COMPETENCY STANDARDS
FOR
MECHANICAL FITTING

Skills for Employment Investment Program (SEIP)
Finance Division, Ministry of Finance

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INTRODUCTION:

The Skills for Employment Investment Program (SEIP) Project of the Finance Division of the Ministry of Finance has embarked on a project which aims to qualitatively and quantitatively expand the skilling capacity of identified public and private training providers by establishing and operationalizing a responsive skill eco system and delivery mechanism through a combination of well-defined set of funding triggers and targeted capacity support.

Among the many components of the project, one is to promote a Market Responsive Inclusive Skills Training Delivery program. Key priority economic growth sectors identified by government have been targeted by the project to improve current job skills along with up-skilling of the existing workforce to ensure 'required skills to industry standards'. Training providers are encouraged and supported to work with the industry to address identified skills to enable industry growth and increased employment through the provision of market responsive inclusive skills training programs. Priority sectors were identified to adopt a demand driven approach to training with effective inputs from Industry Skills Councils (ISCs), Employer Associations and Employers.

This document is developed to improve skills in accordance with the job roles andskill sets of the occupationand ensure that the required skills are aligned to industry requirements.

The document details the format, sequencing, wording and layout of the Competency Standard for an occupation which comprised Units of Competence and its corresponding Elements.

OVERVIEW:

A **Competency Standard** is a written specification of the knowledge, skills and attitudes required for the performance of a job or occupation or trade corresponding to the standard of performance required in the workplace.

Competency standard:

- provides a consistent and reliable set of components for training, recognizing and assessing people's skills, and may also have optional support materials.
- enables industry recognized qualifications to be awarded through direct assessment of workplace competencies
- encourages the development and delivery of flexible training which suits individual and industry requirements
- encourages learning and assessment in a work-related environment which leads to verifiable workplace outcomes.

Competency Standards are developed by a working group who comprised national and international process experts and the participation of experts from the industry to identify the competencies required of an occupation in a particularsector.

Competency Standards describe the skills, knowledge and attitude needed to perform effectively in the workplace. Competency Standards acknowledge that people can achieve vocational and technical competency in many ways by emphasizing what the learner can do, not how or where they learned to do it.

With Competency Standards, training and assessment may be conducted at the workplaceorat training organization or any combination of these.

A Unit of Competency describes a distinct work activity that would normally be undertaken by one person in accordance with industry standards.

Units of Competency are documented in a standard format that comprises:

- Reference to Industry Sector, Occupational Title and Occupational Description
- Unit code
- Unit title
- Unit descriptor
- Unit of Competency
- Elements and performance criteria
- Variables and range statement
- Evidence guides

Together all the parts of a Unit of Competency:

- Describe a work activity
- Guide the assessor in determining whether the candidate is competent.

Identification and validation of units of competency and elements for each occupation were made by experts of various construction companies in an industry consultative workshop.

Profile of experts and facilitators who participated in the Competency Verification and Validation Workshop are given below:

Competency Verification-Validation Experts:

Name	Company	Job Position

Workshop Facilitators:

Mr. Md. Mohiuzzaman	SEIP	Course Specialist
Emeterio Cedillo, Jr.	SEIP	International Specialist
Mr. Md. Atiar Rahman	SEIP	National Specialist

The ensuing sections of this document comprise a description of the respective occupation with all the key components of a Unit of Competency:

- A chart with an overview of all Units of Competency for the respective occupation including the Unit Codes and the Unit of Competency titles and corresponding Elements.

- The Competency Standards that include the Unit of Competency, Unit Descriptor, Elements and Performance Criteria, Range of Variables, Curricular Content Guide and Assessment Evidence Guide.

COMPETENCY PROFILE/MAP FOR
MECHANICAL FITTING

UNITS OF COMPETENCY	ELEMENTS			
A. Generic (Basic) Competencies				
PERFORM COMPUTATIONS USING BASIC MATHEMATICAL CONCEPTS (SEIP-MEC-FIT--1-G)	Identify calculation requirements in the workplace.	Select appropriate mathematical methods/concepts for the calculation	Use tool/instrument to perform calculations	
APPLY OCCUPATIONAL HEALTH AND SAFETY (OH&S) PRACTICES IN THE WORKPLACE (SEIP-MEC-FIT-2-G)	Identify OHS policies and procedures	Apply personal health and safety practices	Report hazards and risks	Respond to emergencies
COMMUNICATE IN ENGLISH IN THE WORKPLACE (SEIP-MEC-FIT-3-G)	Read and understand workplace documents in English	Write simple workplace written communications in English.	Listen and comprehend to Englishconversation	Perform conversations in English language
OPERATE IN A SELF-DIRECTED TEAM. (SEIP-MEC-FIT-4-G)	Identify team goals and processes.	Communicate and cooperate with team members.	Work as a team member	Solve problems as a team member
B. Sector Specific (Common) Competencies				
INTERPRET TECHNICAL DRAWINGS AND MANUALS SEIP-MEC-FIT-1-S)	Select technical drawing.	Interpret technical drawings.	Interpret operation and maintenance manuals	
WORK WITH MECHANICAL HAND AND POWER TOOLS (SEIP-MEC-FIT-2-S)	Inspect hand tools and power tools for usability	Use hand tools properly and safely	Operate power tools properly and safely	Clean/maintain hand tools and power tools after use
CARRY OUT PRECISION CHECKS AND MEASUREMENTS (SEIP-MEC-FIT-3-S)	Select the job to be checked and measured	Select measuring and checking tool/instrument	Obtain measurements and checks	Record/communicate measurement and check results
	Clean, maintain and store measuring instruments.			

APPLY QUALITY SYSTEMS AND PROCEDURES (SEIP-MEC-FIT-4-S)	Work within quality system	Apply and monitor quality system improvements in the workplace	Hold responsible for quality work	Apply standard procedures for each job.

C. Occupation Specific (Core) Competencies

PERFORM BASIC WORKSHOP PRACTICE (SEIP-MEC-FIT-1-O)	Perform bench working operations	Perform lathe machine operation	Apply fundamentals of heat treatment	
PERFORM GAS CUTTING AND WELDING WORKS (SEIP-MEC-FIT-2-O)	Weld materials using arc weding machine	Carry out gas cutting and welding	Perform brazing operations	Perform soldering
CARRY OUT BEARINGS AND SEALS MAINTENANCE AND SERVICING (SEIP-MEC-FIT-3-O)	Perform troubleshooting on bearings and seals operation	Service and maintain bearings	Service and maintain seals	Test newly maintained/serviced bearing and seals for proper operation
CARRY OUT DRIVE COMPONENT MAINTENANCE AND SERVICING (SEIP-MEC-FIT-4-O)	Perform fault finding and troubleshooting on machine's drive components	Perform maintenance and servicing of drive components	Test newly maintained/serviced drive components	
CARRY OUT SERVICING AND MAINTENANCE OF FLUID POWER SYSTEMS (SEIP-MEC-FIT-5-O)	Apply fundamentals of pneumatic systems	Carry out servicing and maintenance of pneumatic system components	Apply fundamentals of hydraulic systems	Carry out servicing and maintenance of hydraulic system components

Units & Elements at Glance:

Generic (Basic) Competencies (46 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SEIP-MEC-FIT-1-G	Perform Computations Using Basic Mathematical Concepts	1. Identify calculation requirements in the workplace 2. Select appropriate mathematical methods/concepts for the calculation. 3. Use tool/instrument to perform calculations	14
SEIP-MEC-FIT-2-G	Apply Occupational Health and Safety (OH&S) Practices in the Workplace	1. Identify OHS policies and procedures 2. Apply personal health and safety practices 3. Report hazards and risks 4. Respond to emergencies	10
SEIP-MEC-FIT-3-G	Communicate in English in the Workplace	1. Read and understand workplace documents in English 2. Write simple workplace communications in English 3. Listen and comprehend to English conversations 4. Perform conversations in English language	14
SEIP-MEC-FIT-4-G	Operate in a Self-Directed Team	1. Identify team goals and work processes 2. Communicate and cooperate with team members. 3. Work as a team member. 4. Solve problems as a team member	8
Total Hour			**46**

Sector Specific (Common) Competencies (34 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SEIP-MEC-FIT-1-S	Interpret Technical Drawings and Manuals	1. Select technical drawing 2. Interpret technical drawings. 3. Interpret operation & maintenance manuals	16
SEIP-MEC-FIT-2-S	Work with Mechanical Hand and Power Tools	1. Inspect hand tools and power tools for usability 2. Use hand tools properly and safely 3. Operate power tools properly and safely 4. Clean/maintain hand tools and power tools after use	10
SEIP-MEC-FIT-3-S	Carry out Precision Checks and Measurements	1. Select the job to be checked and measured 2. Select measuring and checking tool/instrument 3. Obtain measurements and checks 4. Record/communicate measurement and check results 5. Clean, maintain and store measuring instruments.	10
SEIP-MEC-FIT-4-S	Apply Quality Systems and Procedures	1. Work within quality system 2. Apply and monitor quality system improvement in the workplace 3. Hold responsible for work quality 4. Apply standard procedures for each job.	8
Total Hours			**44**

Occupation Specific (Core) Competencies (270 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SEIP-MEC-FIT-1-O	Perform Basic Workshop Practice	1. Perform bench working operations 2. Perform lathe machine operation 3. Apply fundamentals of heat treatment	64
SEIP-MEC-FIT-2-O	Perform Gas Cutting and Welding Works	1. Weld materials using arc welding machine 2. Carry out gas welding and cutting 3. Perform brazing operations 4. Perform soldering	62
SEIP-MEC-FIT-3-O	Carry Out Bearings and Seals Maintenance and Servicing	1. Perform troubleshooting on bearings operation 2. Service and maintain bearings 3. Service and maintain seals 4. Test newly maintained/serviced bearings and seals for proper operation	48
SEIP-MEC-FIT-4-O	Carry Out Drive Component Maintenance and Servicing	1. Perform fault finding and troubleshooting of mechanical drive components 2. Perform maintenance and servicing of mechanical drive components 2. Test newly maintained/serviced drive components	48
SEIP-MEC-FIT-5-O	Carry Out Servicing and Maintenance of Fluid Power Systems	1. Apply fundamentals of pneumatic systems 2. Carry out repair and maintenance of pneumatic system components 3. Apply fundamentals of hydraulic systems 4. Carry out servicing and maintenance of hydraulic system components	48
Total Hours			**270**

COMPETENCY STANDARD: MECHANICAL FITTING

A. The Generic (Basic Competencies)

Unit of Competency: **PERFORM COMPUTATIONS USING BASIC MATHEMATICAL CONCEPTS**	**Nominal Duration:** 14 hrs.	**Unit Code:** SEIP-MEC-FIT-1-G
Unit Descriptor: This unit of competency requires the knowledge, skills and attitude to perform computations using basic mathematical concepts in the workplace. It specifically includes the tasks of identifying calculation requirements in the workplace, selecting appropriate mathematical method/concept for the calculation and using appropriate instruments tools to carry out calculation.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in**bold and underlined**are elaborated in the range of variables).

Elements of Competency	**Performance Criteria**
1. Identify calculation requirements in the workplace	1.1 **Calculation requirements** are identified from **workplace information.**
2. Select appropriate mathematical methods/concepts for the calculation.	2.1 **Appropriate method** is selected to carry out the calculation requirements.
3. Use tool/instrument to perform calculations	3.1 Calculations are completed using appropriate **tools and instruments.**

Range of variables:

Variable	**Range** May include but not limited to:
1. Calculation requirements.	1.1 Area 1.2 Height 1.3 Length/Breath/thickness 1.4 Diameter 1.5 Weight 1.6 Capacity 1.7 Time 1.8 Temperature. 1.9 Material usage 1.10 Speed 1.11 Costing 1.12 Mass 1.13 Density
2. Workplace information	2.1 Mechanical Plan 2.2 Design 2.3 Working drawing

	2.4 Verbal instructions 2.5 Job order
3. Appropriate method	3.1 Addition 3.2 Subtraction 3.3 Division 3.4 Multiplication 3.5 Conversion 3.6 Percentage and ratio calculation 3.7 Simple equation
4. Tools/instruments	4.1 Calculator 4.2 Computer

Curricular Content Guide

1. Underpinning Knowledge	1.1 Numerical concept 1.2 Basic mathematical methods such as addition, subtraction, multiplication and division and percentages. 1.3 Mathematical language, symbols and terminology. 1.4 Measuring units 1.5 Knowledge of computer application
2. Underpinning Skills	2.1 Adding numbers 2.2 Subtracting numbers 2.3 Multiplying numbers 2.4 Dividing numbers 2.5 Measuring of linear 2.6 Using of mathematical language, symbols, terminology and technology 2.7 Measuring of different physical parameter 2.8 Calculating geometrical parameters: angle, parallelism, perpendicularity, area and volume
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Promptness in carrying out activities 3.3 Tidiness and timeliness 3.4 Respect to peers, sub-ordinates and seniors in workplace 3.5 Environmental concern 3.6 Sincerity and honesty
4. Resource Implications	The following resources must be provided. 4.1 Stationeries 4.2 Consumables 4.3 Calculators 4.4 Computers 4.5 Measuring tape

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Identified calculation requirements from workplace information. 1.2 Selected appropriate method to carry out the calculation requirements. 1.3 Completed calculations using appropriate tools/instruments.
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Oral questioning 2.3 Demonstration.
5. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **APPLY OCCUPATIONAL HEALTH AND SAFETY (OHS) PRACTICES IN THE WORKPLACE**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-MEC-FIT-2-G
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to apply occupational health and safety (OH&S) practices in the workplace. It specifically includes the tasks of identifying OHS policies and procedures, applying personal health and safety practices, reporting hazards and risks and responding to emergencies.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify OHS policies and procedures	1.1 **OHS policies** and safe operating procedures are read and understood. 1.2 Safety signs and symbols are identified and followed. 1.3 Emergency response, evacuation procedures and other contingency measures are determined.
2. Apply personal health and safety practices	2.1 OHS policies and procedures are followed and practiced. 2.2 **Personal Protective Equipment (PPE)** is selected and used. 2.3 Personal hygiene is maintained.
3. Report hazards and risks	3.1 **Hazards and risks** are identified, assessed and controlled. 3.2 Incidents arising from hazards and risks are reported to authority. 3.3 Corrective actions are implemented to correct unsafe conditions in the workplace.
4. Respond to emergencies	4.1 Alarms and warning devices are responded. 4.2 **Emergency response plans and procedures** are implemented. 4.3 **First aid procedure** is applied during emergency situations.

Range of Variables

Variable	Range May include but not limited to:
1. OHS policies	1.1 International OHS requirements 1.2 Bangladesh standards for OHS 1.3 Building Code 1.4 Fire Safety Rules and Regulations 1.5 Industry Guidelines
2. Personal Protective Equipment (PPE)	2.1 Apron 2.2 Gas Mask 2.3 Gloves 2.4 Safety shoes 2.5 Helmet 2.6 Face mask 2.7 Overalls

	2.8 Goggles and safety glasses 2.9 Ear plugs 2.10 Sun block 2.11 Chemical/Gas masks
3. Hazards and risks	3.1 Chemical hazards. 3.2 Biological hazards. 3.3 Physical Hazards. 3.3.1 Machine hazards. 3.3.2 Materials hazards. 3.3.3 Tools and Equipment hazards.
4. Emergency response plans and procedures	4.1 Firefighting procedures 4.2 Earthquake response procedures 4.3 Evacuation procedures 4.4 Medical and first aid
5. First aid procedure	5.1 Washing of open wound 5.2 Washing chemically infected area 5.3 Applying bandage 5.4 Tourniquet 5.5 Applying CPR (Cardiopulmonary Resuscitation) 5.6 Taking appropriate medicine

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 OHS workplace policies and procedures. 1.2 Work safety procedures. 1.3 Emergency procedures. 1.3.1 Firefighting. 1.3.2 Earthquake response. 1.3.3 Explosion response. 1.3.4 Accident response. 1.4 Types of (biological, chemical and physical) and their effects. 1.5 PPE types and uses. 1.6 Personal hygiene practices. 1.7 OHS awareness.
2. Underpinning Skills	2.1 Identifying OHS policies and procedures 2.2 Following personal work safety practices 2.3 Reporting hazards and risks 2.4 Responding to emergency procedures 2.5 Maintaining physical well-being in the workplace 2.6 Performing first aids. 2.7 Performing basic firefighting accessories using fire extinguishers 2.8 Applying basic first aide procedures
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness.

	3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 PPEs 4.3 Firefighting equipment 4.4 Emergency response manual 4.5 First aid kits

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Followed OHS policies and procedures 1.2 Selected and used personal protective equipment (PPE) 1.3 Reported incidents arising from hazards and risks to authority 1.4 Emergency response plans and procedures are implemented 1.5 Applied basic first aide procedure
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Demonstration 2.3 Oral questioning 2.4 Interview
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: COMMUNICATE IN ENGLISH IN THE WORKPLACE	Nominal Duration: 14 hrs.	Unit Code: SEIP-MEC-FIT-3-G
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to communicate in English in the workplace. It specifically includes work tasks of reading and understanding workplace documents in English, writing simple workplace written communications in English, listening and comprehending to English conversations and performing conversations in English.		

Elements and Performance Criteria:

(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Read and understand workplace documents in English	1.1 Workplace documents are read and understood. 1.2 Visual information is interpreted.
2. Write simple workplace communications in English	2.1 Simple **routine workplace documents** are prepared using key words, phrases, simple sentences and **visual aids**are prepared. 2.2 Key information is written in the appropriate places in standard forms.
3. Listen and comprehend to English conversations	3.1 Active listening is demonstrated.
4. Perform conversations in English language	4.1 Conversation is performed in English with peers, customers and management to the required workplace standard.

Range of Variables

Variable	Range May Include but not limited to:
1. Routine workplace documents	1.1 Agenda 1.2 Simple reports such as progress and incident reports 1.3 Job sheets 1.4 Operational manuals 1.5 Brochures and promotional material 1.6 Visual and graphic materials 1.7 Standards 1.8 OSH information 1.9 Signs
2. Visual aids	2.1 Maps 2.2 Diagrams 2.3 Forms 2.4 Labels 2.5 Graphs 2.6 Charts

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 Read workplace documents in English 1.2 Write simple routine workplace documents in English 1.3 Listen to conversation in English 1.4 Perform conversation in English 1.5 Interaction skills (i.e., teamwork, interpersonal skills, etc.) 1.6 Job roles, responsibilities and compliances
2. Underpinning Skills	2.1 Ability to read and understand workplace documents in English by using appropriate vocabulary and grammar, standard spelling and punctuation 2.2 Ability to write simple routine workplace documents in English such as: Schedules and agenda, job sheets, operational manuals and brochures and promotional material 2.3 Ability of listening in English and interpreting 2.4 Ability to perform conversation in English with peers, customers and management to the required workplace standard 2.5 Work effectively with others 2.5.1 Listening and questioning skills 2.5.2 Ability to follow simple directions
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Promptness in carrying out activities 3.3 Tidiness and timeliness 3.4 Respect of peers, sub-ordinates and seniors in workplace 3.5 Environmental concern. 3.6 Sincere and honest to duties.
4. Resource Implications	The following resources must be provided: 4.1 Work place Procedure 4.2 Materials relevant to the proposed activity 4.3 All tools, equipment, material and documentation required. 4.4 Relevant specifications or work instructions

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Conversed in English with peers and customers 1.2 Made reports of workplace documents in English
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Demonstration 2.3 Oral questioning 2.4 Interview
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **OPERATE IN A SELF-DIRECTED TEAM**	**Nominal Duration:** 8 hrs.	**Unit Code:** SEIP-MEC-FIT-4-G
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to operate in a self-directed team. It specifically includes work tasks of identifying team goals and work processes, communicating and cooperating with team members, working and solving problems as a team member.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify team goals and work processes	1.1 Team goals and collaborative decision making processes are identified. 1.2 Roles and responsibilities of team members are identified. 1.3 Relationships within team and with other workers are maintaned.
2. Communicate and cooperate with team members.	2.1 Effective interpersonal skills are used to interact with team members and to contribute to activities and objectives. 2.2 Formal and informal **forms of communication** are used effectively to support team achievement. 2.3 Diversity in character is respected and valued in team functioning. 2.4 Views and opinions of other team members are understood and valued. 2.5 Workplace terminology is used correctly to assist communication.
3. Work as a team member.	3.1 Duties, responsibilities, authorities, objectives and task requirements are identified and clarified with team. 3.2 Tasks are performed in accordance with organizational and team requirements, specifications and workplace procedures. 3.3 Team member's support with other members are made to ensure team achieves goals, awareness and requirements. 3.4 Agreed reporting lines are followed using standard operating procedure.
4. Solve problems as a team member	4.1 Current and potential problems faced by team are identified. 4.2 A solution to the problem is identified. 4.3 Problems are solved effectively and the outcome of the implemented solution is evaluated.

Range of Variables

Variable	Range May Include but not limited to:
1. Forms of communication	1.1 Agenda 1.2 Simple reports such as progress and incident reports 1.3 Job sheets 1.4 Operational manuals

	1.5 Brochures and promotional material 1.6 Visual and graphic materials 1.7 Standards 1.8 OSH information 1.9 Signs

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 Team goals and collaborative decision making processes 1.2 Roles and responsibilities of team members 1.3 Relationships within team and with other workers 1.4 Effective interpersonal skills to interact with team members 1.5 Effective formal and informal forms of communication 1.6 Value of diversity in team functioning. 1.7 Correct use of workplace terminology 1.8 Team's duties, responsibilities, authorities, objectives and task requirements 1.9 Support mechanism to other members of team to ensure achievements of goals 1.10 Methods of identifying current and potential problems faced by a team 1.11 Effective problems solving methods and evaluation of outcomes
2. Underpinning Skills	2.1 Identifying team goals and collaborative decision making processes 2.2 Identifying roles and responsibilities of team members 2.3 Identifying relationships within team and with other workers 2.4 Using effective interpersonal skills to interact with team members and to contribute to activities and objectives 2.5 Using formal and informal forms of communication 2.6 Understanding and valuing views and opinions of other team members 2.7 Performing tasks in accordance with organizational and team requirements, specifications and workplace procedures 2.8 Supporting other members of the team to ensure team achieves goals, awareness and requirements 2.9 Identifying current and potential problems faced by the team 2.10 Identifying solutions to the problem 2.11 Solving problems effectively and evaluating the outcome of the implemented solution
3. Underpinning Attitudes	3.1 Teamwork 3.2 Promptness in carrying out activities 3.3 Tidiness and timeliness 3.4 Respect of peers, sub-ordinates and seniors in workplace 3.5 Sincere and honest to duties
4. Resource Implications	The following resources must be provided: 4.1 Workplace (simulated or actual)

	4.2 Pens 4.3 Papers 4.4 Work books 4.5 Learning manuals

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Identified team goals and work processes 1.2 Communicated and cooperated with team members 1.3 Worked as a team member 1.4 Solved problems as a team member
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Demonstration 2.3 Oral questioning 2.4 Interview
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

B. The Sector Specific (Common) Competencies

Unit of Competency: **INTERPRET TECHNICAL DRAWINGS AND MANUALS**	**Nominal Duration:** 16 hrs.	**Unit Code:** SEIP-MEC-FIT-1-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required of a worker to interpret technical drawings and manuals. It specifically includes the tasks of selecting technical drawing, interpreting technical drawings and storing manuals, designs and plans.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	**Performance Criteria**
1. Select technical drawing	1.1 **Drawing** is selected and checked to ensure that it conforms to the job requirements. 1.2 Drawing is validated.
2. Interpret technical drawings.	2.1 Drawing components, assemblies are identified 2.2 Dimensions are identified according to job requirement 2.3 Clearances/tolerances are checked in accordance with workplace standard 2.4 **Instructions** are identified and followed accurately. 2.5 Material **specifications** are interpreted 2.6 Symbols in drawing are interpreted.
3. Interpret operation & maintenance manuals	3.1 Operation and maintenance manuals are collected and interpreted 3.2 Operation and maintenance manuals are followed when operating and maintaining lathe machine

Range of Variables

Variable	***Range*** May Include but not limited to:
1. Drawing	1.1 Technical drawing 1.2 Sketches 1.3 Manuals
2. Instructions	2.1 Note 2.2 Instruction 2.3 Special instruction 2.4 Precaution
3. Specifications	3.1 Product specifications 3.2 Method specifications 3.3 Material specifications

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 Technical drawing interpretation 1.2 Sequence of drawing 1.3 Methods of checking and applying drawing for work 1.4 Drawing selection and checking method to ensure conformity to the job requirements. 1.5 Drawing components, assemblies 1.6 Identification of dimensions according to job requirement 1.7 Procedure of checking clearances/tolerances 1.8 Work instructions 1.9 Material specifications 1.10 Drawing symbols interpretation 1.11 Use of operation and maintenance manuals
2. Underpinning Skills	2.1 Practicing workplace safety 2.2 Interpreting drawing, following operation and maintenance manuals, 2.3 Performing jobs in accordance with the drawing 2.4 Performing calculation as per drawing 2.5 Selecting and checking of drawing to ensure conformity to the job requirements. 2.6 Identifying drawing components and assemblies 2.7 Identifying dimensions according to job requirement 2.8 Checking clearances/tolerances in accordance with workplace standard 2.9 Following operation and maintenance manuals when operating and maintaining lathe machine
3. Underpinning Attitudes	3.1 Care in the use of drawings/manuals 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Sincere and honest to duties.
4. Resource Implications	The following resources must be provided: 4.1 Workplace (simulated or actual) 4.2 Relevant drawing/manuals 4.3 Pens 4.4 Papers 4.5 Work books 4.6 Learning manuals

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Identified dimension according to job requirement 1.2 Maintained clearances and tolerances according to workplace

	requirement. 1.3 Interpreted drawing symbols 1.4 Interpreted operation & maintenance manuals
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **WORK WITH MECHANICAL HAND AND POWER TOOLS**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-MEC-FIT-2-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to work with mechanical hand and power tools. It specifically includes the tasks of inspecting hand tools and power tools for usability, using hand tools properly and safely, operating power tools properly and safely and cleaning/maintaining hand tools and power tools after use.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Inspect hand tools and power tools for usability	1.1 Appropriate tools are selected 1.2 Application of tools to job requirement is determined 1.3 Usability of tools are checked and verified 1.4 **Hand tools** and **power tools** are prepared. 1.5 Sources of power supply for power tools are identified
2. Use hand tools properly and safely	2.1 Appropriate hand tool for the job is used 2.2 Proper and safe use/operation is applied in the different types of hand tools 2.3 **Safety precautions** is observed when using hand tools 2.4 Unsafe or faulty tools are identified and marked for repair
3. Operate power tools properly and safely	3.1 Power supply outlet and electrical cord are inspected and confirmed safe for use in accordance with established workplace safety requirements. 3.2 Proper sequence of operation is applied in using power tools to produce results. 3.3 Power tools are used safely in accordance to manufacturer's operating specification.
4. Clean/maintain hand tools and power tools after use	4.1 Dust and foreign matters are removed from power tools in accordance to workplace standard. 4.2 Condition of tools is checked after use 4.3 Appropriate lubricant is applied after use and prior to storage 4.4 **Measuring tools** are checked and calibrated. 4.5 Defective tools, instruments, power tools and accessories are inspected and corrected or replaced

Range of Variables

Variable	Range May include but not limited to:	
1. Hand tools	1.1 Ball peen hammer. 1.2 Cross peen hammer. 1.3 Straight peen hammer. 1.4 Mallet/soft hammer. 1.5 Bench vise.	1.29 Drill bits 1.30 Tap extruder. 1.31 Screw Extruder. 1.32 Hacksaw frame. 1.33 Hacksaw blade.

	1.6 Soft jaw. 1.7 Rough file. 1.8 Medium file. 1.9 Smooth file. 1.10 Punches. 1.11 Chisels. 1.12 Wrenches. 1.13 Pliers. 1.14 Scriber. 1.15 Scraper. 1.16 Screw drivers. 1.17 Dividers. 1.18 Trammels. 1.19 Surface plate 1.20 Marking table. 1.21 Height gauge. 1.22 Layout tools. 1.23 Tap sets. 1.24 Die sets. 1.25 Tap handle 1.26 Die handle 1.27 Hacksaw 1.28 Paint Brushes	1.34 Rivet Gun 1.35 Sledge Hammers 1.36 Sockets 1.37 Spanners 1.38 Vice grip 1.39 Wire Cutters 1.40 Wood Planners 1.41 Hand drill machine. 1.42 Hand grinding machine. 1.43 Pedestal drill. 1.44 Powered screw driver. 1.45 Hand shear. 1.46 Clamps 1.47 Jacks. 1.48 Soldering iron. 1.49 Allen wrenches. 1.50 Draft punches
2. Power tools	2.1 Power drills 2.2 Power rivet gun. 2.3 Hand grinders 2.4 Pneumatic wrenches 2.5 Press machine 2.6 Jack hammer	2.7 Planers 2.8 Pedestal drills
3. Safety precautions	3.1 Use of appropriate PPEs. 3.2 Proper hand, feet and eye coordination 3.3 Safe condition of electrical outlets, cords and lamps 3.4 Working environment 3.5 Safe operating condition of hand tools and power tools. 3.6 Awareness to OHS requirements	
4. Measuring instruments	4.1 Measuring tape 4.2 Steel rule 4.3 Meter rule 4.4 Outside & inside caliper 4.5 Protractors' 4.6 Tri-square 4.7 Sprit level 4.8 Vernier caliper 4.9 Micrometer 4.10 Simple protractor 4.11 Vernier protractor 4.12 Limit gauges 4.13 Snap gauges.	

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 Types of tools, functions and use 1.2 Types of Hand tools and their proper use and techniques 1.3 Types of Power tools, use and safe handling method 1.4 Technical application of tools 1.5 Procedures in the use of hand tools and power tools 1.6 Policies and procedures for occupational health and safety 1.7 Use of PPE 1.8 Handling of tools and equipment 1.9 Reporting and documentation 1.10 Preventive maintenance 1.11 Methods and techniques 1.12 Quality procedures 1.13 Storage procedures
2. Underpinning Skills	2.1 Using appropriate hand tool for the job. 2.2 Observing safety precautions when using hand tools. 2.3 Using power tools correctly and safely in accordance to manufacturer's operating specification. 2.4 Checking condition of tools after use. 2.5 Applying appropriate lubricant on hand tools and power tools after use and prior to storage. 2.6 Inspecting and correcting or replacing defective tools, instruments, power tools and accessories. 2.7 Storing Tools and power tools safely in appropriate location.
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. Promptness in carrying out activities. 3.3 Tidiness and timeliness. 3.4 Respect of peers, sub-ordinates and seniors in workplace. 3.5 Environmental concern. 3.6 Sincere and honest to duties.
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Different types of hand tools and power tools 4.3 Pens 4.4 Papers 4.5 Work books 4.6 Tools and power tools operating and maintenance manuals

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Using appropriate hand tool for the job. 1.2 Observing safety precautions when using hand tools. 1.3 Used power tools safely in accordance to manufacturer's operating specification.

	1.4 Checking the condition of tools after use. 1.5 Appling appropriate lubricant on hand tools and power tools after use and prior to storage. 1.6 Inspecting and corrected or replaced defective tools, instruments, power tools and accessories. 1.7 Storing tools and power tools safely in appropriate location.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **CARRY OUT PRECISION CHECKS AND MEASUREMENTS**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-MEC-FIT-3-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to use graduated measuring instrument in the light engineering sector workplace. It specifically includes the tasks of selecting the job to be measured, selecting graduated measuring instrument, obtaining measurements, recording and communicating measurements, cleaning, maintaining and storing measuring instruments.		

Elements and Performance Criteria:

(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Select the job to be checked and measured	1.1 Job is selected for measuring and checking 1.2 Required **dimensional measurement** is determined in accordance with drawing/plan 1.3 Required **physical condition** is identified in accordance with drawing/plan 1.4 Required **geometrical dimension** is identified in accordance with drawing/plan 1.5 Job drawing is used to select the measuring instruments.
2. Select measuring and checking tool/instrument	2.1 Appropriate measuring instruments is selected in accordance with job requirement. 2.2 **Direct and indirect measuring instruments** and **checking instrument** are identified 2.3 Applications of measuring device is determined. 2.4 Usability and accuracy of measuring device is checked and verified. 2.5 Measuring device is prepared for measurement. 2.6 Fits, Tolerance, clearance and limits are identified according to job requirements.
3. Obtain measurements and checks	4.1 Measurements are obtained using appropriate measuring instrument. 4.2 **Systems of measurements** are identified and converted where necessary. 4.3 Measurement is kept accurately in accordance to specification 4.4 Measurement is checked against job requirement 4.5 Physical conditions are checked in accordance with job requirements 4.6 Geometrical dimensions are checked in accordance with job specifications
4. Record/communicate measurement and check results	4.1 Measurements are recorded in accordance with workplace procedure 4.2 Measurement is interpreted, recorded and communicated to authority
5. Clean, maintain and store measuring instruments.	5.1 Dust and dirt are removed from the measuring instruments 5.2 Condition of measuring instruments are checked

	5.3 Appropriate lubricant is applied after use and prior to storage 5.4 Measuring instruments are checked and calibrated 5.5 Measuring instruments are stored in accordance with workplace procedure.

Range of Variables

Variable	**Range** May include but not limited to:
1. Dimensional measurement	1.1 Length 1.2 Width 1.3 Depth 1.4 Diameter 1.5 Radius 1.6 Height
2. Physical condition	2.1 Roughness 2.2 Color 2.3 Smoothness 2.4 Surface finish 2.5 Flatness
3. Geometrical dimension	3.1 Parallelism 3.2 Perpendicularity 3.3 Angularity 3.4 Concentricity 3.5 Eccentricity 3.6 Roundness 3.7 Circularity
4. Direct measuring instruments.	4.1 Set squares 4.2 Dial indicators 4.3 Steel tape 4.4 Steel rule 4.5 Meter rule 4.6 Calculator 4.7 Vernier slide caliper 4.8 Digital vernier slide caliper 4.9 Micrometer (inch/millimeter) 4.10 Digital micrometer 4.11 Vernier bevel protractor 4.12 Sprit level 4.13 AVO meter(analogue/digital) 4.14 Thermometers 4.15 Water meter 4.16 Gas meter 4.17 Simple protractor
5. Indirect measuring instrument	5.1 Outside caliper 5.2 Inside caliper 5.3 Bevel tri-square 5.4 Telescoping gage

	5.5 Straight edge 5.6 Sine bar 5.7 Trammel
6. Checking instrument.	6.1 Plug gauge 6.2 Snap gauge 6.3 Screw pitch gauge 6.4 Slip gauges 6.5 Feeler gauges 6.6 Screw pitch gauge 6.7 Slip gauge 6.8 Tri-square 6.9 Center gauge 6.10 Bevel tri-square
7. Systems of measurements	7.1 ISO standard 7.2 English system 7.3 Metric system

Curricular Content Guide

1. Underpinning Knowledge	1.1 Difference between measuring and checking 1.2 Types of measuring tools and their applications 1.3 Types of checking tools and their applications 1.4 Geometrical dimensions and tolerances 1.5 Method, procedure and techniques when taking linear Measurements 1.6 Methods, procedures and techniques when checking physical conditions of workpieces 1.7 Methods, procedures and techniques when Checking geometrical dimensions of workpieces 1.8 Measurement conversion systems 1.9 Workplace record keeping procedures 1.10 Preventive maintenance for measuring and checking tools 1.11 Calibration and adjustment procedures for measuring and checking tools
2. Underpinning Skills	2.1 Determining required dimensional measurements, physical conditions and geometrical dimensions in accordance with drawing/plan and workplace specification 2.2 Measuring and checking linear and geometrical dimensions within the required tolerance in accordance to specification 2.3 Checking physical conditions using appropriate checking tool 2.4 Identifying and converting systems of measurements where necessary. 2.5 Recording measurements in accordance with workplace procedure 2.6 Interpreting and communicating measurement to authority 2.7 Applying appropriate lubricant on measuring and checking tools

	and instruments after use and prior to storage 2.8 Checking condition of measuring instruments, calibrating and storing in accordance with workplace procedure
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties.
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Different types of graduated measuring and checking instruments 4.3 Pens 4.4 Papers 4.5 Work books 4.6 Measuring tools operating and maintenance manual.

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Determined required dimensional measurements, physical conditions and geometrical dimensions in accordance with drawing/plan and workplace specification 1.2 Measured and checked linear and geometrical dimensions within the required tolerance in accordance to specification 1.3 Checked physical conditions using appropriate checking tool 1.4 Identified and converted systems of measurements where necessary. 1.5 Recorded measurements in accordance with workplace procedure 1.6 Interpreted and communicated measurement to authority 1.7 Applied appropriate lubricant on measuring and checking tools and instruments after use and prior to storage 1.8 Checked condition of measuring instruments, calibrated and stored in accordance with workplace procedure

2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **APPLY QUALITY SYSTEMS AND PROCEDURES**	**Nominal Duration:** 8 hrs.	**Unit Code:** SEIP-MEC-FIT-4-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to apply quality systems and procedures. It specifically includes the tasks of working within quality system, applying and monitoring quality system improvement in the workplace, holding responsibility for quality work and applying standard procedures for each job.		

Elements and Performance Criteria:

(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Work within quality system	1.1 Instructions and procedures are followed strictly and duties are performed in accordance with demand of **quality improvement system.** 1.2 Conformance to specifications is ensured. 1.3 Defects are detected and reported to authority according to standard operating procedures. 1.4 Customer's satisfaction is ensured in performing an operation or quality of product or services.
2. Apply and monitor quality system improvement in the workplace	2.1 Performance measurement systems are identified 2.2 Performance is assessed at regular interval. 2.3 Specifications and standard operating procedures are established and identified. 2.4 Defects are detected and reported according to standard operating procedures. 2.5 Process improvement procedures are applied 2.6 Quality of product is checked and verified.
3. Hold responsible for work quality	3.1 Concept of supplying product or service to meet the **customer quality requirements** is understood and accordingly applied. 3.2 Responsibility is taken for quality work.
4. Apply standard procedures for each job.	4.1 **Quality control and quality assurance** system procedures for each job are followed. 4.2 Conformance to specification is ensured in every case at all situations.

Range of Variables

Variable	Range May include but not limited to:
1. Quality improvement system	A system comprising some or all of the following elements: 1.1 Quality inspection 1.2 Quality control. 1.3 Quality improvement. 1.4 Quality assurance
2. Customer quality	2.1 Appropriateness of product

requirements.	2.2 Appearance 2.3 Durability. 2.4 Grade or quality design 2.5 Usability life span 2.6 Conformance to Quality 2.7 Reliability 2.8 Maintainability	
3. Quality control and quality assurance	3.1 Quality control 3.1.1 Product 3.1.2 Reactive 3.1.3 Line function 3.1.4 Find the defects 3.1.5 Walk through 3.1.6 Testing 3.1.7 Inspection 3.1.8 Checkpoint Review	3.2 Quality Assurance 3.2.1 Process 3.2.2 Pro-active 3.2.3 Staff function 3.2.4 Prevent the defects 3.2.5 Quality audit 3.2.6 Defining process 3.2.7 Selection of tools 3.2.8 Training

Curricular Evidence Guide

1. Underpinning Knowledge	1.1 The reasons why good quality should be maintained and poor quality should be eliminated 1.2 Meaning of the key terms - quality, quality assurance, quality control, quality inspection, quality improvement and total quality control. 1.3 Process and procedures for improving and maintaining quality 1.4 Procedures for addressing defects. 1.5 Record keeping within the quality improvement system in workplace 1.6 Factors, which affect successful implementi0n of the quality systems and procedures.
2. Underpinning Skills	2.1 Maintaining good quality 2.2 Eliminating poor quality 2.3 Understanding the meaning of the key terms - quality, quality assurance, quality control, quality inspection, quality improvement and total quality control. 2.4 Improving and maintaining quality 2.5 Addressing defects and procedures 2.6 Recording within the quality improvement system in workplace. 2.7 Implementing quality systems and procedures
3. Under pinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties.

4. Resource Implications	The following resources must be provided: 4.1 Workplace 4.2 Tools and equipment appropriate to maintain workplace 4.3 Materials relevant to the proposed activity 4.4 Relevant drawings, manuals, codes, standards and reference material

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Followed instructions and procedures strictly 1.2 Performed duties in accordance with demand of quality system 1.3 Ensured conformance to specifications 1.4 Detected defects and reported to authority in accordance to standard operating procedures. 1.5 Understood concept of supplying product or service to meet the customer quality requirements 1.6 Held responsible for quality work 1.7 Followed quality control and quality assurance system procedures for each job
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

C. The Occupation Specific (Core) Competencies

Unit of Competency: **PERFORM BASIC WORKSHOP PRACTICE**	**Nominal Duration:** 64 hrs.	**Unit Code:** SEIP-MEC-FIT-1-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to perform basic workshop practice**.** It specifically includes the tasks of performing benchworking operations, performing lathe machine operation and applying fumdamentals of heat treatment.		

Elements and Performance Criteria Template:
(Terms in the performance criteria that are written in **bold and underlined** are described in the range of variables).

Elements of Competency	**Performance Criteria**
1. Perform benchworking operations	1.1 **Benchwork Tools and equipment** are gathered and checked for its functioning and working conditions. 1.2 **Benchworking materials** are collected in accordance with workplace specification 1.3 **Benchworking operations** are performed in accordance with workplace requirements/plan. 1.4 **Personal Protective Equipment (PPE**) are used when perfoming benchwork operation in accordance with workplace requirments 1.5 Work area, tools, equipment and materials are maintained and stored in accordance wth workplace procedures.
2. Perform lathe machine operation	2.1 **Lathe tools and equipment** are gathered and checked for functionality and working conditions. 2.2 **Work piece and lathe setting** is carried out in accordance with job requirements. 2.3 **Lathe machine operations** are carried out in accordance with workplace/plan requirements and specifications**.** 2.4 Personal Protective Equipment (PPE) are used when perfoming lathe machine operation in accordance with workplace requirements 2.5 Work area, tools, equipment and materials are maintained and stored in accordance wth workplace procedures.
3. Apply fumdamentals of heat treatment	3.1 Principles of heat treatment processes are explained 3.2 **Heat treatment tools and equipment** are gathered and checked for functionality and working conditions 3.3 **Heat treatment materials** are prepared in accordance with workplace requirement. 3.4 **Heat treatment processes** are carried out in accordance with work place requirements and specifications. 3.5 Work area, tools, equipment and materials are maintained and stored in accordance wth workplace procedures.

Range of Variables

Variable	**Range** (Includes but not limited to):
1. Benchwork tools and equipment	1.1 Tools 1.1.1 Scriber 1.1.2 File 1.1.3 Chisel 1.1.4 Ball peen hammer 1.1.5 Cross peen hammer 1.1.6 Drill bit 1.1.7 Hand hacksaw 1.1.8 Combination wrench set 1.1.9 Mechanical pliers 1.2 Equipment 1.2.1 Workbenck 1.2.2 Drill press (Pedestal/Bench) 1.2.3 Bench grinder/pedestal grinder 1.2.4 Bending machine
2. Benchworking materials	2.1 M.S. plate 2.2 Steel rod 2.3 Angular bar, Mild Steel 2.4 Angular bar, Aluminum 2.5 Black iron pipe 2.6 Cotton rags 2.7 Coolant oil 2.8 Greae 2.9 Lubricating machine oil 2.10 Cleaning solvent
3. Benchworking operations	3.1 Lay outing 3.2 Sawing 3.3 Chiselling 3.4 Filing 3.5 Drilling 3.6 Reaming 3.7 Countersinking 3.8 Counterboring 3.9 Off-hand grinding 3.10 Hand tapping/threading
4. Personal Protective Equipment (PPE)	4.1 Safety eye glasses 4.2 Goggles 4.3 Face mask 4.4 Dust mask 4.5 Hand gloves 4.6 Apron 4.7 Safety shoes
5. Lathe tools and equipment	5.1 Tools 5.1.1 Set of combination wrench 5.1.2 Set of socket wrench 5.1.3 Pipe wrench

	5.1.4 C-spanner 5.1.5 Centering gauge 5.1.6 Steel rule 5.1.7 Vernier caliper 5.1.8 Micrometer 5.1.9 Dial indicator 5.1.10 Machinist hammer 5.1.11 Plastic/rubber mallet 5.1.12 Flat screwdriver 5.1.13 Philips screw driver 5.1.14 Hand hacksaw 5.2 Equipment 5.2.1 Lathe machine with accessories 5.2.2 Drill press 5.2.3 Bench/pedestal grinder 5.2.4 Tool and cutter grinder 5.2.5 Bench table 5.2.6 Bench vise 5.2.7 Anvil
6. Work piece and lathe setting	6.1 Workpiece measuring and checking 6.2 Workpiece chucking/clamping on lathe chuck 6.3 Workpiece centering 6.4 Workpiece levelling and alignment 6.5 Cutting tool grinding/sharpening 6.6 Ginding tool clamping 6.7 Lathe machine speed setting 6.8 Tool feed setting/adjusting 6.9 Machine coolant checking and operating 6.10 Machine guard checking and engaging
7. Lathe machine operations	7.1 Facing 7.2 Straight turning 7.3 Shoulder turning 7.4 Step turning 7.5 Grooving 7.6 parting off operation 7.7 Taper turning
8. Heat treatment tools and equipment	8.1 Tools 8.1.1 Mechanical pliers 8.1.2 Hammer 8.1.3 Thermometer 8.1.4 Pyrometer 8.1.5 Temperature meter 8.1.6 Tongs 8.1.7 Anvil 8.1.8 Quenching bucket 8.2 Equipment 8.2.1 Heat treatment oven/furnace 8.2.2 Oxy-acetylene outfit

	8.2.3 LPG gas equipment 8.2.4 Quenching unit
9. Heat treatment materials	9.1 Mild steel plate 9.2 Mild steel round bar 9.3 Carbon steel bar (round or square profile) 9.4 Quecning oil 9.5 Water 9.6 Carbon material (coal) 9.7 LPG gas 9.8 Acetylene gas 9.9 Oxygen gas
10. Heat treatment processes	10.1 Heating 10.2 Annealing 10.3 Hardening 10.4 Tempering 10.5 Normalizing

Curricular Content Guide

1. Underpinning Knowledge	1.1 Procedure of gathering and checking the working conditions of benchwork tools and equipment 1.2 Types and properties of materials used in benchwork operations 1.3 Different types and application of benchworking operations 1.4 Methods, techniques and procedures of performing the different types of benchworking operations. 1.5 Types and application of the different Personal Protective Equipment (PPE) used when perfoming benchwork 1.6 Use and care of lathe tools and equipment 1.7 Procedure of setting work piece and lathe in accordance with job requirements. 1.8 Procedure of performing the different types of lathe machine operations. 1.9 Proper use and application of Personal Protective Equipment (PPE) when perfoming lathe machine operation 1.10 Principles of heat treatment processes 1.11 Procedure of gathering and checking heat treatment tools and equipment for functionality and working conditions 1.12 Types and properties of heat treatment materials. 1.13 Heat treatment processes and their applications 1.14 Maintaining the work area, tools, equipment and materials in benchworks. 1.15 Proper storing and maintenance of tools, equipment and materials.
2. Underpinning Skills	2.1 Gathering and checking the function and working conditions of of tools and equipment used in benchwork. 2.2 Identifying and collecting benchwork materials in accordance

	with workplace specification 2.3 Performing benchwork operations in accordance with workplace requirements/plan. 2.4 Using personal protective equipment (PPE) when perfoming benchwork operation in accordance with workplace requirements 2.5 Gathering and checking Lathe tools and equipment for functionality and working conditions. 2.6 Carrying out workpiece and lathe setting in accordance with job requirements. 2.7 carrying out Lathe machine operations in accordance with workplace/plan requirements and specifications. 2.8 using personal protective equipment (PPE) when perfoming lathe machine operation in accordance with workplace requirements 2.9 Explaining the principles of heat treatment processes 2.10 Gathering and checking of heat treatment tools and equipment for functionality and working conditions 2.11 Preparing heat treatment materials in accordance with workplace requirement. 2.12 Carrying out heat treatment processes in accordance with work place requirements and specifications. 2.13 Maintaining work area, tools, equipment and materials in accordance with workplace procedures. 2.14 Storing tools, equipment and materials in accordance wth workplace procedures.
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Concern to environmental care 3.3 Eagerness to learn 3.4 Tidiness, timeliness, and orderliness 3.5 Respect for rights of peers and seniors in workplace 3.6 Communication with peers and seniors in workplace
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Complete set of tools and equipment 4.3 Materials required for workshop practices and operations 4.4 Conplete set of tools, equipment and PPEs 4.5 Work instruction sheets/manuals 4.6 Pens 4.7 Papers

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Performed different benchworking operations in accordance with workplace plans/specifications. 1.2 Performed different lathe machine operations in accordance with workplace plans/specifications.

	1.3 Carried out heat treatment processes in accordance with workplace requirements and specifications. 1.4 Used Personal Protective Equipment (PPE) are when perfoming workshop practices. 1.5 Cleaned and maintained tools, equipment and materials in accordance wth workplace procedures.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: PERFORM GAS CUTTING AND WELDING WORKS	Nominal Duration: 62 hrs.	Unit Code: SEIP-MEC-FIT-2-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to perform gas cutting and welding works. It specifically includes the tasks of welding materials using arc weding machine, carrying out gas welding and cutting , performing brazing operations and performing soldering.		

Elements and Performance Criteria Template:
(Terms in the performance criteria that are written in **bold and underlined** are described in the range of variables).

Elements of Competency	Performance Criteria
1. Weld materials using arc welding machine	1.1 Welding details are interpreted in accordance with given welding plan/drawing. 1.2 **Welding Tools and equipment** are selected and gathered in accordance with welding plan/requirements. 1.3 **Welding materials** and **electrodes** are selected according to requirements of the job. 1.4 **Welding joint**, **welding position** and procesess are identified in accordance with job requirement. 1.5 Welding is performed in accordance with the specified welding joint and welding position. 1.6 PPE is selected and used when performing electric arc welding operation.
2. Carry out gas welding and cutting	2.1 **Gas cutting and welding Tools and equipment** are identified and prepared in accordance with work requirements/specifications. 2.2 **Gas cutting and welding materials** are identified and prepared in accordance with work requirements/specifications. 2.3 Fusion gas welding is performed in accordance with workplace requirements and specifications. 2.4 Welds are cleaned, checked for quality and **weld defects** are identified. 2.5 Gas cutting procedure is peformed in accordance with workplace requirements. 2.6 Appropriate method of cleaning/removing slag on cut ends of material is performed. 2.7 Cutting defects are identified and corrective action is taken in accordance with workplace procedures.
3. Perform brazing operations	3.1 Appropriate **type of flame** is set on the welding torch in accordance with required brazing application. 3.2 **Suitable Materials** are brazed in accordance with workplace requirements/specifications. 3.3 Different **types joints** are brazed in accordance with workplace requirements 3.4 Appropriate brazing flux and brazing filler rods are used for brazing work.

	3.5 Brazed surface is cleaned, checked for quality and defects are identified.
4. Perform soldering	4.1 **Soldering tools and equipment** are identified and prepared in accordance with workplace requirements. 4.2 **Soldering Materials** are identified and prepared. 4.3 Soldering process is carried out in accordance with workplace requirements and specifications 4.4 Soldered surface is cleaned, checked for quality and defects are rectified.

Range of Variables

Variable	**Range** (Includes but not limited to):
1. Welding Tools and equipment	1.1 Tools 1.1.1 Clamps 1.1.2 Chipping hammer 1.1.3 Pliers 1.1.4 Wire brush 1.1.5 Weld gauge 1.1.6 Job holding devices/fixture 1.1.7 Portable grinder 1.1.8 Portable drill 1.2 Equipment 1.2.1 AC welding machine 1.2.2 DC welding machine. 1.2.3 Drill press (Pedestal/Bench) 1.2.4 Bench grinder/pedestal grinder 1.2.5 Bending machine 1.2.6 Hydraulic press 1.2.7 Welding table
2. Welding materials	2.1 M.S. plate 2.2 Steel rod 2.3 Angular bar, Mild Steel 2.4 Angular bar, Aluminum 2.5 Black iron pipe
3. Electrodes	3.1 E-6010 3.2 E-6011 3.3 E-6013 3.4 E-6021 3.5 E-7018
4. Welding joint	4.1 Butt joint 4.2 T-joint 4.3 Lap joint 4.4 Corner joint 4.5 Edge joint
5. Welding position	5.1 Fillet weld 5.1.1 1F 5.1.2 2F

	5.1.3 3F 5.1.4 4F 5.2 Gooved weld 5.2.1 1G 5.2.2 2G
6. Gas cutting and welding Tools and equipment	6.1 Tools 6.1.1 Spark lighter 6.1.2 Welding torch tip set 6.1.3 Pressure regulating set with hose 6.1.4 Clamps 6.1.5 Chipping hammer 6.1.6 Locking pliers 6.1.7 Mechanical Pliers 6.1.8 Vise grip 6.1.9 Wire brush 6.1.10 Portable grinder 6.1.11 Hand drill 6.1.12 6.2 Equipment 6.2.1 Welding table 6.2.2 Job holding devices/fixture 6.2.3 Oxy-acetylene welding set 6.2.4 LPG welding set 6.2.5 Cutting outfit ser 6.2.6 Gas welding outfit set 6.2.7 Drill press (Pedestal/Bench) 6.2.8 Bench grinder/pedestal grinder
7. Gas cutting and welding materials	7.1 B.I sheet metal strips, gauge 18 7.2 G.I sheet metal strip, Gauge 16 7.3 Flux (Borax) 7.4 Filler rod (1/16”, 3/32”, 5/32” and 1/8” dia.) 7.5 G.I. wire gauge 16 7.6 Oxygen gas 7.7 Acetylene gas 7.8 LPG gas
8. Weld defects	8.1 Lack of penetration 8.2 Excess of penetration 8.3 Porosity 8.4 Crack 8.5 Slag 8.6 Inclusion 8.7 Undercut 8.8 Lack of fusion 8.9 Notches 8.10 Irregular shape 8.11 Dimension
9. Type of flame	9.1 Carburizing flame 9.2 Neutral flame

	9.3 Oxidizing flame
10. Suitable materials	10.1 Steel plates 10.2 Copper plates 10.3 Copper tubes 10.4 Steel tubes 10.5 Cast iron plates
11. Types joints	11.1 Lap 11.2 Butt 11.3 Fillet
12. Soldering tools and equipment	12.1 Soldering gun 12.2 Soldering iron (different wattage) 12.3 Desoldering pump 12.4 Clamps 12.5 Pliers 12.6 Wire brush 12.7 Solddering table 12.8 Job holding devices/fixture
13. Soldering Materials	13.1 Soldering paste 13.2 Solder wire 13.3 Solder bar 13.4 Ssoldering flux 13.5 Flux thinner 13.6 Flux rework pen 13.7 Solder mask

Curricular Content Guide

1. Underpinning Knowledge	1.1 Welding plans and drawing. 1.2 Welding Tools and equipment 1.3 Welding materials and electrodes selection 1.4 Types of Welding joint, welding positions and welding processes 1.5 Procedures, methods and tehcniques of electric arc welding 1.6 Use and selection of PPE in welding 1.7 Gas cutting and welding tools and equipment 1.8 Gas cutting and welding materials 1.9 Fusion gas welding processes and procedures 1.10 Checking quality of welds and weld defects identification 1.11 Gas cutting procedure 1.12 Method of cleaning/removing slag on cut ends 1.13 Types of cutting defects and remedial actions 1.14 Type of flame in brazing process 1.15 Procedure of brazing 1.16 Types of brazed joints

	1.17 Brazing flux and brazing filler rods 1.18 Procedure of cleaning and checking for quality and defects 1.19 Soldering tools and equipment 1.20 Soldering materials and their uses 1.21 Soldering processes 1.22 Procedure of cleaning and checking soldered surface for quality and defects rectification
2. Underpinning Skills	2.1 Interpreting welding plans and drawings 2.2 Selecting and gathering welding tools and equipment 2.3 Selecting welding materials and electrodes in accordance with requirements of the job. 2.4 Identifying welding joint, welding position and procesess in accordance with job requirement. 2.5 Performing arc welding in accordance with the specified welding joint and welding position. 2.6 Selecting and using PPE when performing electric arc welding operation. 2.7 Identifying and preparing gas cutting and welding tools and equipment 2.8 Identifying and preparing gas cutting and welding materials 2.9 Performing fusion gas welding in accordance with workplace requirements and specifications. 2.10 Cleaning and checking welds and identifying weld defects. 2.11 Peforming gas cutting procedure 2.12 Performing appropriate method of cleaning/removing slag on cut ends of material 2.13 Identifying and correcting cutting defects 2.14 Setting the type of flame in brazing process 2.15 Brazing suitable materials in accordance with workplace requirements/specifications. 2.16 Brazing different types of joints in accordance with workplace requirements 2.17 Using appropriate brazing flux and brazing filler rods for work. 2.18 Cleaning and checking for quality brazed surface and identifying defects. 2.19 Identifying and preparing soldering tools and equipment 2.20 Identifying and preparing soldering materials 2.21 Carrying out soldering process in accordance with workplace requirements and specifications 2.22 Cleaning and checking soldered surface for quality and rectifying defects.
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Concern to environmental care 3.3 Eagerness to learn 3.4 Tidiness, timeliness, and orderliness 3.5 Respect for rights of peers and seniors in workplace 3.6 Communication with peers and seniors in workplace

4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Complete set of tools and equipment 4.3 Materials required for workshop practices and operations 4.4 Conplete set of tools, equipment and PPEs 4.5 Work instruction sheets/manuals 4.6 Pens 4.7 Papers

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Performed welding in accordance with the specified welding joint and welding position 1.2 Performed fusion gas welding in accordance with workplace requirements and specifications. 1.3 Brazed different types of joints in accordance with workplace requirements 1.4 Carried out soldering process in accordance with workplace requirements and specifications
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: CARRY OUT BEARINGS AND SEALS MAINTENANCE AND SERVICING	Nominal Duration: 48 hrs.	Unit Code: SEIP-MEC-FIT-3-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to carry out bearings and seals maintenance and servicing. It specifically includes the tasks of performing troubleshooting on bearings operation, servicing and maintaining bearings, servicing and maintaining seals and testing newly maintained/serviced bearings and seals for proper operation.		

Elements and Performance Criteria Template:
(Terms in the performance criteria that are written in **bold and underlined** are described in the range of variables).

Elements of Competency	Performance Criteria
1. Perform troubleshooting on bearings operation	1.1 **Classification and types of bearings** are identified. 1.2 Properties and application of plain bearings are described. 1.3 Properties and application ofdifferent types of roller bearings and explained. 1.4 **Types of loads** experienced by bearings are explained. 1.5 Bearing load analysis is applied on different **bearing mounting arrangement.** 1.6 **Common faults of bearing**operation are identified.
2. Service and maintain bearings	2.1 **Bearing maintenance and servicing tools, equipment and materials** are identified and prepared. 2.2 Appropriate **methods of bearing removal and mounting** is applied in accordance with workplace requirements and specification. 2.3 **Bearing plays and clearances** are applied during bearing mounting in accordance with workplace or machine manufacturer's specification. 2.4 Reccommended lubricant is applied on bearings when performing bearing mounting in accordance with workplace requirements/machinemanufacturer's specification. 2.5 **Personal Protective Equipment (PPE)** and workshop safety is worn and observed when performing bearing maintenance and servicing. 2.6 Tools, equipment and materials are cleaned and stored in accordance with workplace procedure.
3. Service and maintain seals	3.1 **Classification and types of seals** are identified. 3.2 **Common faults of seals operation** are identified. 3.3 **Gasket and seals maintenance and servicing tools, equipment and materials** are identified and prepared. 3.4 Appropriate **methods of gasket and seals removal and installation**are applied in accordance with workplace requirements and specification. 3.5 Reccommended lubricant is applied on seals during mounting in accordance with workplace requirements or machinemanufacturer's specification.

	3.6 Personal Protective Equipment (PPE) is worn and workshop safety is observed when performing seals maintenance and servicing. 3.7 Tools, equipment and materials are cleaned and stored in accordance with workplace procedure.
4. Test newly maintained/serviced bearings and seals for proper operation	4.1 Newly maintained/serviced bearings are tested for proper operation in accordance with workplace requirements or machine manufacturer's specifications. 4.2 Newly maintained/serviced seals are tested for proper operation in accordance with workplace requirements or machine manufacturer's specifications.

Range of Variables

Variable	**Range** (May include but not limited to):
1. Classification and types of bearings	1.1 Bearing Classification 1.1.1 Plain (sliding) bearing 1.1.2 Anti-friction (Rolling bearing) 1.2 Types of plain (sliding) bearings 1.2.1 Sleeve (bush) bearing 1.2.2 Journal bearing 1.3. Anti-friction (rolling) bearing 1.3.1 Ball bearing 1.3.2 Roller bearing
2. Types of loads	2.1 Radial load 2.2 Axial load 2.3 Combined radial and axial load
3. Bearing mounting arrangement	3.1 Straddle loaded bearings 3.2 Overhang loaded bearings
4. Common faults of bearings operation	4.1 Abrasion due to presence of foreign materials 4.2 Lack of lubrication 4.3 Corrosion due to presence of water or moisture 4.4 Faulty adjustment (Too tight or too loose) 4.5 Faulty dismounting and mounting procedure
5. Bearing maintenance and servicing tools, equipment and materials	5.1 Tools 5.1.1 Set of combination wrench 5.1.2 Set of socket wrench 5.1.3 Set of open-ended wrench 5.1.4 Adjustable wrench 5.1.5 Screw driver set 5.1.6 Ball peen hammer 5.1.7 Rubber/plastic hammer 5.1.8 Rubber mallet 5.1.9 Mechanica; pier 5.1.10 Vise grip 5.1.11 Set of bearing sleeve 5.1.12 Drift punch

	5.1.13 Bearing puller 5.2 Equipment 5.2.1 Bearing heater 5.2.2 Mandrel 5.2.3 Hydraulic press 5.2.4 Drill press 5.2.5 Portable grinder 5.2.6 Oxy-acetylene welding outfit 5.3 Materials 5.3.1 Lubricating oil 5.3.2 Grease 5.3.3 Cotton rag 5.3.4 Cleaning solvent
6. Methods of bearing mounting and removal	6.1 Use of hammer and drift punch 6.2 Use of puller 6.3 Use of hydraulic press/jack 6.4 Use of bearing heater
7. Bearing plays and clearances	7.1 Radial clearance/play 7.2 Axial clearance/play
8. Personal Protective Equipment (PPE)	8.1 Safety eye glass (receptacles) 8.2 Face shield 8.3 Apron 8.4 Hand gloves 8.5 Safety helmet (hard hat) 8.6 Safety shoes
9. Classification and types of seals	9.1 Static seals 9.1.1 Gaskets 9.1.2 O-rings 9.1.3 Packings 9.2 Dynamic seals 9.2.1 Shaft seals 9.2.2 Rod seals 9.2.3 Mechanical seals
10. Common faults of seals operation	10.1 Premature wear due to presence of foreign materials 10.2 Incompatible system lubricant/fluid 10.3 Faulty mounting 10.4 Incorrect type/design/size of seal used 10.5 Excessive/abnormal system pressure 10.6 Excessive/abnormal system temperature 10.7 Excessive/abnormal system vibration
11. Gasket and seals maintenance and servicing tools, equipment and materials	11.1 Tools 11.1.1 Set of combination wrench 11.1.2 Set of socket wrench 11.1.3 Set of open-ended wrench 11.1.4 Adjustable wrench 11.1.5 Screw driver set 11.1.6 Ball peen hammer

	11.1.7 Rubber/plastic hammer 11.1.8 Mechanical pliers 11.1.9 Vise grip 11.1.10 Set of sleeve 11.1.11 Drift punch 11.1.12 Seal puller 11.2 Equipment 11.2.1 Mandrel 11.2.2 Hydraulic press 11.2.3 Drill press 11.3 Materials 11.3.1 Lubricating oil 11.3.2 Grease 11.3.3 Cotton rag 11.3.4 Cleaning solvent
12. Methods of gasket and seals removal	12.1 Use of hammer and drift punch 12.2 Use of special seal puller 12.3 Use of sleeve and hydraulic press 12.4 Lubricating the seal during installation

Curricular Content Guide

1. Underpinning Knowledge	1.1 Classification and types of bearings 1.2 Properties and application of plain bearings 1.3 Properties and application of different types of roller bearings 1.4 Types of bearings loads 1.5 Bearing load analysis 1.6 Common faults of bearing operation 1.7 Bearing maintenance and servicing tools, equipment and materials. 1.8 Appropriate methods of bearing removal and mounting 1.9 Bearing plays and clearances 1.10 Reccommended lubricant applied on bearings 1.11 Personal Protective Equipment (PPE) and workshop safety 1.12 Tools, equipment and materials cleaning and storing procedures. 1.13 Classification and types of seals 1.14 Common faults of seals operation 1.15 Gasket and seals maintenance and servicing tools, equipment and materials 1.16 Appropriate methods of gasket and seals removal and installation. 1.17 Applying reccommended lubricant for seals during mounting 1.18 Personal Protective Equipment (PPE) and workshop safety when performing seals maintenance and servicing. 1.19 Cleaning and storing procedures for tools, equipment and materials

	1.20 Procedure of testing Newly maintained/serviced bearings for proper operation 1.21 Procedure of testing newly maintained/serviced seals for proper operation
5. Underpinning Skills	5.1 Identifying classification and types of bearings 5.2 Describing the properties and application of plain bearings 5.3 Explaining the properties and application of different types of roller bearings 5.4 Explaining the types of loads experienced by bearings 5.5 Applying bearing load analysis on different bearing mounting arrangement. 5.6 Identifying the common faults of bearing operation. 5.7 Identifying and preparing bearing maintenance and servicing tools, equipment and materials. 5.8 Applying appropriate methods of bearing removal and mounting in accordance with workplace requirements and specification. 5.9 Applying bearing plays and clearances on mounted bearings in accordance with workplace or machine manufacturer's specification. 5.10 Applying recommended lubricant on bearings when performing bearing mounting in accordance with workplace requirements/machinemanufacturer's specification. 5.11 Wearing Personal Protective Equipment (PPE) and observing workshop safety when performing bearing maintenance and servicing. 5.12 Cleaning and storing tools, equipment and materials in accordance with workplace procedure. 5.13 Identifying the classification and types of seals 5.14 Identifying common faults of seals operation 5.15 identifying and preparing gasket and seals maintenance and servicing tools, equipment and materials 5.16 Applying the methods of gasket and seals removal and installation 5.17 Applying the reccommended lubricant on seals during mounting in accordance with workplace requirements or machine manufacturer's specification. 5.18 Wearing Personal Protective Equipment (PPE) and observing workshop safety when performing seals maintenance and servicing. 5.19 Cleaning and storing tools, equipment and materials in accordance with workplace procedure. 5.20 Testing newly maintained/serviced bearings for proper operation in accordance with workplace requirements or machine manufacturer's specifications. 5.21 Testing newly maintained/serviced seals for proper operation in accordance with workplace requirements or machine

	manufacturer's specifications.
6. Underpinning Attitudes	6.1 Commitment to occupational health and safety practices 6.2 Concern to environmental care 6.3 Eagerness to learn 6.4 Tidiness, timeliness, and orderliness 6.5 Respect for rights of peers and seniors in workplace 6.6 Communication with peers and seniors in workplace
7. Resource Implications	7.1 Workplace (simulated or actual) 7.2 Complete set of tools and equipment 7.3 Materials required for workshop practices and operations 7.4 Conplete set of tools, equipment and PPEs 7.5 Work instruction sheets/manuals 7.6 Pens 7.7 Papers

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Identified faults of bearing operation in accordance with machine manufacturer's troubleshooting procedure. 1.2 Carried out servicing and maintainance on bearings in accordance with workplace requirements and machine specifications. 1.3 Carried out servicing and maintainance on seals in accordance with workplace requirements and machine specifications. 1.4 Tested newly maintained/serviced bearings for proper operation in accordance with workplace requirements or machine manufacturer's specifications. 1.5 Tested newly maintained/serviced seals for proper operation in accordance with workplace requirements or machine manufacturer's specifications.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **CARRY OUT DRIVE COMPONENT MAINTENANCE AND SERVICING**	**Nominal Duration:** 48 hrs.	**Unit Code:** SEIP-MEC-FIT-4-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to carry out drive component maintenance and servicing. It specifically includes the tasks of performing fault finding and troubleshooting of mechanical drive components, performing maintenance and servicing of mechanical drive components and testing newly maintained/serviced drive components.		

Elements and Performance Criteria Template:
(Terms in the performance criteria that are written in**bold and underlined**are described in the range of variables).

Elements of Competency	Performance Criteria
1. Perform fault finding and troubleshooting of mechanical drive components	1.1 Operating principles of **mechanical machines** and their drive components are explained. 1.2 **Types of mechanical drives** and their principles of operation are explained 1.3 **Types of machine motion transmission** and their application is described. 1.4 **Operational problems of mechanical drive components** are observed. 1.5 **Fault/cause of trouble of mechanical drive components** are identified.
2. Perform maintenance and servicing of mechanical drive components	2.1 **Tools, equipment and materials** are gathered and checked for usability and operating condition. 2.2 **Operating condition of mechanical drive components** are checked and qualified in accordance with workplace requirements/machine manufacturer's specifications. 2.3 Installation of mechanical drive components are performed in accordance with workplace requirements/machine manufacturer's specifications. 2.4 Alignment of mechanical drive components are checked and nonconformities are rectified in accordance with workplace requirements/machine manufacturer's specifications. 2.5 Levelness of mechanical drives are checked and nonconformities are rectified in accordance with workplace requirements/machine manufacturer's specifications. 2.6 **Parts/component** replacement of mechanical drives are carried out in accordance with workplace requirements/machine manufacturer's specifications. 2.7 Preventive maintenance activities for mechanical drive components are carried out in accordance with workplace /machine manufacturer's requirements. 2.8 **PPE** is used and safe working practices are observed at work.

3. Test newly maintained/serviced drive components	3.1 Newly maintained/serviced mechanical drive components are tested for proper operation. 3.2 Necessary adjustments are carried out in accordance with workplace /machine manufacturer's specifications.

Range of Variables

Variable	**Range** (May include but not limited to):
1. Mechanical machines	1.1 Pumps (water, oil, slurry) 1.2 Air compressors 1.3 Gas compressors 1.4 Furnace 1.5 Cranes 1.6 Conveyors 1.7 Boilers 1.8 Furnace
2. Types of mechanical drives	2.1 ShaftS 2.2 Bearing 2.3 Coupling 2.4 Belt drives 2.5 Chain drives 2.6 Gear drives
3. Types of machine motion transmission	3.1 Rotation to rotation shafts in line 3.2 Rotation to rotation shaft in parallel 3.3 Rotation to rotation shafts in an angle 3.4 Rotation to linear motion 3.5 Linear motion to rotation
4. Operational problems of mechanical drive components	4.1 Excessive vibration 4.2 Noisy operation 4.3 Low power 4.4 Low capacity
5. Fault/cause trouble of mechanical drive components	5.1 Damaged/brokenbearings 5.2 Very low operating speed 5.3 Overspeeding 5.4 Overloading 5.5 Shaft misalignment 5.6 Machine and components not leveled 5.7 Excessive vibration 5.8 Excessive operating temperature 5.9 Noisy operation
6. Tools, equipment and materials	6.1 Tools 6.1.1 Set of combination wrench 6.1.2 Set of open ended wrench 6.1.3 Set of socket wrench 6.1.4 Set of allen keys/wrench 6.1.5 Screw driver set 6.1.6 Adjustable wrench 6.1.7 Pipe wrench

	6.1.8 Pry bar 6.1.9 Center punch 6.1.10 Drift Punch set 6.1.11 Ball peen hammer 6.1.12 Hand hacksaw 6.1.13 Spirit level 6.1.14 Piano wire (for levelling) 6.1.15 Bearing puller 6.1.16 Rubber/plastic hammer 6.1.17 Mallet 6.2 Equipment 6.2.1 Drill press 6.2.2 Grinding machine 6.2.3 Hydrauliic press 6.2.4 Pneumatic torque wrench 6.2.5 Work benches 6.2.6 Oxy-acetylene welding and cutting outfit 6.2.7 Arc welding machine 6.3 Materials 6.3.1 Gasket materials 6.3.2 O-rings 6.3.3 Lubricating oil 6.3.4 Grease 6.3.5 Welding rod 6.3.6 Cleaning solvent 6.3.7 Cotton rags
7. Operating condition of mechanical drive components	7.1 Presence of corrosion 7.2 Dimension 7.3 Wear 7.4 Geometrical shape 7.5 Material deterioration
8. Parts/component of mechanical drive component	8.1 Shaft (Plain, stepped, crankshaft, cam shaft) 8.2 Bearing 8.3 Coupling 8.4 Gasket 8.5 Seal 8.6 Chain 8.7 Sprocket 8.8 V-belt 8.9 Flat belt 8.10 Timing belt 8.11 Gears 8.12 Camshaft
9. PPE	9.1 Safety glass/receptacle 9.2 Face mask/face shield 9.3 Hand gloves 9.4 Safety shoes 9.5 Tight fitting clothes/apparel

Curricular Content Guide:

1. Underpinning Knowledge	1.1 Operating principles of mechanical machines 1.2 Types of mechanical drives and their principles of operation 1.3 Types of machine motion transmission and their application 1.4 Operational problems of mechanical drive components 1.5 Common faults/trouble of mechanical drive components 1.6 Gathering and checking procedures of tools, equipment and materials 1.7 Operating condition of mechanical drive components 1.8 Installation procedures of mechanical drive components 1.9 Alignment methods and techniques of mechanical drive components 1.10 Leveling methods and techniques of mechanical drives 1.11 Parts/component replacement procedures of mechanical drives 1.12 Preventive maintenance activities for mechanical drive components 1.13 Procedure of testing newly maintained/serviced mechanical drive components 1.14 Adjustment procedures of mechanical drive components for misalignment, out of level and other operational problems
2. Underpinning Skills	2.1 Explaining the operating principles of mechanical machines and their drive components 2.2 Explaining the types of mechanical drives and their principles of operation 2.3 Describing the types of machine motion transmission and their application 2.4 Observing operational problems of mechanical drive components 2.5 Identifying fault/trouble of mechanical drive components 2.6 Gathering and checking of tools, equipment and materialsfor usability and operating condition. 2.7 Checking and qualifying the operating condition of mechanical drive components 2.8 Performing installation of mechanical drive components in accordance with workplace requirements/machine manufacturer's specifications. 2.9 Checking alignment of mechanical drive components and rectifying nonconformities in accordance with workplace requirements/machine manufacturer's specifications. 2.10 Checking level of mechanical drive components and rectifying nonconformities in accordance with workplace requirements/machine manufacturer's specifications. 2.11 Carrying out parts/component replacement of mechanical drives in accordance with workplace requirements/machine manufacturer's specifications. 2.12 Carrying out Preventive maintenance activities for mechanical

	drive componentsin accordance with workplace /machine manufacturer's requirements. 2.13 Testing of newly maintained/serviced mechanical drive components for proper operation. 2.14 Carrying out necessary adjustments after testing in accordance with workplace/machine manufacturer's specifications.
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Concern to environmental care 3.3 Eagerness to learn 3.4 Tidiness, timeliness, and orderliness 3.5 Respect for rights of peers and seniors in workplace 3.6 Communication with peers and seniors in workplace
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Complete set of tools and equipment 4.3 Materials required for workshop practices and operations 4.4 Conplete set of tools, equipment and PPEs 4.5 Work instruction sheets/manuals 4.6 Pens 4.7 Papers

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Identified fault/trouble of mechanical drive components. 1.2 Performed repair and parts/components replacements of mechanical drive components in accordance with workplace/machine manufacturer's requirements and specifications. 1.3 Performed preventive maintenance and servicing of mechanical drive components in accordance with workplace requirements/machine manufacturer's specifications. 1.4 Tested newly maintained/serviced mechanical drive components and carried out necessary adjustment where necessary.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **CARRY OUT SERVICING AND MAINTENANCE OF FLUID POWER SYSTEMS**	**Nominal Duration:** 48 hrs.	**Unit Code:** SEIP-MEC-FIT-5-O
Unit Descriptor: this unit covers the knowledge, skills and attitudes required to carry out servicing and maintenance of fluid power systems. it specifically includes the tasks of applying fundamentals of pneumatic systems, carrying out repair and maintenance of pneumatic system components, applying fundamentals of hydraulic systems and carrying out servicing and maintenance of hydraulic system components.		

Elements and Performance Criteria Template:
(Terms in the performance criteria that are written in **bold and underlined** are described in the range of variables).

Elements of Competency	Performance Criteria
1. Apply fundamentals of pneumatic systems	1.1 Principles of pneumatics is described 1.2 **Pneumatis physical units and quantities** are identified 1.3 **Compressed air system fundamentals** are described 1.4 **Pneumatic system components** and principles of operation are explained
2. Carry out repair and maintenance of pneumatic system components	2.1 **Types of air compressor** applied in pneumatic power systems are identified. 2.2 **Air compressor maintenance and servicing** is carried out in accordance with workplace/compressor manufacturer's specifications. 2.3 **Air line system operation and maintenance** is carried out in accordance with workplace requirements. 2.4 Maintenance and repair of pneumatic system components are performed in accordance with workplace requirements. 2.5 Pneumatic system components are tested in accordance with workplace specifications.
3. Apply fundamentals of hydraulic systems	3.1 Principles of hydraulics is described 3.2 **Hydraulics physical units and quantities** are identified 3.3 **Hydraulics system fundamentals** are described 3.4 **Hydraulic system components** and principles of operation are explained
4. Carry out servicing and maintenance of hydraulic system components	4.1 **Types of hydraulic pumps** applied in hydraulic power systems are identified. 4.2 **Hydraulic pump maintenance and servicing** is carried out in accordance with workplace/pump manufacturer's specifications. 4.3 **Hydraulic system servicing and maintenance** is carried out in accordance with workplace requirements. 4.4 Hydraulic system components are tested in accordance with workplace specifications.

Range of Variables

Variable	**Range** (May include but not limited to):
1. Pneumatic physical units and quantities	1.1 Force 1.2 Pressure 1.3 Volume 1.4 Flow rate
2. Compressed air system fundamentals	2.1 Air intake preparation 2.2 Compressed air generation 2.3 Compressed air distribution 2.4 Compressed air application
3. Pneumatic system components	3.1 Pneumatic service unit 3.1.1 Pressure regulators 3.1.2 Air filter and water separator 3.1.3 Air lubricator 3.2 Directional valves 3.2.1 3/2 way directional valve 3.2.2 4/2 way directional valve 3.2.3 5/2 way valve 3.2.4 4/3 way valve 3.2.5 5/3 way valve 3.3 Flow control valves 3.3.1 Non-return valve 3.3.2 Shuttle valve 3.3.3 Flow metering valve 3.3.4 One-way valve 3.3.5 Quick exhaust valve 3.4 Pressure control valves 3.4.1 Pressure regulating valve 3.4.2 Pressure limiting valve 3.4.3 Pressure sequence valve 3.5 Pneumatic actuators 3.5.1 Single acting cylinder 3.5.2 Double acting cylinder
4. Types of air compressor	4.1 Reciprocating air compressor 4.1.1 Single stage 4.1.2 Multi-stage 4.2 Rotary air compressor 4.2.1 Rotary Vane type 4.2.2 Centrifugal type 4.3 Centrifugal air compressors 4.3.1 Single stage 4.3.2 Multi-stage
5. Air compressor maintenance and servicing	5.1 Preventive maintenance and servicing 5.1.1 Cleaning/replacement of air cleaner 5.1.2 Draining of moisture 5.1.3 Adjusting system pressure 5.1.4 Checking and changing of lubricant

	5.1.5 Checking and changing of oil separator unit 5.2 Corrective maintenance 5.2.1 Overhauling of air-end unit 5.2.2 Repair/replacement of pressure regulating valve 5.2.3 Repair of intake manifold 5.2.4 Repair of pressure lines/pipes
6. Air line system maintenance	6.1 Replacement of air service unit 6.2 Adding lubricant to lubricator (if available) 6.3 Replacing air strainer of service unit 6.4 Draining moisture from moisture separator 6.5 Replacing leaky pipes/air hose
7. Hydraulics physical units quantities	7.1 Force 7.2 Area 7.3 Pressure 7.4 Volume 7.5 Flow rate
8. Hydraulics system fundamentals	8.1 Laws and application of hydrostatics and hydrodynamics. 8.2 Law of volume flow 8.3 Pressure transfer principles 8.4 Principle of pressure intensifier 8.5 Functions of hydraulic fluid
9. Hydraulic system components	9.1 Power pack units 9.1.1 Hydraulic oil tank 9.1.2 Hydraulic pump 9.1.3 Pressure relief valve 9.1.4 Hydraulic oil 9.1.5 Oil filter 9.1.6 Oil cooler 9.2 Directional valves 9.2.1 2/2 way valve 9.2.2 3/2 way directional valve 9.2.3 4/2 way directional valve 9.2.4 5/2 way directional valve 9.2.5 4/3 way directional valve 9.2.6 5/3 way directional valve 9.3 Flow control valves 9.3.1 Check valve 9.3.2 Shut-off valve 9.3.3 One-way Flow control valve 9.4 Pressure control valves 9.4.1 Pressure regulating valve 9.4.2 Pressure limiting valve 9.4.3 Pressure sequence valve 9.5 Hydraulic actuators 9.5.1 Single acting cylinder 9.5.2 Double acting cylinder
10. Types of hydraulic pumps	10.1 Reciprocating pump

	10.1.1 Piston type 10.1.2 Diaphargm type 10.1.3 Plunger 10.2 Rotary pump 10.2.1 Rotary Vane 10.2.2 Rotary gear 10.2.3 Axial piston 10.3 Centrifugal type 10.3.1 Single stage 10.3.2 Multi-stage
11. Hydraulic pump maintenance and servicing	11.1 Preventive maintenance and servicing 11.1.1 Cleaning/replacement of oil cleaner 11.1.2 Checking and adding hydraulic oil 11.1.3 Adjusting system pressure 11.1.4 Changing of hydraulic oil 11.1.5 Checking and repair of oil leaks 11.2 Corrective maintenance 11.2.1 Overhauling of pump 11.2.2 Replacement of hydraulic pump 11.2.3 Repair/replacement of pressure relief valve 11.2.4 Repair of hydraulic pressure lines/pipes
12. Hydraulic system servicing and maintenance	12.1 Maintenance, repair and replacement of directional valves 12.2 Maintenance, repair and replacement of flow control valves 12.3 Maintenance, repair and replacement of hydraulic actuators (cylinders) 12.4 maintenance, repair and replacement of hydraulic pipes and hoses.

Curricular Content Guide:

1. Underpinning Knowledge	1.1 Principles of pneumatics 1.2 Pneumatics physical units and quantities 1.3 Compressed air system fundamentals 1.4 Pneumatics system components and principles of operation 1.5 Types of air compressor applied in pneumatic power systems 1.6 Procedure of carrying out air compressor maintenance and servicing 1.7 Methods of carrying out air line system operation and maintenance 1.8 Maintenance and repair of pneumatic system components 1.9 Procedure of testing of pneumatic system components 1.10 Principles of hydraulics 1.11 Hydraulics physical units and quantities 1.12 Hydraulics system fundamentals 1.13 Hydraulics system components and principles of operation. 1.14 Types of hydraulic pumps applied in hydraulic power systems

	1.15 Hydraulic pump maintenance and servicing 1.16 Hydraulic system servicing and maintenance 1.17 Testing of hydraulic system components
2. Underpinning Skills	2.1 Describing the principles of pneumatics 2.2 Identifying pneumatics physical units and quantities 2.3 Describing compressed air system fundamentals 2.4 Explaining pneumatic system components and principles of operation 2.5 Identifying the types of air compressor applied in pneumatic power systems 2.6 Carrying out air compressor maintenance and servicing in accordance with workplace/compressor manufacturer's specifications. 2.7 Carrying out air line system operation and maintenance in accordance with workplace requirements. 2.8 Performing maintenance and repair of pneumatic system components in accordance with workplace requirements. 2.9 Testing of pneumatic system components in accordance with workplace specifications. 2.10 Describing the principles of hydraulics 2.11 Identifying hydraulics physical units and quantities 2.12 Describing hydraulics system fundamentals 2.13 Explaining hydraulic system components and principles of operation 2.14 Identifying types of hydraulic pumps applied in hydraulic power systems 2.15 Carrying out hydraulic pump maintenance and servicing 2.16 Carrying out hydraulic system servicing and maintenance 2.17 Testing of hydraulic system components
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Concern to environmental care 3.3 Eagerness to learn 3.4 Tidiness, timeliness, and orderliness 3.5 Respect for rights of peers and seniors in workplace 3.6 Communication with peers and seniors in workplace
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Complete set of tools and equipment 4.3 Materials required for workshop practices and operations 4.4 Conplete set of tools, equipment and PPEs 4.5 Work instruction sheets/manuals 4.6 Pens 4.7 Papers

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Explained pneumatic system components and principles of operation. 1.2 Performed maintenance and repair of pneumatic system components in accordance with workplace requirements. 1.3 Explained hydraulic system components and principles of operation. 1.4 Carried out hydraulic system servicing and maintenance in accordance with workplace requirements.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module.

End of Competency Standard