipment are used and maintained as per manufacturer’s instructions  1.4 Drawing materials are used as per workplace procedures  1.5 Waste materials are disposed in accordance with workplace procedures and ***environmental legislations***  1.6 ***Personal Protective Equipment*** is used according to occupational safety and health regulations |
| 2. Produce plane geometry drawings | * 1. Different types of lines used in drawing and their meanings are identified according to standard drawing conventions   2. Different types of ***geometric forms*** are constructed according to standard conventions   3. Different types of angles are constructed according to principles of trigonometry   4. Different types of angles are measured using appropriate measuring tools   5. Angles are bisected according to standard conventions   2.10 Freehand sketching of different types of geometric forms, tools, equipment, diagrams is conducted |
| 3. Produce solid geometry drawings | 3.1 Drawings of patterns are interpreted according to standard conventions  3.2 Patterns are developed in accordance with standard conventions |
| 4. Produce orthographic and pictorial drawings | 4.1 Symbols and abbreviations are identified and their meaning interpreted according to standard drawing conventions  4.2 First and third angle orthographic drawings are interpreted and produced in accordance with the standard conventions  4.3 Orthographic elevations are dimensioned in accordance with standard conventions  4.4 Isometric drawings are interpreted and produced in accordance with standard conventions  4.5 Assembly drawing is produced and interpreted in line with the operating standards |
| 5. Produce electrical drawings | 5.1 Electrical symbols and abbreviations are identified and their meaning interpreted according to BS 3939  5.2 ***Electrical drawings*** are produced in accordance with BS 3939 |
| 6. Apply CAD packages | 6.1 CAD packages are selected according to task requirements  6.2 CAD packages are applied in production of electrical drawings |

**RANGE**

| **Variable** | **Range** |
| --- | --- |
| 1. Drawing equipment may include but is not limited to: | * Drawing boards * T and set squares * drawing sets * computers with CAD packages |
| 1. Drawing materials may include but is not limited to: | * Drawing papers * Pencils * Erasers * masking tapes * paper clips |
| 1. Environmental legislations may include but is not limited to: | EMCA 1999 |
| 1. Personal Protective Equipment may include but is not limited to: | * Dust coats * closed leather shoes |
| 1. Geometric forms may include but is not limited to: | * Circles * Triangles * Rectangles * Parallelogram * Polygons * Pyramids * Conic sections * Prisms * Loci |
| 1. Standard conventions may include but is not limited to: | * Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends) * Drawing scale (paper size and drawing symbols) * International drawing standards |
| 1. Electrical drawings may include but is not limited to: | * Block * Schematic * Circuit * line * wiring diagrams |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1.Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied and adhered to safety procedures   2. Cared and maintained drawing equipment   3. Interpreted circuit, assembly and lay out diagrams   4. Applied appropriate technical standards, used proper tools and equipment for a given task   5. Produced sketches and drawings   6. Applied CAD packages in production of drawings |
| 2.Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 3.Methods of Assessment | Competency may be assessed through:   * 1. Practical tests   2. Observation |
| 4.Context of Assessment | Competency may be assessed   1. Off the job 2. on the job 3. During industrial attachment |
| 5.Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ENGINEERING MATHEMATICS

**UNIT CODE: ENG/OS/AUT /CC/02/6/A**

**UNIT DESCRIPTION**

This unit describes the competencies required by a Mechatronics Engineering technician to apply a wide range of engineering mathematics in their work. This includes: applying algebraic functions, trigonometry and hyperbolic functions, complex numbers, coordinate geometry, carrying out binomial expansion, calculus, ordinary differential equations, Laplace transforms, power series, Statistics, Fourier series, Vector theory, Matrix, Numerical methods, probability, commercial calculations, estimations, measurements and calculations of quantities in solving problems.

|  |  |
| --- | --- |
| **ELEMENTS AND PERFORMANCE CRITERIAELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| * 1. Apply Algebra | 1. Calculations involving Indices are performed as per the concept 2. Calculations involving Logarithms are performed as per the concept 3. Scientific calculator is used in solving mathematical problems in line with manufacturer’s manual 4. Simultaneous equations are performed as per the rules 5. Quadratic equations are calculated as per the concept 6. Arithmetic and geometric progression problems are solved |
| * 1. Apply Trigonometry and hyperbolic functions | 1. Calculations are performed using trigonometric rules 2. Calculations are performed using ***hyperbolic functions*** |
| * 1. Apply complex numbers | * 1. Complex numbers are represented using Argand diagrams   2. Operations involving complex numbers are performed   3. Calculations involving complex numbers are performed using De Moivre’s theorem |
| 1. Apply Coordinate Geometry | * 1. Polar equations are calculated using coordinate geometry   2. Graphs of given polar equations are drawn using the Cartesian plane   3. Normal and tangents are determined using coordinate geometry   4. Loci of points are determined for given mechanism |
| 1. Carry out Binomial Expansion | * 1. Roots of numbers are determined using binomial theorem   2. Errors of small changes are determined using binomial theorem   3. Power series are derived through Binomial expansion |
| 1. Apply Calculus | * 1. Derivatives of functions are determined using Differentiation   2. Derivatives of hyperbolic functions are determined using Differentiation   3. Derivatives of inverse trigonometric functions are determined using Differentiation   4. Rate of change and small change are determined using Differentiation.   5. Calculation involving stationery points of functions of two variables are performed using differentiation.   6. Integrals of algebraic functions are determined using integration   7. Integrals of trigonometric functions are determined using integration   8. Integrals of logarithmic functions are determined using integration   9. Integrals of hyperbolic and inverse functions are determined using integration |
| 1. Solve Ordinary differential equations | * 1. First order and second order differential equations are formed.   2. First order and second order differential equations are solved using the method of undetermined coefficients   3. First order and second order differential equations are solved from given boundary conditions |
| 1. Apply Laplace transforms | * 1. Laplace transforms are solved using initial and final value theorems   2. Inverse Laplace transforms are solved using partial fractions   3. Differential equations are solved using Laplace transforms |
| 1. Apply Power Series | * 1. Power series are obtained using Taylor’s Theorem   2. Power series are obtained using Maclaurin’s theorem |
| 1. Apply Statistics | 1. Identification, Collection and Organization of data is performed 2. Interpretation, analysis and presentation of data in appropriate format is performed 3. Mean, median, mode and Standard deviation are obtained from given data |
| 1. Apply Fourier Series | * 1. Fourier series coefficients are obtained using Fourier series techniques   2. Fourier series for 2π to T is are obtained using Fourier series techniques   3. Fourier series for odd and even functions are obtained using Fourier series techniques   4. Harmonic analysis is performed using numerical methods |
| 12.Apply Vector theory | * 1. Calculations involving vector algebra, dot and cross products using vector theory   2. Gradient, Divergence and Curl are obtained   3. Vector calculations are performed using Green’s theorem   4. Vector calculations are performed using Stoke’s theorem   5. Conservative vector fields and line and surface integrals are obtained using Gauss’s theorem |
| 1. Apply Matrix | * 1. Determinant and inverse of 3x3 matrix are obtained   2. Solutions of simultaneous equations are obtained   3. Calculation involving Eigen values and Eigen vectors are performed |
| 1. Apply Numerical methods | * 1. Roots of polynomials are obtained using iterative numerical methods   2. Interpolation and extrapolation are performed using numerical methods |
| 1. Apply concepts of probability for work | * 1. Calculations are performed based on Laws of probability   2. Calculation involving probability distributions, mathematical expectation sampling distributions are performed   3. Probability events are determined from dependent, independent and mutually exclusive   4. Counting is done using permutation, combination, tree diagrams and Venn diagrams techniques |
| 1. Perform commercial calculations | * 1. Exchange rate calculations are done using devaluation and revaluation   2. Sales, stock turnover and profit and loss are determined   3. Incomes, salaries and wages are calculated |
| 1. Perform estimations, measurements and calculations of quantities | * 1. Measurement information in workplace is extracted and interpreted   2. Appropriate workplace measuring tools and equipment are identified and selected   3. Conversions are performed between units of measurement   4. Measurements are estimated and taken   5. Length, width, height, perimeter, area and angles of ***figures*** are calculated   6. Volume and surface area of figures are calculated   7. Information is recorded using mathematical language and symbols appropriate for the task |

**RANGE**

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

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| **Variable** | **Range** |
| 1. Hyperbolic functions may include but not limited to: | * + Sinh x   + Cosh x   + Cosec x   + Coth x   + Tanh x   + Sech x |
| 1. Figures may include but not limited to: | * + Triangles   + Squares   + Rectangles   + Circles   + Spheres   + Cylinders   + Cubes   + Polygons   + Cuboids   + Pyramids |
| 1. Quantities may include but not limited to: | * + Weight,   + Mass   + Area   + Volume   + Length   + Width   + Depth   + Perimeter |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Applying fundamental operations (addition, subtraction, division, multiplication)
* Using and applying mathematical formulas
* Logical thinking
* Problem solving
* 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, knowledge and range.

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| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied Trigonometry and hyperbolic functions   2. Applied complex numbers   3. Determined angles and length in triangles   4. Applied Calculus   5. Solved Ordinary differential equations   6. Applied Laplace transforms   7. Applied Power Series   8. Applied Fourier Series   9. Applied Vector theory   10. Applied Matrix   1.11 Identified and selected measuring equipment  1.12 Collected, Analyzed and presented data  1.13 Applied Numerical methods |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. on the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY AUTOMOTIVE ENGINEERING SCIENCE PRINCIPLES

**UNIT CODE: ENG/OS/AUT/CC/3/06 UNIT DESCRIPTION**

This unit describes the competencies required by a technician in order to apply a wide range of automotive science principles in their work. It involves resolving forces, determining effects of loads in automotive systems, analyzing properties of materials determining the nature of friction in automotive systems, solving problems related to motion, applying simple machines concepts, determining the effect of heat and applying the gas laws and using the concept of density and pressure.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are***  ***elaborated in the Range****.* |
| 1. Resolve forces | * 1. Forces are defined as per reference   2. Theorems are stated and explained   3. Forces are resolved as per theorems   4. Resultant forces are determined as   per the methods. |
| 2. Determine effects of loads in automotive systems. | * 1. ***Types of forces*** are identified   2. Equilibrium of forces and plane framework are calculated   3. Point loads are analyzed as per procedure.   4. Principle of moments is stated as   per reference |

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| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are***  ***elaborated in the Range****.* |
| 3. Analyse properties of materials | * 1. ***Mechanical properties and stress*** are identified in accordance with standard   2. Mechanical properties of a materials are tested as per procedure   3. Direct, shear and torsion stresses are calculated as per formula   4. Factors affecting choice of   materials are identified |
| 4. Determine the nature of friction in automotive systems | * 1. Friction is defined from reference   2. Laws of friction are stated as per reference   3. Effects of friction are identified from experiments   4. Forces to overcome friction are calculated for various situations   5. Tools and equipment are   operated |
| 5. Solve problems related to motion. | * 1. Terms are defined according to reference   2. Laws of motion are stated as per reference   3. Parameters of motion are calculated.   4. Motion graphs are drawn for |

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| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are***  ***elaborated in the Range****.* |
|  | different situations.   * 1. Relationship between linear and angular motion is established from formula   2. Motion of a vehicle on a curved and banked track is analysed as   per the laws of motion. |
| 6. Apply simple machines concepts in automotive engineering | * 1. Terms related to machines are defined from reference   2. Simple machines are described from design.   3. The law of machine is applied from formula   4. Machines performance indicators are determined from law |
| 7. Determine the effect of heat and apply the gas laws | * 1. Terms are defined in accordance with reference   2. Effects of heat on matter are identified from experiments.   3. Modes of heat transfer are identified from observation   4. Gas laws are stated from reference   5. Quantity of heat and temperature are measured using instruments   6. Problems on heat and gases are |

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| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are***  ***elaborated in the Range****.* |
|  | calculated from formula |
| 8. Use the concept of density and pressure | * 1. Terms are defined from reference   2. Parameters are measured using instruments   3. Laws and principles are stated in accordance with reference   4. Calculations on density and pressure are performed from derived formula   5. Concepts of pressure and density   are applied in vehicle systems |

**RANGE**

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

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| **Variable** | **Range** |
| 1. Types of forces may include but not limited to: | * Friction * Centrifugal * Centripetal * Gravitational * Inertia * Shear |
| 1. 1. Mechanical systems may include but not limited to: | * + Pulleys   + Levers   + Wedge   + Screws   + Wheel and axle   + Inclined plane |

# 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 automotive engineering formulas
* Use of basic mechanical machines
* Perform various unit conversions of engineering quantities
* Basic mechanical systems design
* simple machine operations
* Logical thinking
* Problem solving
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton‟s laws of motion
* Levers and pulleys
* Gear trains
* Laws of conservation of energy
* Laws of friction
* Types of forces
* Calculation of pressure and density
* Mechanical advantage and efficiency calculations
* Properties of materials
* Gas laws
* SI units of mechanical energy.
* Power transmission systems
* Operation of mechanical machines
* Mechanical calculation of power, energy, work done, torque and safety factor
* Units of measurement, conversions 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.

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| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified Mechanical systems   2. Identified Principles of automotive science   3. Performed mechanical calculations of a system   4. Identified types of forces on a system |
|  | * 1. Calculated resultant forces on plane framework   2. Identified application of forces on automotive systems   3. Tested mechanical properties of a materials   4. Identified tools and equipment for measuring system parameters   5. Recorded and interpreted measured parameters.   6. Operated Power transmission systems |
| 2. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 3. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Case studies   4. Written tests |
| 4. Context of Assessment | Competency may be assessed   1. Off the job 2. on the job 3. During industrial attachment |
| 5. Guidance information for  assessment | Holistic assessment with other units relevant to the industry sector, workplace  and job role is recommended. |

# APPLY WORKSHOP TECHNOLOGY PRINCIPLES

**UNIT CODE: ENG/OS/AUT/CC/04/6**

**UNIT DESCRIPTION**

This unit describes the competencies required to workshop technology skills. It involves using technical drawing to plan work operations, choosing of appropriate tools and materials, measuring and marking out dimensions on work pieces ,using hand tools to cut and file parts , using drills to make holes, threading using taps and dies, producing components using a lathe machine, assembling metal parts and sub-assemblies, polishing finished work, performing housekeeping, inspecting finished work for accuracy and quality and maintaining tools and equipment.

# ELEMENTS AND PERFORMANCE CRITERIA

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| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Use technical drawing to plan work operations | * 1. Technical drawings and geometric symbols are read and interpreted as per ***drawing standards.***   2. ***Operation Plan*** is produced as per the technical drawings.   3. Technical drawings are produced ***as***   per drawing Standards. |
| 2. Choose appropriate tools and materials | * 1. Working tools, equipment and materials are selected for the task.   2. The work areas are tidied up as per organization policy. |

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| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 3. Measure and mark out dimensions on workpieces | * 1. Measuring tools suitable for the work are selected   2. Measuring tools are inspected and calibrated if required   3. Dimensions are marked on the workpiece as per the working   drawing. |
| 4. Use hand tools to cut and file parts | * 1. ***Hand tools*** are selected based on operation plan   2. Workpiece is cut to specification   3. Workpiece is filed to specification   4. Part are produced to ***specifications*** |
| 5. Use drills to make holes | * 1. Hole centers are marked and center   punched as per operation plan.   * 1. Drill bits are selected and mounted   2. Workpiece is mounted and clamped   3. ***Hole is drilled*** to specification   4. Holes inspected to specification |
| 6. Thread using taps and dies | * 1. Taps and dies selected based on operation plan.   2. Taps and dies are set up on the work piece   3. Threads arecut to specification |

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| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 7. Produce components using a lathe machine | 7.1 Workpieces are turned to specification |
| 8. Assemble metal parts and sub-assemblies | * 1. Parts joined, fitted and assembled   2. Final assembly inspected as per specification |
| 9. Polish finished work | * 1. Polishingmaterial are selected   2. Finished work is cleaned   3. Finished work is polished to specification |
| 10. Perform housekeeping | * 1. Waste is segregated and disposed as per disposal guidelines.   2. Housekeeping is carried out as   per workplace requirement |
| 11. Inspect finished work for accuracy and quality | * 1. Inspection tools and methods selected as per operation plan   2. Finished work is inspected as per specification   3. Adjustments are made based on   inspections results |
| 12. Maintenance of tools and equipment | * 1. Machines and tools are inspected   2. Machines and tools are lubricated   3. Tools are ground to specification   4. Faults on machines and tools are identified and reported   5. Store tools and equipment |

**RANGE**

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

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| **VARIABLE** | **RANGE** |
| 1. Drawing Standards tools may include but not limited to: | * + ISO   + BS   + ANSI |
| 1. Operation Plan tools may include but not limited to: | * + Sequence of operations   + Measuring tools   + Hand tools   + Cutting tools   + Inspection tools |
| 1. Hand tools may include but not limited to: | * Files * Saws * Hammers * Chisels * Taps and dies |
| 1. Specifications tools may include but not limited to: | * Dimensions * Tolerances * Geometry * Surface finish |
| 1. Hole drilled tools may include but is not limited to: | * Location * Counter sinking * Counter boring * Reaming * Boring |

# 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:

* + Technical drawing
  + Using measuring and inspection tools
  + Using hand tools
  + Using portable and bench drilling machines
  + Soldering and brazing
  + Riveting and fastening
  + Basic use of the lathe machine
  + Using grinding machine

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* + Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
  + National Environment Management Authority Act, Kenya 2004
  + OSH act
  + Equipment manuals
  + Basic technical drawing complyingto ISO, ANSI & BS standards
  + ISO 1101 Geometrical tolerance and where to use the norm
  + Work Planning and documentation
  + Measuring tools
  + Hand tools
  + Bench work
  + Portable and bench drilling machines
  + Lathe machine
  + Grinding machine
  + Inspection and quality control
  + Preventive maintenance of machine tools
  + Metal cutting technology
  + Materials and metallurgy
  + WIBA act (2007)
  + Report writing

**EVIDENCE GUIDE**

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

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| 1. Critical Aspects of Competency | Assessment requires evidence that the learner:   * 1. Observed rules and procedures in the workshop   2. Interpreted technical drawing   3. Produced operation plan   4. Produced holes on a workpiece   5. Threaded using taps and dies   6. Assembled metal parts   7. Polished finished work   8. Maintained tools and equipment   9. Did housekeeping before, during and after operations |
| 2. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 3. Methods of Assessment | Competency may be assessed through:   * 1. Observing the behaviour of the learner   2. Oral presentations   3. Inspection of written operation procedures   4. Inspection of finished product   5. Observing housekeeping of the work area and/or machine tool |
| 4. Context of Assessment | Competency may be assessed   1. Off the job 2. on the job 3. During industrial attachment |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# CORE UNITS OF COMPETENCY

**PERFORM VEHICLE BASIC MAINTENANCE**

**UNIT CODE:** ENG/OS/AUT/CR/1/6

**Unit description**

This unit specifies the competencies required to perform vehicle basic maintenance. It involves assessing vehicle mechanical and operational condition, carrying out diagnosis tests, servicing vehicle lubrication system, replenishing fluids and lubrications, replacing vehicle service parts, conducting road tests carrying out adjustments o vehicle components and systems, servicing vehicle wheels and tyres and finalising service and repair procedure.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  **Bold and italicized terms are**  **elaborated in the Range** |
| 1. Assess vehicle mechanical and operational condition | * 1. Assessment is undertaken in accordance with manufacturers‟ routine and periodic maintenance schedule   2. Defects are identified using prescribed assessment methods as per service manual   3. Mechanical and operational assessment report is prepared as   per organizations approved format |
| 2. Carry out diagnostic tests | 2.1 Service ***technical information*** is  sourced as per service manual |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  **Bold and italicized terms are**  **elaborated in the Range** |
|  | 2.2. Condition and performance of the vehicle system is assessed using diagnostic equipment and tools as prescribed by the manufactures‟ specifications  2.3 Diagnostic assessment report is  prepared and provided as per the organization policy |
| 3. Service vehicle lubrication system | * 1. Vehicle lubrication system is diagnosed according   to manufacturer‟ manuals   * 1. Engine transmission and hydraulic filters are   replaced according to assessment results   * 1. Vehicle components are greased according to   manufacturer‟s specifications   * 1. Lubrication system pressure is tested according to   workshop procedures |
| 4. Replenish fluids and lubricants | 4.1 Lubricants for engines and transmissions are  obtained using vehicle  manufacturers‟ specifications |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  **Bold and italicized terms are**  **elaborated in the Range** |
|  | * 1. Grades of fluids for brakes and clutch operation, power assisted steering, cooling system, windscreen washers and diesel exhaust emission control are identified and obtained as per manufactures‟ technical information   2. Protective measures on lubricants and fluids are   applied as per the workplace policy and OSHA 2007.   * 1. Lubricants and fluids are replenished as prescribed by vehicle manufacturers‟ specifications.   2. Waste oil and fluids are disposed in compliance with   workplace policy and OSHA 2007. |
| 5. Replace/service vehicle service parts | * 1. Tools and equipment for use are selected, obtained and assembled based on service manual   2. Vehicle service parts are identified, verified, replaced and adjusted as   per manufacturer‟s part numbers. |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  **Bold and italicized terms are**  **elaborated in the Range** |
|  | * 1. Teston the vehicle is carried out to ascertain replaced/serviced parts perform according to the service manual   2. Worn out/damage parts are disposed as per the workplace policy and OSHA 2007   3. Vehicle replacement/servicing records are prepared and kept according to the workplace requirements   4. Maintenance activities are completed within an agreed time   frame as per organization policy |
| 6. Conduct road tests | * 1. Visual inspection of the vehicle and its system is carried out as per manufacturers specifications   2. Vehicle is road-tested in compliance with company standards, traffic rules and   manufacturers‟ standards |
| 7. Carry out adjustments to vehicle components and systems. | * 1. Using of manufacturers technical information to identify operating specifications and tolerances   2. Identifying components and |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  **Bold and italicized terms are**  **elaborated in the Range** |
|  | systems that are to be checked and  adjusted |
| 8. Service Vehicle Wheels and Tyres | * 1. Identify and repair tyre punctures according to vehicles fault   2. Perform wheel balancing according to standard operating procedures   3. Perform tyre fitting on the rim according to SOP   4. Straighten bent wheel rims according to SOP   5. Replace tyre pressure nozzles according to SOP   6. Maintain tyre pressure according to   manufacturer‟s specifications. |
| 9. Finalize service and repair procedures. | * 1. Vehicle interior and exterior is cleaned and made presentable in compliance with company policy   2. Vehicle service and repair report is prepared and shared as per the organizations requirement   3. Service and repair records are   maintained as per organization policy. |

**RANGE**

This section provides work environments and conditions to which the performance criteria

apply. It allows for different work environments and situations that will affect performance.

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| **Variable** | **Range** |
| 1. Technical information may include but not limited to: | * + Vehicle technical data;   + Manufacturers‟ online information;   + Schedules of inspection;   + Legal regulations   + On-board diagnostics (OBD) displays. |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Organizational and legislative requirements
* Manufacturer's warranty requirements relating to routine maintenance activities for vehicle systems and components
* Methods of assessing vehicle conditions
* Report writing
* Technical information
* Customer relation
* Diagnostic tools and equipment
* Rectification system defects
* Vehicle fluids and lubricants
* Vehicle systems and components
* Vehicle inspection
* Legal requirements relating to the vehicle maintenance activities for vehicle systems and components
* Kenyan legislation and workplace procedures relevant to:
  + Health and safety
  + The environment (including waste disposal)
  + Appropriate personal and vehicle protection
* Workplace procedures for:
* Recording vehicle maintenance work and any variations from the
  + Original vehicle specification
  + The referral of problems
* Reporting delays to the completion of work
* documenting vehicle maintenance information
* work timeframe
* Sharing of information at workplace
* Relationship between time and costs
* Reporting anticipated delays to relevant person(s) promptly
* Technical information
  + Finding and sources
  + Importance of correctness in sourcing
  + Use
  + interpreting
* On-board diagnostic displays
* Purpose of and how to use identification codes
* Operation of vehicle systems
* Engines, cooling systems, air supply and exhaust systems, fuel systems and ignition systems operate for different vehicles
* How clutch assemblies, clutch operating systems, manual gear boxes, automatic gear boxes, drivelines and hubs and final drive assemblies operate for different vehicles
* Suspension systems, steering systems, braking systems, wheels and tyres for motor vehicle operate
* The purpose, operating principles and location of vehicle batteries, charging systems, starting systems, lighting systems and ancillary equipment for the different type of vehicle
* The operating specifications and tolerances for the different type(s) of vehicles
* The hazards associated with high energy electrical components
* Routine maintenance requirements
* How to conduct scheduled, routine light vehicle maintenance activities using prescribed examination methods and assessments against vehicle specifications to identify damage, corrosion, inadequate fluid levels, leaks, wear, security problems and general condition and serviceability
* How to check and adjust clearances, gaps, settings, alignment, pressures, tension, speeds and levels relevant to the engine area, transmission area, chassis area, electrical area and body (including to valves, ignition, fuel and emissions, brakes, transmission, lights, headlight alignment, tyres and tyre rotation, steering and body fittings).
* How to replenish and replace routine service components and materials, including filters, drive belts, spark plugs, wiper blades, brake linings and pads, lubricants and fluids
* How to recognise and report cosmetic damage to vehicle components and units that are outside the scope of normal routine service
* How to identify codes and grades of lubricants, brake/clutch fluids and coolants
* How to work safely avoiding damage to the vehicle and its systems
* The consequence of using incorrect lubricants, fluids and components

**REQUIRED SKILLS**

* Communications (verbal and written);
* Trouble shooting
* Proficient in ICT;
* Time management;
* Problem solving;
* Decision making;
* Multitasking;
* First aid;
* Report
* Driving.
* Planning
* Writing

**EVIDENCE GUIDE**

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

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| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Used manufacturers‟ technical information and prescribed procedures in vehicle maintenance activities   2. Established and recorded accurate diagnosis of vehicle systems   3. Serviced vehicle components as per the service manual and customer‟s specification   4. Replenished fluids and carried out adjustments and replacement of serviceable part   5. Recorded work that was carried out, including   the assessment of vehicle condition and its systems |

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|  | * 1. Conducted road test and handed the vehicle to the customer in a clean condition   2. Prepared maintenance records |
| 2. Resource Implications. | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 3. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Observation with the use of checklists;   2. Verbal questioning during maintenance activities to test underpinning knowledge;   3. Short-answer tests to assess understanding of   vehicle systems and the importance of using correct lubricants and fluids. |
| 4. Context of Assessment. | Competency may be assessed   1. Off the job 2. on the job 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. |

# SERVICE AND REPAIR VEHICLE ENGINE COMPONENTS

**UNIT CODE: ENG/OS/AUT/CR/2/6**

**Unit description:**

This unit specifies competencies required to service and repair vehicle engine components. It involves troubleshooting and servicing vehicle engine components, performing vehicle engine overhaul, servicing vehicle engine cooling system, servicing vehicle engine exhaust system and lubricating vehicle engine system

**ELEMENTS AND PERFORMANCE CRITERIA**

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
| 1. Troubleshoot vehicle ***engine components*** condition | * 1. Personal protective equipment (PPE) are used as per OSHA 2007   2. Health and safety regulations are observed as per OSH Act 2007   3. Engine is removed according to manufacturer‟s specification   4. Engine parts are dismantled according to manufacturer‟s specification   5. Engine parts are inspected and checked as per workplace procedures   6. Engine defective parts are replaced   according to manufacturer‟s |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | specification   * 1. Engine parts are serviced according to manufacturer‟s specification   2. Vehicle engine parts are reassembled according to manufacturer‟s specification   3. Engine is fit back into the vehicle according to manufacturer‟s specification   4. Re-installation checks are performed according to manufacturer‟s specification |
| 2. Perform vehicle engine overhaul | * 1. Engine oil seals are replaced according to manufacturer‟s specification   2. Engine oil rings/ piston gudgeon pin are replaced according to manufacturer‟s specification   3. Timing belts/chains are replaced according to manufacturer‟s specification   4. Engine bearings are replaced according to manufacturer‟s specification   5. Engine pulleys are replaced according   to manufacturer‟s specification |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | * 1. Engine V-belts are replaced according to manufacturer‟s specification   2. Engine gaskets are replaced according to manufacturer‟s specification   3. Engine blocks are serviced according to manufacturer‟s specification   4. Water/oil pump is replaced according to manufacturer‟s specification   5. Tappet clearance is adjusted according to manufacturer‟s specification   6. Engine camshaft is replaced according to manufacturer‟s specification   7. Valve seats are grinded according to manufacturer‟s specification   8. Valve guides are replaced according to manufacturer‟s specification   9. Oil sump/strainer/PCV is replaced according to manufacturer‟s specification   10. Engine mountings are replaced according to manufacturer‟s specification   11. Engine tune up is performed according to manufacturer‟s specification |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
| 3. Service vehicle engine cooling system | * 1. 3.1 Radiator cap is checked and tested according to manufacturer‟s specification   2. Cooling radiator is checked and tested according to manufacturer‟s specification   3. Cooling system hoses are checked and tested according to manufacturer‟s specification   4. Thermostat operations are checked and tested according to manufacturer‟s specification   5. Thermistor switches/ sensors are checked and tested according to manufacturer‟s specification   6. Water pump is checked and tested according to manufacturer‟s specification   7. Cooling fan operation is checked and tested according to manufacturer‟s specification   8. Cooling system is pressure tested according to manufacturer‟s specification   9. Cooling system is bled according to |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | manufacturer‟s specification   * 1. Vehicle engine coolant is “read” according to manufacturer‟s specification   2. Coolant is replenished/ drained and replaced according to manufacturer‟s specification |
| 4. Service vehicle engine exhaust system | * 1. Leakage is checked according to workplace procedures   2. Blockage is checked according to workplace procedures   3. Catalytic converter/ particulate filters is checked and tested according to workplace procedures   4. Exhaust system leaks are repaired according to manufacturer‟s specification   5. Exhaust system is installed and mounted according to manufacturer‟s specification   6. Oxygen sensor is checked and tested according to manufacturer‟s specification |
|  | 4.7 Draining and replacing engine oil |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the  required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | * 1. Replacing engine transmission and hydraulic filters   2. Greasing light vehicle components   3. Greasing heavy commercial vehicle components   4. Greasing Heavy machinery   5. Reading Lubricants |
| 5. lubricate vehicle engine system | * 1. engine oil is drained and replaced according to manufacturer‟s specification   2. engine transmission and hydraulic filters are replaced according to manufacturer‟s specification   3. light vehicle components are greased according to manufacturer‟s specification   4. heavy commercial vehicle components are greased according to manufacturer‟s specification   5. Heavy machinery are greased according to manufacturer‟s specification   6. Lubricants are “read” according to   manufacturer‟s specification |

**RANGE**

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

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| **Variable** | **Range** |
| 1. Re-installation checks may include but is not limited to: | * 1. bleeding   2. engine ignition timing   3. initialization |
| 2.Engine components may include but is not limited to: | * 1. Oil seals and oil filters   2. Piston and piston rings   3. Top covers   4. Valves, push rods and valve lifters   5. Camshaft   6. Crankshaft   7. Drive pulleys   8. Oil sump and oil pump   9. Timing gears   10. Cylinder head   11. Cylinder block |
| 3.Engine pulleys may include  but is not limited to: | * 1. water pump   2. camshaft |
| 4. Engine V-belts may include  but is not limited to: | * 1. fan   2. power steering |

**REQUIRED KNOWLEDGE AND SKILLS**

**The individual needs to demonstrate knowledge of:**

* Legislative and organizational requirements and procedures
* Kenyan legislation and workplace procedures relevant to:
  + Health and safety
  + Environment
  + Personal and vehicle protective equipment
  + Waste disposal
* Legal requirements relating to the vehicles warranty and insurance policies
* Workplace procedures for:
  + Recording the fault, the location and fault correction activities
  + Reporting the results of tests
  + The referral of problems
  + Reporting anticipated delays
* Assessment and rectification procedures
* Obtaining the correct information for rectification
* Documenting assessment and rectification information
* Working to agreed time frame and keeping others informed of progress
* The relationship between time, costs and profitability
* Reporting anticipated delays
* How to find, interpret and use technical information for engine service activities
* Importance of using the correct technical information
* The purpose of and how to use identification codes.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written)
* Proficient in ICT
* Time management
* Problem solving
* Decision making
* Planning
* Multitasking
* First aid
* Report writing
* Driving

**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. | ***sessment requires evidence that the candidate***:   * 1. Used Personal protective equipment (PPE)   2. Observed Health and safety regulations   3. Removed engine   4. Dismantled engine parts and inspected them   5. Replaced defective engine parts   6. Serviced engine parts   7. Reassembled vehicle engine parts   8. Fit back engine into the vehicle   9. Performed vehicle engine overhaul   10. Serviced vehicle engine cooling system   11. Serviced vehicle engine exhaust system   12. Lubricated vehicle engine system |

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| 2. Resource implications. | ***The following resources must be provided:***   * 1. A workshop that is fully equipped for the service and repair of vehicle engines   2. Instruments and equipment for measuring and assessing the condition of engine components   3. Access to manufacturers‟ technical information   4. Facilities for the disposal of waste oil and scrap parts   5. Customer database and systems for recording service records   6. Personal protection equipment   7. Access to computers |
| 3. Methods of assessment. | ***Competency may be assessed through:***   * 1. Observation with the use of checklists   2. Verbal questioning during service and repair activities to test underpinning knowledge   3. Short-answer tests to assess understanding of engine operations, measuring, assessing   component condition and fault rectification. |
| 4. Context of Assessment. | Competency may be assessed individually in an actual workplace or in work- simulated conditions within accredited  institutions. |
| 5. Guidance information for  assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |

# SERVICE VEHICLE FUEL SYSTEM

**UNIT CODE: ENG/OS/AUT/CR/3/6**

**Unit description:**

This unit specifies competencies required to service vehicle fuel system. It involves, servicing fuel components, replacing petrol fuel and diesel injector pumps, pipes, rail and nozzles, performing injector pump timing and testing fuel injector and injection pressure and voltage.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are***  ***elaborated in the Range*** |
| 1. Service fuel components e.g. injectors, tank | * 1. Identify the component to be serviced according to vehicle‟s performance.   2. Tools and equipment are used according to manufacturer‟s manual.   3. Remove faulty component according to manufacturer‟s manual.   4. Service the faulty component according to manufacturer‟s   manual. |
| 2. Replace petrol fuel pump | 2.1 Petrol fuel pump location is identified as per manufacturers |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are***  ***elaborated in the Range*** |
|  | manual   * 1. Petrol fuel pump is removed and replaced as per manufacturers manual   2. Tools and Equipment are used to remove and refit petrol fuel components as per   manufacturers‟ manual   * 1. Faulty fuel pump is stored as per company policy   2. Fuel system operation test is   conducted as per manufacturers manual |
| 3. Replace diesel injector pump, rail, pipes and nozzles | * 1. Diesel injector pump, rail, pipes and nozzles location is identified as per manufacturers manual.   2. Pump, rail, pipes and nozzles are removed as per ***manufacturer’s procedure.***   3. New pump, rail, pipes and nozzles are fitted as per manufacturers manual.   4. Air bubbles from the fuel system are removed by bleeding the system in accordance with the   manufacturer‟s specification. |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are***  ***elaborated in the Range*** |
|  | 3.5 Diesel system operation test is conducted as per manufacturer‟s  manual |
| 4. Perform injector pump timing | * 1. Fan belt and timing cover are removed in accordance with the workshop manual   2. Timing marks are identified in accordance with manufacturers‟ manual   3. Timing marks are aligned and timing belt fitted as per manufacturers manual   4. Timing belt tensioner is adjusted and timing marks reconfirmed as per manufacturers manual   5. Timing cover and fan belt are fitted back as per manufacturers manual   6. Diesel system operation test is   performed as per manufacturers manual |
| 5. Test fuel injectors for injection pressure and voltage | * 1. Identify the gauges for testing according manufacturer‟s specification.   2. Tools and equipment are   identified according to |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are***  ***elaborated in the Range*** |
|  | manufacturer‟s manual.   * 1. Connect the gauges according to manufacturer‟s manual   2. Take the measurements according to manufacturer‟s specification.   3. Record and file results according to standard operating procedures   (SOP) |

**RANGE**

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

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| **Variable** | **Range** |
| 1. Tools and equipment may include but is not limited to: | * 1. Specialist tools relevant to specific vehicle makes and models;   2. General workshop equipment;   3. Electrical multi-meter   4. Fuel system pressure gauge   5. Faulty code diagoniser   6. Prepared and shared vehicle fuel system service report |
| 2. Components may include but is not limited to: | * 1. Fuel pump   2. Fuel filter   3. Fuel tank |

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| **Variable** | **Range** |
|  | * 1. Fuel high pressure pump   2. Fuel pipes   3. Fuel feed pump   4. Injectors   5. Fuel level gauge   6. Fuel sensors |
| 3. Manufacturer‟s procedure may include but is not limited to: | * 1. Vehicle technical data   2. Manufacturers‟ tolerances and specification data.   3. Manufacturers‟ specifications   4. Approved company practices |
| 4. Gauges may include but is  not limited to: | 4.1 Pressure gauge  42 Multimeter gauge |
| 5. Measurements may include  but is not limited to: | * 1. Injection pressure   2. Injection voltage |
| 6. standard operating procedures (SOP) may include but is not limited  to: | * 1. Company policy   2. Filling system   3. Record management procedures   4. Client satisfaction procedures. |

**REQUIRED KNOWLEDGE AND SKILLS**

The individual needs to demonstrate knowledge of:

* Handling fuel in line with health and safety precautions
* Interpretation of symbols on the manufacturers manual
* Fuel system
* Legislative and organisational requirements and procedures
* Kenyan legislation and workplace procedures relevant to:
* health and safety;
* the environment (including waste disposal
* Appropriate personal and vehicle protective equipment.
* Legal requirements relating to the vehicle, its construction and fuel and exhaust emission control. Workplace procedures for:
  + Recording fault location and correction activities;
  + Reporting the results of tests;
  + The referral of problems;
  + Reporting delays to the completion of work.

The importance of working to recognized assessment and rectification

* Procedures and obtaining the correct information for rectification.
* The importance of documenting assessment and rectification information.
* The importance of working to agreed timescales and keeping others informed of progress
* The importance of reporting anticipated delays to relevant person(s) promptly.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written)
* Proficient in ICT
* Time management
* Interpretation
* Problem solving
* Planning;
* Decision making;
* Multitasking;
* First aid;
* Report writing;
* Driving

**EVIDENCE GUIDE**

This provides advice on assessment and is dealt in conjunction with the performance criteria, required skills and knowledge and range.

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| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Worked in a safe and clean environment using personal protection and appropriate tools and equipment;   2. Observed regulations concerned with health and safety and the disposal of waste;   3. Used technical information to service vehicle fuel system in accordance with manufacturers‟ specifications;   4. Inspected and replaced fuel system components;   5. Tested fuel system for satisfactory operation   as per the manufacturers specifications. |
| 2. Resource implications. | ***The following resources must be provided:***   * 1. Workshop that is fully equipped for the service of vehicle fuel system   2. Specialist tools relevant to specific vehicle makes and models;   2.4 Electrical Multimeter   * 1. Access to manufacturers‟ technical information;   2. Facilities for the disposal of waste fuel and scrap parts;   3. Customer database and systems for service records;   2.11 Personal protection equipment. |
| 3. Methods  of assessment. | Competency may be assessed through:  3.1 Observation with the use of checklists |

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|  | * 1. Verbal questioning during practical activities   2. Short-answer tests |
| 4. Context of assessment. | Competency may be assessed individually in an  actual workplace or in work-simulated conditions within accredited institutions. |
| 5. Guidance information  for assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |

# SERVICE VEHICLE TRANSMISSION SYSTEMS

**UNIT CODE: ENG/OS/AUT/CR/4/6**

**UNIT DESCRIPTION:**

This unit specifies competencies required to service vehicle transmission system. It involves preparing to service vehicle transmission systems, removing, assessing, repairing/replacing and testing the vehicle transmission system.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
| 1. Organize to service vehicle transmission system | * 1. Work area is cleaned and safety measures undertaken before use as per workshop regulations/ OSHA   2. Vehicle is parked on a workshop hoist as per workshop regulations   3. Tools and equipment and materials are availed as per manufacturers recommendation   4. Identify relevant workforce according to   workshop procedures. |
| 2. Troubleshoot vehicle transmission system | * 1. Visual inspection of the vehicle is done according to workshop procedures.   2. Technical inspection is done while engine is running according to manufacturer‟s specifications.   3. Vehicle is inspected underneath |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | according to workshop setup.  2.4 Faulty components are established according to inspection done. |
| 3. Overhaul gear box unit (Manual) | * 1. Drain gearbox oil according to workshop procedures.   2. Remove faulty gearbox from vehicle according to manufacturer‟s manual.   3. Clean external housing of the gearbox according to workshop procedures.   4. Dismantle faulty gearbox according to manufacturer‟s manual.   5. Clean internal ***manual gearbox components*** according to workshop procedures.   6. Service and replace worn out gearbox components according to manufacturer‟s specifications.   7. Assemble serviced/new components of the gearbox according to manufacturer‟s manual.   8. Fit new gearbox mounting according to workshop procedures.   9. Refit serviced gearbox to the vehicle according to manufacturer‟s manual.   10. Refill gearbox oil to the   Recommended level according to |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | manufacturer‟s specification.  3.11 Test serviced gearbox according to workshop procedures. |
| 4. Overhaul gearbox (semi/automatic) | * 1. Drain automatic transmission fluid (ATF) according to workshop procedures.   2. Remove faulty gearbox from the vehicle according to manufacturer‟s manual.   3. Clean external housing of the gearbox according to workshop procedures.   4. Dismantle faulty gearbox according to manufacturer‟s manual.   5. Clean internal ***semi/automatic gearbox components*** according to workshop procedures.   6. Service and replace worn out gearbox components according to manufacturer‟s specifications.   7. Assemble serviced/new components of   the gearbox according to manufacturer‟s manual.   * 1. Fit new gearbox mountings according to workshop procedures.   2. Refit serviced gearbox to the vehicle according to manufacturer‟s manual.   3. Refill ATF to the recommended level   according to manufacturer‟s |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | specification.  4.11 Test serviced gearbox according to workshop procedures. |
| 5. Carry out hydraulic/tiptronic system tests and measurements | * 1. Identify tools and equipment according to manufacturer‟s specifications.   2. Perform stall test according to manufacturer‟s manual   3. Perform pressure test according to manufacturer‟s specifications.   4. Perform shift test according to manufacturer‟s specifications.   5. Perform tiptronic diagnosis test using fault diagnostic gadget according to manufacturer‟s manual.   6. Record and file results according to   standards operation 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.

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| **Variable** | **Range** |
| 1. Components may include  but is not limited to: | * 1. Bearings   2. Gears |

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| **Variable** | **Range** |
|  | * 1. Synchromesh unit   2. Gearbox shafts and thrust plates   3. Gear selectors, sensors and linkages   4. Constant velocity and universal joints   5. Clutch assemblies release bearings   6. Automatic gearbox pump and oil strainer   7. Transmission unit mounting   8. Flywheel   9. Transmission drive shaft/half shaft   10. Propeller shaft/center rubber |
| 2. Manual gearbox components may include but is not limited to: | * 1. Input shaft   2. Lay shaft   3. Output shaft   4. Speed gearwheels   5. Synchronizer unit   6. Selector shafts/forks |
| 3. Semi/automatic gearbox components may include but is not limited to: | * 1. Fluid flywheel   2. Torque convertor   3. Shift valve   4. Brake bands   5. Front clutch   6. Rear clutch   7. Sun wheel gears   8. Planetary gears   9. Carrier gear   4.0 Output shaft |

**REQUIRED KNOWLEDGE AND SKILL**

**Required knowledge**

The individual needs to demonstrate knowledge of:

 Operation of transmission systems

 Measuring, assessing the condition of components

 Fault rectification

 Kenyan legislation and workplace procedures relevant to:

o health and safety

o the environment (including waste disposal

o personal and vehicle protective equipment

* Legal requirements relating to the vehicle and its construction
* Workplace procedures for:
  + recording fault location and correction activities;
  + reporting the results of tests;
  + the referral of problems;
  + reporting delays to the completion of work
* Recognized assessment and rectification
* Procedures and obtaining the correct information for rectification
* Documenting assessment and rectification information
* Working within given time frame and sharing information
* The relationship between time, costs and profitability
* How to find, interpret and use sources of technical information for transmission of servicing activities
* Reporting anticipated delays to relevant person(s)
* Purpose of, and how to use identification codes
* How to prepare, inspect, test and use all the removal and replacement equipment required
* Operation of transmission systems
* Gaskets, sealants, seals, fittings and fasteners
* Test and evaluate the performance of replacement transmission system units and components
* The relationship between testing methods and the transmission system units and components replaced – the use of appropriate test methods
* When replacement units and components must meet the original equipment specification (OES) for warranty or other requirements
* How to work safely avoiding damage to other vehicle systems, units and components and contact with leakage and hazardous substances
* How to work safely avoiding damage to other vehicle systems, units and components and contact with leakage and hazardous substances

**Required Skills**

The individual needs to demonstrate the following skills:

* Decision making;
* Multitasking;
* First aid;
* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Problem solving;
* Planning;
* Report writing;
  + Driving

**EVIDENCE GUIDE**

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

|  |  |
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| 1. Critical Aspects of Competency. | ***Assessment requires evidence that the candidate***:   * 1. Worked in a safe and clean environment using personal protection and appropriate tools and equipment;   2. Observed regulations concerned with health |

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|  | and safety and the disposal of waste;   * 1. Used technical information to remove and dismantle transmission units and assess components against manufacturers‟ specifications   2. Prepared recommendations for the repair and restoration of components   3. Restored, reassembled and replaced transmission units to accord with   manufacturers‟ specifications   * 1. Prepared vehicle transmission system servicing report.   2. Completed vehicle transmission system   servicing within agreed time frame. ` |
| 2. Resource Implications. | ***The following resources must be provided:***   * 1. Workshop fully equipped for servicing motor vehicle transmission systems   2. Vehicle lift,   3. Specialist tools and equipment appropriate for the different makes of vehicles   4. Instruments and equipment for measuring and assessing the condition of transmission units;   5. Specialist equipment for servicing automatic transmission units;   6. Access to manufacturers‟ technical information;   7. Facilities for the disposal of waste oil and scrap parts;   8. Customer database and systems for recording service records;   9. Personal protection equipment. |

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| 3. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Observation with the use of checklists;   2. Verbal questioning during service and repair activities   3. Short-answer tests |
| 4. Context of Assessment. | Competency may be assessed individually in an actual workplace or in work-simulated  conditions within accredited institutions. |
| 5. Guidance information for  assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |

# SERVICE VEHICLE STEERING SYSTEM

**UNIT CODE: ENG/OS/AUT/CR/5/6**

**UNIT DESCRIPTION:**

This unit specifies competencies required to service vehicle steering system. It involves assessment, removal, servicing and replacement of vehicle steering components. It also involves fitting and testing vehicle steering components and documenting vehicle steering service.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| ELEMENT  These describe the key outcomes which make the workplace function. | PERFORMANCE CRITERIA  These are assessable statements which specify the required level of performance for each of the elements.  Bold and italicized terms are elaborated in the  Range |
| 1. Assess vehicle steering system | * 1. Work area and steering units are prepared as per the workshop procedures   2. ***Tools and equipment*** are assembled as per job assignment   3. Vehicle steering system checklist is prepared based on workplace requirements   4. Personal protective clothing and equipment (***PPE***) is used as per ***OSHA 2007***   5. Steering systems are visually inspected in accordance with service manual   6. Faulty steering components are identified as   per the service manual |
| 2. Remove steering  components | 2.1 ***Technical information*** is used according to  the service manual |

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| ELEMENT  These describe the key outcomes which make the workplace function. | PERFORMANCE CRITERIA  These are assessable statements which specify the required level of performance for each of the elements.  Bold and italicized terms are elaborated in the  Range |
|  | 2.2 Vehicle is raised in accordance with workshop procedures  2.2 ***Lubricants and fluids*** are drained and disposed according to health and safety standards  2. Steering components are removed as per  service manual |
| 3. Assess serviceability of vehicle steering components | * 1. ***Steering components*** are disassembled as per the service manual   2. Steering components are cleaned in accordance with service manual   3. Serviceability of steering components is   ***assessed*** as per the service manual 3.4Serviceability report is prepared in accordance  with workshop procedure |
| 4. Replace/service vehicle steering components | * 1. Worn/damaged components are replaced as per manufacturer‟s manual   2. Replacement parts are verified against manufacturers‟ part numbers   3. Steering components are re-assembled in accordance with manufacturers‟ specification   4. Vehicle steering components are serviced   according to the service manual |
| 5. Fit and test vehicle steering components | * 1. Steering components are fitted back as per service manual   2. Lubricants and fluids are replenished |

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| --- | --- |
| ELEMENT  These describe the key outcomes which make the workplace function. | PERFORMANCE CRITERIA  These are assessable statements which specify the required level of performance for each of the elements.  Bold and italicized terms are elaborated in the  Range |
|  | according to the service manual 5.3***Steering geometry*** is set in accordance with  manufacturers‟ specifications   * 1. Steering system is tested as per the manufacturers specification   2. ~~R~~oad test is carried out in accordance with   manufacturers‟ specifications |
| 6. Document vehicle steering system service | 6.1. Steering service and repair is completed according to workplace policy/customer‟s specification   * 1. Vehicle steering service system report is prepared as the SOPs   2. Steering ***service and repair records*** are generated and shared in line with company   standard operating 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.

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| --- | --- |
| **Variable** | **Range** |
| 1. Steering components may include but is not limited to: | * 1. Steering rack   2. Tie rods; 1.3Steering box 1.4Steering column   3. Universal joint/coupling   4. Drop arm   5. Dust rubber boot   6. Steering wheel |
| 3. Assessment methods. | * 1. Visual   2. Measurement   3. Acoustic   4. Vibration   5. Functional   6. Serviceable   7. Unserviceable   8. Tolerances |
| 5. Steering geometry  / wheel alignment | * 1. Toe in / Toe out   2. Castor   3. Camber   4. Kingpin inclination |
| 6. Service and repair records | 1. Job cards    1. Company IT system    2. Customer database |
| 7. Agreed timeframe | * 1. Manufacturers‟ recommended work times   2. Job times set by the company   3. Job time agreed with a specific customer |

**REQUIRED KNOWLEDGE AND SKILLS**

The individual needs to demonstrate knowledge of:

* Kenyan legislation and workplace procedures relevant to:
  + health and safety
  + the environment (including waste disposal
  + personal and vehicle protective equipment
* Legal requirements relating to the vehicle and its construction
* Workplace procedures for:
  + recording fault location and correction activities;
  + reporting the results of tests;
  + the referral of problems;
* reporting delays to the completion of work
* sources of technical information
* How to use wheel alignment and steering geometry measuring and adjusting equipment
* Construction and operation of suspension and steering systems
* The construction, layout and operation of different types of suspension systems, including:
  + Beam axle;
  + Independent types; front and rear;
  + Hydro-Pneumatic;
  + Active suspension and their control systems.
  + Types of springs and how they are mounted and located on the vehicle
  + The layout and operation of different types of steering systems, including
* Different types of steering gear, including:
  + Rack and pinion;
  + Recirculating ball.
  + Hydraulic and electronic power assisted
* The principles of suspension and steering geometry including:
  + Front and rear wheel alignment;
  + Toe-out-on-turns;
  + Camber;
  + Castor;
  + Kingpin inclination.
* How to remove and replace suspension and steering system units and components for the classification of vehicle being worked on
* How to select and use gaskets, sealants, seals, fittings and fasteners
* How to test and evaluate the performance of replacement suspension and steering system units and components against vehicle operating specifications, and any legal requirements
* When replacement units and components must meet the original equipment specification (OES) for warranty or other requirements
* How to work safely avoiding damage to other vehicle systems, units and components

**Required Skills**

The individual needs to demonstrate the following foundation skills:

* Decision making;
* Multitasking;
* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Problem solving;
* Planning
* First aid;
* Report writing;
* Record keeping
* Driving

**EVIDENCE GUIDE**

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

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| 1. Critical aspects of Competency. | ***Assessment requires evidence that the candidate***:   * 1. Worked in a safe and clean environment using personal protection and appropriate tools and equipment;   2. Observed regulations concerned with health and safety and the disposal of waste   3. Used technical information to remove and dismantle steering units   4. Assessed vehicle steering components against manufacturers‟ specifications   5. Repaired/serviced, replaced and restored components as per manufacturer‟s specification   6. Reassembled steering components in accordance with manufacturers‟ specifications   7. Completed steering system servicing within set time frame   1.6 Documented steering servicing records as per  customer specifications and company policy. |
| 2. Resource implications. | ***The following resources must be provided:***   * 1. A workshop that is fully equipped for servicing vehicle steering systems.   2. Vehicle lift   3. Tool kits and vehicle steering equipment   4. Access to manufacturers‟ technical information   5. Facilities for the disposal of waste oil and scrap parts   6. Customer database   7. Personal protection equipment |

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|  | 2.8 Computer |
| 3. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Observation   2. Verbal   3. Written |
| 4. Context of Assessment. | Competency may be assessed individually in an actual workplace or in work-simulated  conditions within accredited institutions. |
| 5. Guidance information for  assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |

# SERVICE VEHICLE SUSPENSION SYSTEMS.

**UNIT CODE: ENG/OS/AUT/CR/6/6**

**Unit description:**

This unit specifies competencies required to service vehicle suspension system. It involves assessment, removal, servicing and replacement of vehicle suspension components. It also involves fitting and testing vehicle suspension components and documenting vehicle suspension service.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  Bold and italicized terms are elaborated in the  Range |
| 1. Assess vehicle suspension system | * 1. Work area and steering units are prepared as per the workshop procedures   2. ***Tools and equipment*** are assembled as per job assignment   3. Vehicle suspension checklist is prepared according to the workplace requirements   4. Personal protective clothing and equipment (***PPE***) is used as per ***OSHA 2007***   5. Suspension systems are visually inspected in accordance with service manual   6. Faulty suspension components are identified   as per the service manual |
| 2.Remove vehicle suspension  components | * 1. ***Technical information*** is used according to the service manual   2. Vehicle is raised in accordance with |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  Bold and italicized terms are elaborated in the  Range |
|  | workshop procedures  2. Suspension components are removed as per service manual |
| 3. Assess vehicle suspension components serviceability | * 1. ***Suspension components*** are disassembled as per the service manual   2. Suspension components are cleaned in accordance with service manual   3. Serviceability of suspension components is   ***assessed*** as per the service manual   * 1. Suspension component serviceability report   is prepared in accordance with workshop procedure |
| 4. Replace/service vehicle suspension components | * 1. Worn/damaged components are replaced as per manufacturer‟s manual   2. Suspension components‟ replacement parts are verified against manufacturers‟ part numbers   3. Suspension components are re-assembled in accordance with manufacturers‟ specification   4. ***Hydrolastic suspension components*** are replaced according to service manual   5. ***Hydro-pneumatic components*** are replaced according to service manual   6. ***Macpherson strut suspension components***   are serviced/replace as per the service manual |
| 5. Fit and test vehicle | 5.1 Suspension components are fitted back as per |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  Bold and italicized terms are elaborated in the  Range |
| suspension components | service manual   * 1. ***Suspension alignment***s set in accordance with manufacturers‟ specifications   2. ~~R~~oad test is carried out as per the service manual   3. Vehicle suspension service checklist is filled   in accordance with workplace policy |
| 6. Vehicle suspension system service documentation | 6.1. Suspension service and repair is completed within workplace policy/customer‟s specification   * 1. Vehicle suspension service system report is prepared as the SOPs   2. Suspension ***service and repair records*** are generated and shared in line with company   standard operating 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.

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| **Variable** | **Range** |
| 1. Suspension  components may include but is not | * 1. Wishbone/arms   2. Shock absorbers/dampers 1.3Strut |

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| **Variable** | **Range** |
| limited to: | 1.4Torsion bar 1.5Stabilizer  1.6 Coil/leaf/rubber spring |
| 3. Assessment methods may include but is not limited to: | * 1. Visual   2. Measurement   3. Acoustic   4. Vibration   5. Functional   6. Serviceable   7. Unserviceable   8. Tolerances |
| 5. Suspension alignments may include but is not  limited to: | * 1. Wheel base   2. Wheel track |
| 6. Service and repair records may include but  is not limited to: | 1. Job cards    1. Company IT system    2. Customer database |
| 7. Agreed timeframe may include but is not  limited to: | * 1. Manufacturers‟ recommended work times   2. Job times set by the company   3. Job time agreed with a specific customer |

**REQUIRED KNOWLEDGE AND SKILS**

The individual needs to demonstrate knowledge of:

* Kenyan legislation and workplace procedures relevant to:
  + health and safety
  + the environment (including waste disposal
  + personal and vehicle protective equipment
* Legal requirements relating to the vehicle and its construction
* Workplace procedures for:
  + recording fault location and correction activities;
  + reporting the results of tests;
  + the referral of problems;
* reporting delays to the completion of work
* sources of technical information
* How to use wheel alignment and steering geometry measuring and adjusting equipment
* Construction and operation of suspension and steering systems
* The construction, layout and operation of different types of suspension systems, including:
* Beam axle;
* Independent types; front and rear;
* Hydro-Pneumatic;
* Active suspension and their control systems.
  + Types of springs and how they are mounted and located on the vehicle
  + The layout and operation of different types of steering systems, including
  + Different types of steering gear, including:
  + Rack and pinion;
  + Recirculating ball.
  + Hydraulic and electronic power assisted
* The principles of suspension and steering geometry including:
  + Front and rear wheel alignment;
  + Toe-out-on-turns;
  + Camber;
  + Castor;
  + Kingpin inclination.
* How to remove and replace suspension and steering system units and components for the classification of vehicle being worked on
* How to select and use gaskets, sealants, seals, fittings and fasteners
* How to test and evaluate the performance of replacement suspension and steering system units and components against vehicle operating specifications, and any legal requirements
* When replacement units and components must meet the original equipment specification (OES) for warranty or other requirements
* How to work safely avoiding damage to other vehicle systems, units and components

**REQUIRED SKILLS**

*The individual needs to demonstrate the following foundation skills*:

* Decision making;
* Multitasking;
* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Problem solving;
* Planning
* First aid;
* Report writing;
* Record keeping
* Driving

**EVIDENCE GUIDE**

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

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| --- | --- |
| 1. Critical Aspects of Competency. | ***Assessment requires evidence that the candidate***:   * 1. Worked in a safe and clean environment using personal protection and appropriate tools and equipment   2. Observed regulations concerned with health   and safety and the disposal of waste |

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|  | * 1. Used technical information to remove and disassemble suspension units   2. Assessed vehicle suspension components against manufacturers‟ specifications   3. Repaired/serviced, replaced and restored suspension components as per   manufacturer‟s specification   * 1. Reassembled suspension components in accordance with manufacturers‟ specifications   2. Completed suspension system servicing within set time frame   1.6 Documented suspension servicing records as  per customer specifications and company policy. |
| 2. Resource Implications. | ***The following resources must be provided:***   * 1. A workshop that is fully equipped for servicing vehicle suspension systems.   2. Vehicle lift   3. Tool kits and vehicle suspension equipment   4. Access to manufacturers‟ technical information   5. Facilities for the disposal of waste oil and scrap parts   6. Customer database   7. Personal protection equipment   8. Computer |
| 3. Methods  of assessment. | ***Competency may be assessed through:***   * 1. Observation   2. Verbal   3. Written |
| 4. Context of | Competency may be assessed |

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| assessment. | individually in an actual workplace or in  work-simulated conditions within accredited institutions. |
| 5. Guidance  information for assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |

# SERVICE VEHICLE BRAKING SYSTEM

**UNIT CODE: ENG/OS/AUT/CR/7/6**

**UNIT DESCRIPTION:**

This unit specifies competencies required to service motor vehicle braking system. It involves, assessing, servicing, replacing or repairing and maintaining vehicle braking units and components. It includes final testing to ensure satisfactory operation to the customer‟s specification.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the***  ***Range*** |
| 1. Assess vehicle braking system | * 1. ***Tools and equipment*** are used as per service manual   2. Personal protective clothing and equipment PPE is used as per workshop regulations   3. Vehicle braking system is tested in accordance with **service manual**   4. **Braking system** are observed according to the service manual   5. Braking system observation checklist is filled as   per company policy |
| 2. Dismantle wheel **brake assembly parts** | * 1. **Vehicle is parked and prepared** in accordance with workshop procedures   2. S***ources of technical information*** are used as per service manual   3. ***Brake components are*** dismantled as per service |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the***  ***Range*** |
|  | manual and checklist  2.3 Lubricants and fluids are drained and disposed in accordance with Occupational Safety and Health  regulations ***OSHA 2007*** |
| 3.Assess braking components | * 1. ***Brake*** components are cleaned in accordance with the service manual   2. Brake c***omponents*** are ***assessed in accordance***   with manufacture‟s specifications   * 1. Worn/damaged ***components*** are identified according to the service manual   2. Compatibility of replacement parts is verified   against manufacturers part numbers |
| 4. Replace wheel brake assembly parts | * 1. Brake pads and linings are replaced in accordance to manufacturer‟s specifications   2. Brake calipers and drum are replaced according manufacturer‟s specifications   3. Brake flexible pipes are replaced as per the manufacturer‟s specifications   4. Brake adjusters/actuators (HCV) are replaced as per the manufacturer‟s specifications   5. Parking brake cables are serviced/replaced   according to the manufacturer‟s manual |
| 5. Replace brake cylinders | * 1. Brake master cylinder is replaced/serviced according manufacturer‟s manual   2. Brake slave cylinder is replaced/serviced as per   the manufacturer‟s specifications |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the***  ***Range*** |
|  | 5.3 Brake booster is serviced as per the |
| 6. Service brake system | * 1. Drum/disc brakes are assembled according to the manuals   2. Brake fluid is replenished and system bleeding is carried out as per service manual   3. Brake booster and ABS system is service according to the manufacturer‟s specifications   4. Braking system is adjusted (Dynamometer test) as per the workshop manual   5. Auxiliary brakes are serviced according the manufacturer‟s manual   6. Vehicle is road tested in accordance with legal requirements and manufacturers parameters   7. Service and repair activities are completed within an ***agreed time frame***   8. Service and repair ***records*** are completed in   accordance with Standard Operating 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.

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| **Variable** | **Range** |
| 1. Brake units and components may include but is not limited to: | * 1. Servo unit (booster)   2. Master cylinder   3. Calipers   4. Disc (rotor)   5. Drum   6. Brake pads and linings   7. Wheel cylinders   8. Brake adjusters   9. Actuators   10. ABS unit   11. Flexible pipes   12. Parking brake cable. |
| 2. Assessment may include but is not limited to: | * 1. Corrosion   2. Seizure   3. Serviceable   4. Unserviceable   5. Within or outside tolerances   6. Necessitates adjustment. |
| 3. Records may include but is not limited to: | * 1. Job cards   2. Company IT system   3. Customer database |
| 4. Agreed timescale may include but is not limited to: | * 1. Manufacturers‟ recommended work times   2. Job times set by the company   3. Job time agreed with a specific customer |
| 5. High energy electrical | 5.1 High tension ignition circuits; |

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| **Variable** | **Range** |
| components may include but  is not limited to: | 5.2 Xenon Headlamps. |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Legislative and organizational requirements and procedures
* Kenyan legislation and workplace procedures relevant to:
  + health and safety
  + the environment (including waste disposal);
  + appropriate personal and vehicle protective equipment
* Legal requirements relating to the vehicle and its construction including brake operation and efficiencies
* Workplace procedures for:
  + recording fault location and correction activities;
  + reporting the results of tests;
  + the referral of problems;
  + reporting delays to the completion of work

The importance of working to recognized assessment and rectification procedures and obtaining the correct information for rectification

* The importance of documenting assessment and rectification information.
* The importance of working to agreed timescales and keeping others informed of progress.
* The relationship between time, costs and profitability
* The importance of reporting anticipated delays to relevant person(s) promptly. The use of technical information including
* How to find, interpret and use sources of technical information for brake servicing activities
* The importance of using the correct sources of technical information
* The purpose of, and how to use identification codes
* Vehicle earthing principles and earthing methods
* Electrical and electronic principles associated with transmission systems, including types of sensors and actuators, their application and operation
* Types of circuit protection and why these are necessary.
* Electrical safety procedures, electric symbols, units and terms
* Electrical and electronic control system principles
* The hazards associated with high energy electrical component.

**Operation of brake systems**

* How brake and their related units and components are constructed, removed and replaced for the classification of vehicle worked upon
* Brake units and components removal and replacement
* How to remove and replace brake system mechanical, electrical and hydraulic units and components for the classification of vehicle worked upon
* How to select and use sealants, seals, fittings and fasteners
* How to test and evaluate the performance of replacement brake system units and components and the reassembled system against the vehicle
* Operating specifications and any legal requirements
* The use of appropriate test methods
* When replacement units and components must meet the original equipment specification (OES) for warranty or other requirements
* How to work safely avoiding damage to other vehicle systems, units and components and contact with leakage and hazardous substances

**Required Skills**

The individual needs to demonstrate the following skills

* Proficient in ICT
* Time management
* Problem solving
* Communications (verbal and written)
* Planning
* Decision making
* Multitasking
* First aid
* Report writing
* Record keeping
* Driving

**EVIDENCE GUIDE**

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

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| 1. Critical Aspects of Competency. | ***Assessment requires evidence that the candidate***:   * 1. Worked in a safe and clean environment using personal protection and appropriate tools and equipment   2. Observed regulations concerned with health and safety and the disposal of waste   3. Used technical information to remove and dismantle brake components and assess components against   manufacturers‟ specifications;   * 1. Prepared recommendations for the repair brake components   2. Repaired, reassembled and replaced brake components in accordance with manufacturers‟ specifications   3. Finalized servicing activities to conform to vehicle operating   specifications within specified time |

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|  | frame  1.6 Performed vehicle road test appropriately |
| 2. Resource Implications. | ***The following resources must be provided:***   * 1. A workshop that is fully equipped for servicing light motor vehicle brake systems including a vehicle lift, specialist tools and equipment appropriate for the different makes of vehicles that are being serviced   2. Instruments and equipment for measuring and assessing the condition of brake units   3. Specialist equipment for servicing ABS brake units   4. Access to manufacturers‟ technical information   5. Facilities for the disposal of waste oil, fluids and scrap parts   6. Customer database and systems for recording service records   7. Personal protection equipment. |
| 3. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Observation with the use of checklists   2. Verbal questioning during service and repair activities to test underpinning knowledge   3. Short-answer tests to assess understanding of the operation of   brake systems, measuring, assessing |

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|  | the condition of components and fault  rectification. |
| 4. Context of Assessment. | Competency may be assessed individually in an actual workplace or in work-simulated  conditions within accredited  institutions. |
| 5. Guidance information for assessment. | This unit may be assessed on an integrated  basis with others within this occupational sector. |

# SERVICE VEHICLE ELECTRICAL SYSTEMS

**UNIT CODE: ENG/AUT/CR/8/6/A**

**UNIT DESCRIPTION:**

This unit specifies competencies required to service vehicle electrical system. It involves, carrying out diagnostics, rectifications, replacements and installations of vehicle electrical systems and components.

# ELEMENTS AND PERFORMANCE CRITERIA

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
| 1 Diagnose ***electrical systems*** | * 1. Electrical defect(s) are identified according to client‟s report.   2. **Electrical diagnostic tools and equipment** are used as per the **service manual**   3. Diagnostic procedures are used as per service manual   4. Cause and location of defects is   identified as per service manual |
| 2 Service vehicle ignition system | * 1. Battery ***condition and functionality*** is checked according to manufacturer‟s specification.   2. Ignition coil is checked/ replaced according to manufacturer‟s specification.   3. Ignition distributor and distributor cap is |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | serviced according to manufacturer‟s specification.   * 1. Ignition spark plug and high tension (HT) cables are serviced as per manufacturer‟s manual.   2. Ignition switch/key is serviced/ replaced according to manufacturer‟s specification.   3. Ignition timing is carried out as per manufacturer‟s specification.   4. Electronic ignition fault diagnosis is   performed as per manufacturer‟s manual. |
| 3 Service vehicle electrical accessories | * 1. Electrical accessories are checked to confirm compatibility with the vehicle as per manufactures specifications   2. Electrical accessories are checked for compatibility with legal legislations as per state policies.   3. Location and fitting is identified in accordance with legislations and   manufactures‟ specification   * 1. Accessories are installed in accordance with manufacturer‟s specification   2. Accessories are tested for correct   operation as per manufacturer‟s |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | specification. |
| 4 Service vehicle air-conditioning  system | * 1. Air-con condenser and condenser cooling fans are checked/ serviced according to manufacturer‟s specifications.   2. Evaporator and heater blower fans are checked/ serviced according to   manufacturer‟s specifications.   * 1. Compressor and pressure switch are checked/ serviced according to   manufacturer‟s specifications.   * 1. Drier and expansion valve are checked/ serviced according to manufacturer‟s specification.   2. Air conditioner is recharged according to manufacturer‟s specification.   3. Air conditioner leakages are checked   according to manufacturer‟s specification. |
| 5 Service vehicle charging systems | * 1. Alternator is checked /serviced as per manufacturer‟s specification.   2. Alternator control box is checked/ serviced as per the manufacturer‟s specifications.   3. Charging system is tested according   to manufacturer‟s specifications. |
| 6. Service vehicle | 6.1 Vehicle alarms and horns are |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
| auxiliary systems | checked / serviced according to manufacturer‟s specification.   * 1. Vehicle gauges are checked/ serviced according to   manufacturer‟s specification.   * 1. Vehicle central locking is checked   / serviced according to  manufacturer‟s specification.   * 1. Radio and television are checked/ serviced / installed according to manufacturer‟s specification.   2. Power windows and power mirrors are checked/ serviced according to manufacturer‟s specifications.   3. Air bags are checked and replaced   according to manufacturer‟s specifications. |
| 7. Service vehicle lighting system | * 1. Main beam and dip beam switch is checked/ replaced according to   manufacturer‟s specifications.   * 1. Connectors and wire harness are checked/ replaced according to manufacturer‟s specifications.   2. ***Main headlight***, interior lights and reverse lights are checked/ serviced   / replaced according to |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | manufacturer‟s specifications.   * 1. Direction indicator lights and ***flasher unit*** are checked/ serviced/ replaced according to manufacturer‟s specifications.   2. Headlight beam setting is performed according to manufacturer‟s   specifications. |
| 8. Service vehicle electrical motors | * 1. Electrical motor faults are identified according to manufacturer‟s specifications.   2. Electrical motors are removed from the vehicle according to manufacturer‟s manual.   3. Electrical motors are serviced according to manufacturer‟s specifications.   4. Tests are performed on serviced electrical motors according to manufacturer‟s manual.   5. Electrical motors are installed on the vehicle as per manufacturer‟s   specifications. |
| 9. Install Vehicle safety systems | * 1. Install Airbags according to manufacturer‟s manual   2. Connect Safety belts according to   workshop procedures |

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| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in***  ***the Range*** |
|  | * 1. Mount electrical components related to vehicle safety according to   manufacturer‟s manual   * 1. Fit anti-roll components according to manufacturer‟s manual   2. The vehicle tracker according to   manufacturer‟s manual |

**RANGE**

This section provides work environments and conditions to which the performance criteria

apply. It allows for different work environments and situations that will affect performance.

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| **Variable** | **Range** |
| 1. Electrical Diagnostic Tools and equipment may include but is not limited to: | * 1. General workshop equipped for servicing vehicle electrical systems;   2. Electronic diagnostic equipment;   3. Multi-meters;   4. Ignition test equipment.   5. Hydrometer   6. High rate discharge tester   7. Feeler gauge |
| 2. Service Manual may  include but is not limited | 2.1 Instructions provided by the  manufacturer on how to remove, |

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| **Variable** | **Range** |
| to: | disassemble, repair and refit  components |
| 3. Condition and functionality may include  but is not limited to: | * 1. Specific gravity/hydrometer test   2. High rate discharge test |
| 4. Technical information. may include but is not limited to: | * 1. Vehicle technical data;   2. Manufacturers‟ online information;   3. On-board diagnostics (OBD) displays;   4. Accessory manufacturers technical   data |
| 5. Electrical systems may include but is not limited to: | * 1. Starting system including motors and battery terminals;   2. Charging system including alternators;   3. Ignition system components including steering lock switches;   4. Audio systems including speakers;   5. Electrical wiring;   6. Lighting system including bulbs and sockets;   7. Electrical and electronic sensors;   8. Auxiliary motors including wipers, heater blowers, and window actuators. |
| 6. Gauge may include but is not limited to: | * 1. Speedometer   2. Temperature gauge   3. Fuel level gauge   4. Oil pressure gauge |
| 7. Electrical motors may  include but is not limited to: | * 1. Starter motor   2. Wiper motor |
| 8. Aftermarket accessories | 8.1 GPS systems; |

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| **Variable** | **Range** |
| may include but is not limited to: | * 1. Cameras;   2. Radios and speakers;   3. Auxiliary lights; |
| 9. Headlights may include  but is not limited to: | * 1. Sealed beam   2. Non-sealed beam |
| 10. Flasher unit may include  but is not limited to: | * 1. Hazard warning   2. Electronic type |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Legislative and organizational requirements and procedures
* Kenyan legislation and workplace procedures relevant to:
  + health and safety;
  + the environment (including waste disposal);
  + appropriate personal and vehicle protective equipment
* Legal requirements relating to the vehicle and its construction including brake operation and efficiencies
* Workplace procedures for:
  + recording fault location and correction activities;
  + reporting the results of tests;
  + the referral of problems;
  + reporting delays to the completion of work
* The importance of working to recognized assessment and rectification procedures and obtaining the correct information for rectification
* The importance of documenting assessment and rectification information.
* The importance of working to agreed timescales and keeping others informed of progress.
* The relationship between time, costs and profitability
* The importance of reporting anticipated delays to relevant person(s) promptly. The use of technical information including
* How to find, interpret and use sources of technical information for brake servicing activities
* The importance of using the correct sources of technical information
* The purpose of, and how to use identification codes
* Vehicle earthling principles and earthling methods
* Electrical and electronic principles associated with transmission systems, including types of sensors and actuators, their application and operation
* Types of circuit protection and why these are necessary.
* Electrical safety procedures electric symbols, units and terms
* Electrical and electronic control system principles
* The hazards associated with *high energy electrical component*.
* Operation of brake systems
* How brake and their related units and components are constructed, removed and replaced for the classification of vehicle worked upon
* Brake units and components removal and replacement
* How to remove and replace brake system mechanical, electrical and hydraulic units and components for the classification of vehicle worked upon
* How to select and use sealants, seals, fittings and fasteners
* How to test and evaluate the performance of replacement brake system units and components and the reassembled system against the vehicle
* Operating specifications and any legal requirements
* The use of appropriate test methods
* When replacement units and components must meet the original equipment specification (OES) for warranty or other requirements
* How to work safely avoiding damage to other vehicle systems, units and components and contact with leakage and hazardous substances

**Required Skills**

The individual needs to demonstrate the following skills

* Proficient in ICT;
* Time management;
* Problem solving;
* Communications (verbal and written);
* Planning;
* Decision making;
* Multitasking;
* First aid;
* Report writing;
  + Driving

**FOUNDATION SKILLS**

The individual needs to demonstrate the following foundation skills:

* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Problem solving;
* Planning;
* Decision making;
* Multitasking;
* First aid;
* Report writing;
  + Driving.

**EVIDENCE GUIDE**

This provides advice on assessment and must be in conjunction with the performance criteria,

required skills and knowledge and range.

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| 1. Critical Aspects of Competency | ***Assessment requires evidence that the candidate:***   * 1. Worked in a safe and clean environment   2. Diagnosed vehicle electrical system   3. Rectified electrical defects   4. Installed aftermarket accessories   5. Generated and shared electrical system serving report |
| 2. Resource Implications | ***The following resources must be provided:***  General workshop equipped for servicing vehicle electrical systems;   * 1. Electronic diagnostic equipment;   2. Multi-meters;   3. Ignition test equipment. |
| 3. Methods of Assessment | ***Competency may be assessed through:***   * 1. Observation with the use of checklists;   2. Verbal questioning during practical activities to test underpinning knowledge;   3. Short-answer tests to assess understanding of vehicle electrical systems, their construction and   operating principles. |
| 4. Context of Assessment | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited  institutions |
| 5. Guidance information for | This unit may be assessed on an |

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| assessment | integrated basis with others within this  occupational sector. |