COMPETENCY STANDARDS & ASSESSMENT GUIDE
FOR

REFRIGERATION AND AIR CONDITIONING

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, 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 and skill sets of the occupation and 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 that 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.

A working group who comprised national and international process experts develops competency Standards and the participation of experts from the industry to identify the competencies required of an occupation in a particular sector.

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 workplace rat 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 expert workers of various construction companies through an industry consultative workshop held at the Bangladesh Engineering Industry Owners Association (BEIOA) on 28th of February 2016.

EXPERTS INVOLVED:

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/Expertise
Al-Hajj Abul Hasim	Nipun Engineering	Lathe machine operation expert
Sayed Hayder Ali	Asian Tools	Lathe machine operation expert
Md. Ali Akbar	Akbar Engineering Works	Milling machine operation expert
Khandaker Nasir Uddin	Gear Center Engineering	Milling machine operation expert
Md. Nazrul Islam	NH Welding Works	Welding expert
Md. Kamal Miah	Kamal Welding Works	Welding expert
Md. Riaz	Riaz Refrigeration Works	Refrigeration and Air Conditioning expert
Md. Abdul Awoal	Joyti Refrigeration Works	Refrigeration and Air Conditioning expert
Engr. Md. Faruk Hossain	Farmamekh Engineering	CAD-CAM expert
A.K. Azad	Azad Industry	CAD-CAM expert

Workshop Facilitators:

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

Another industry consultative workshop with the involvement of industry expert and trainers was held at the conference room of SEIP on 06 December to further verify the units of competency, elements of competencies, unit descriptor, performance criteria, and range of variable, learning sequence and learning provision.

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

Name	Company	Job Position/Expertise
Mr. ANM Golam Salmani	Z S Engineering	Managing Partner
Mr Md. Abdul Kafi Khan	B-KTTC	Senior Instructor
Mr Shafiqur Rahman	MAWTS	Instructor
Mr Rupak Kanti Biswas	BTEB	Quality Assurance Officer

Workshop Facilitators:

Mr Syed Nasir Ershad	SEIP	AEPD
Mr Ahasan Habib	SEIP	TVET Specialist
Mr Md Mohiuzzaman	SEIP	Course 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/ CHART

for **Refrigeration And Air Conditioning**

UNITS OF COMPETENCY	ELEMENTS			
Generic (Basic) Competencies				
Perform Computations Using Basic Mathematical Concepts (SEIP-LIG-REF-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-LIG-REF-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-LIG-REF-3-G)	Read and understand Workplace documents in English	Write simple workplace written communications in English.	Listen and comprehend to English conversation	Perform conversations in English language
Operate In a Self-Directed Team (SEIP-LIG-REF-4-G)	Identify team goals and processes.	Communicate and cooperate with team members.	Work as a team member	Solve problems as a team member
Sector Specific (Common) Competencies				
Interpret Technical Drawings and Manuals SEIP-LIG-REF-1-S)	Select technical drawing.	Interpret technical drawings.	Interpret operation and maintenance manuals	
Work With Mechanical Hand And Power Tools (SEIP-LIG-REF-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-LIG-REF-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-LIG-REF-4-S)	Work within quality system	Apply and monitor quality system improvements in the workplace.	Hold responsible for work quality	Apply standard procedures for each job.

Occupation Specific (Course) Competencies

Perform Tube Processing Operation (SEIP-LIG-REF-1-O)	Prepare for tube processing operations	Cut tubes	Flare tube ends	Swage tube end
	Bend tube	Braze tubes	**Clean/maintain workplace, tools and equipment**	
Apply Electrical/Electronic Fundamentals (SEIP-LIG-REF-2-O)	Explain fundamental principles of electricity and electronic	**Use electrical switch, socket, cables, circuit breaker, magnetic contactor and electronics device, instruments and equipment**		Test power supply and electrical /electronic components
	Perform basic electrical/electronic circuit connections	Maintain and Store electrical /electronic tools/instruments		
Service And Maintain Refrigerators And Freezers (SEIP-LIG-REF-3-O)	Prepare for servicing and maintenance works	Troubleshoot refrigerator/freezer	Maintain/repair electrical/electronic systems	Service mechanical refrigeration system
	Clean/maintain workplace, tools and equipment			
Service And Maintain Window Type Air Conditioning System (SEIP-LIG-REF-4-O)	Prepare for servicing and maintenance works	Troubleshoot window air conditioner	Maintain/repair electrical/electronic systems	Service mechanical refrigeration system
	Clean/maintain workplace, tools and equipment			
Service And Maintain Split And Package Type Air Conditioning Units (SEIP-LIG-REF-5-O)	Prepare for servicing and maintenance works	Troubleshoot split and package type air conditioning units	Maintain/repair electrical/electronic systems	Service mechanical system and components
	Clean/maintain workplace, tools and equipment			
Repair Refrigeration Compressor (SEIP-LIG-REF-6-O)	Prepare for Compressor Servicing/repairing	Diagnose fault of refrigeration compressor	Repair compressor	Clean/maintain workplace, tools and equipment

Units & Elements at Glance:

Generic (Basic) Competencies (30 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SEIP-LIG-MIL-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	10
SEIP-LIG-MIL-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-LIG-MIL-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	5
SEIP-LIG-MIL-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	5
Total Hour			**30**

Sector Specific (Common) Competencies (30 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SEIP-LIG-REF-1-S	Interpret Technical Drawings and Manuals	1. Select technical drawing 2. Interpret technical drawings. 3. Interpret operation & maintenance manuals	10
SEIP-LIG-REF-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-LIG-REF-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.	5
SEIP-LIG-REF-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.	5
Total Hours			**30**

Occupation Specific (Core) Competencies (300 hrs.)

Code	Unit of Competency	Elements of Competency	Guided Learning Hours
SEIP-LIG-REF-1-O	Perform Tube Processing Operation	1. Prepare for tube processing operations 2. Cut tubes 3. Flare tube ends 4. Swage tube end 5. Bend tube 6. Braze tubes 7. Clean/maintain workplace, tools and equipment	30
SEIP-LIG-REF-2-O	Apply Electrical and Electronic Fundamentals	1. Explain fundamental principles of electricity and electronics 2. Use electrical switch, socket, cables, circuit breaker, magnetic contactor and electronics device, instruments and equipment 3. Test power supply and electrical components 4. Perform basic electrical/ electronic circuit connections 5. Maintain and Store electrical/electronic tools/instruments	30
SEIP-LIG-REF-3-O	Service and Maintain Refrigerators and Freezers	1. Prepare for servicing and maintenance works 2. Troubleshoot refrigerator/freezer 3. Maintain and repair refrigerator/freezer 4. Service mechanical refrigeration system 5. Clean/maintain workplace, tools and equipment	80
SEIP-LIG-REF-4-O	Service and Maintain Window Type Air Conditioning System	1. Prepare for servicing and maintenance works 2. Troubleshoot window air conditioner 3. Maintain/repair electrical /electronic system 4. Service mechanical refrigeration system 5. Clean/maintain workplace, tools and equipment	50
SEIP-LIG-REF-5-O	Service and Maintain Split and Package Type Air Conditioning Units	1. Prepare for servicing and maintenance works 2. Troubleshoot split and package type air conditioning units	80

		3. Maintain/repair electrical and electronic system 4. Service mechanical system and components 5. Clean/maintain workplace, tools and equipment	
SEIP-LIG-REF-6-O	Repair Refrigeration Compressor	1. Prepare for refrigeration compressor servicing/repairing 2. Diagnose fault of compressor 3. Repair compressor 4. Clean/maintain workplace, tools and equipment	30
Total Hours			**300**

COMPETENCY STANDARD: Refrigeration and Air Conditioning

A: The Generic (Basic Competencies)

Unit of Competency: **PERFORM COMPUTATIONS USING BASIC MATHEMATICAL CONCEPTS**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-LIG-REF-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/Breadth/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 Electrical &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 percentage. 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.
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 OCCUPATIONAL HEALTH AND SAFETY (OHS) PRACTICES IN THE WORKPLACE**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-LIG-REF-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
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 Goggles and safety glasses 2.8 Ear plugs

	2.9 Sun block 2.10 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 hazards (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 aid 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 to 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:

4. 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 aid 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
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:** 05 hrs.	**Unit Code:** SEIP-LIG-REF-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 demonstrated. 2.2 Key information is written in the appropriate places in standard forms.
3. Listen and comprehend to conversations in English	3.1 Active listening is demonstrated.
4. Perform conversations in English	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 materials 1.7 Standards 1.8 OHS information 1.9 Signs

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 safety and health 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 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 Converse in English with peers and customers 1.2 Made reports of workplace documents
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Demonstration 2.3 Oral questioning
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:** 05 hrs.	**Unit Code:** SEIP-LIG-REF-4-G
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to work as a team member. 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 identified.
2. Communicate and cooperate with team members.	2.1 Effective interpersonal skills are used to interact with team members and to contribute to team activities. 2.2 Formal and informal **forms of communication** are used effectively to support team achievement. 2.3 Diversity 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, objectives and task requirements are identified and clarified with team. 3.2 Tasks are performed in accordance with specifications and workplace procedures. 3.3 Team member's support with other members are made to ensure team goals. 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 OHS 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, 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 Effectively 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 specifications and workplace procedures. 2.8 Supporting other members of the team to ensure team 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 to 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
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 PLANS**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-LIG-REF-1-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required of a worker to translate technical drawings and plans. 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 the equipment

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 Device specifications 3.2 Component specifications 3.3 Materials 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 with 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 with 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 the equipment
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 to 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
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-LIG-REF-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, 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 and demonstrated. 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 of different hand tools is demonstrated. 2.3 **Safety precautions** is maintained 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 for use in accordance with 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 with manufacturer's operating specification.
4. Clean/maintain hand tools and power tools after use	4.1 Dust and foreign materials are removed from power tools in accordance with 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.	1.29 Drill bits 1.30 Tap extruder. 1.31 Screw Extruder. 1.32 Hacksaw frame.

	1.5 Bench vise. 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	1.33 Hacksaw blade. 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 Powered screw driver. 1.44 Hand shear. 1.45 Clamps 1.46 Jacks. 1.47 Soldering iron. 1.48 Allen wrenches. 1.49 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 AVO meter 4.2 Voltmeter 4.3 Ammeter 4.4 Oscilloscope 4.5 Measuring tape 4.6 Steel rule	

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 with 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 Maintained 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
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:** 05 hrs.	**Unit Code:** SEIP-LIG-REF-3-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to use measuring instrument in the workplace. It specifically includes the tasks of selecting the job to be measured, using measuring instrument appropriately, obtaining measurements, recording and communicating measurements obtained, 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 of job is identified in accordance with drawing/plan. 1.4 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 **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	3.1 Measurements are obtained using appropriate measuring instrument. 3.2 **Systems of measurements** are identified and converted where necessary. 3.3 Measurement is kept accurately in accordance to specification. 3.4 Measurement is checked against job requirement. 3.5 Physical conditions are checked in accordance with job requirement
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. Measuring instruments.	2.1 Steel tape 2.2 Steel rule 2.3 Meter rule 2.4 Calculator 2.5 Digital Vernier slide caliper 2.6 Micrometer (inch/millimeter) 2.7 Digital micrometer 2.8 AVO meter(analogue/digital) 2.9 Thermometers 2.10 Water meter 2.11 Gas meter 2.12 Clip on Ammeter
3. Systems of measurements	3.1 ISO standard 3.2 English system 3.3 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 work pieces 1.7 Methods, procedures and techniques when Checking geometrical dimensions of work pieces 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
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:** 05 hrs.	**Unit Code:** SEIP-LIG-REF-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 with 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
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. Occupation Specific (Core) Competencies

Unit of Competency: **PERFORM TUBE PROCESSING OPERATION**	**Nominal Duration:** 30hrs.	**Unit Code:** SEIP-LIG-REF-1-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required for a worker to perform tube processing operation when performing refrigeration and air conditioning works. It specifically includes the tasks of preparing for tube processing operations, cutting tubes, flaring tube ends, swaging tube end, bending copper/aluminum tube and brazing copper and aluminum tubes.		

Elements and Performance Criteria:
(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. Prepare for tube processing operations	1.1 **PPE** are selected and used. 1.2 **Tools, equipment & materials** are gathered. 1.3 Tools, equipment & materials are checked for usability and operability. 1.4 **Tube dimensions** and **fittings** are identified and gathered. 1.5 Measurements and pipe runs are identified in accordance with workplace requirements/specifications.
2. Cut tubes	2.1 **Tubes** are measured and marked in accordance with specification. 2.2 Tubes are cut using by appropriate cutting method and tool. 2.3 Tubes are reamed on its ends after cutting to remove burrs. 2.4 Tube ends are sealed to ensure non contamination with dirt and **foreign materials.** 2.5 Appropriate **sealing material** is used on tube ends.
3. Flare tube ends	3.1 Tube ends are flared using appropriate flaring tool. 3.2 Flared tube end is checked for quality. 3.3 Flared tube ends are sealed to ensure non-contamination with dirt and foreign materials.
4. Swage tube end	4.1 Tube ends are swaged using appropriate swaging tool. 4.2 Swaged tube end is checked for quality. 4.3 Swaged tube end is sealed to ensure non-contamination with dirt and foreign materials.
5. Bend tube	5.1 Tube is bended using appropriate bending tool. 5.2 Bended copper/aluminum tube is checked for quality in accordance with specifications 5.3 Bended copper/aluminum tubes are sealed to ensure non-contamination with dirt and foreign materials.
6. Braze tubes	6.1 **Brazing equipment** is checked for usability and safety condition. 6.2 Tubes are brazed using appropriate brazing equipment 6.3 Brazed joints are checked for quality. 6.4 Brazed connection is tested in accordance with workplace requirements/specification.
7. Clean/maintain workplace,	7.1 Workplace is cleaned and materials are stored in accordance

tools and equipment	with workplace requirements. 7.2 Tools and equipment are cleaned, checked for damaged and lubricated (if necessary) and stored in accordance with workplace conditions. 7.3 Damaged/defective tools and equipment are reported for repair/replacement

Range of Variables

Variable	**Range** (Includes but not limited to:)
1. PPE	1.1 Safety helmet 1.2 Safety belt 1.3 Safety shoes 1.4 Hand gloves 1.5 Apron 1.6 Safety eye glass 1.7 Goggles 1.8 Welding face mask
2. Tools, equipment & materials	2.1 Tools; 2.1.1 Measuring steel tape 2.1.2 Ball peen hammer 2.1.3 Tube cutter 2.1.4 Hand hacksaw 2.1.5 Swaging tool set 2.1.6 Flaring tool set 2.1.7 Bending tool 2.1.8 Files 2.1.9 Bench vice 2.2 **E**quipment 2.2.1 Oxy-acetylene welding set 2.2.2 Drill press 2.3 Materials 2.3.1 Copper tubes 2.3.2 Aluminum tubes 2.3.3 Steel tube 2.3.4 Brazing flux 2.3.5 Cotton rag 2.3.6 Brazing filler materials
3. Tube dimensions	3.1 Tube size 3.2 Length 3.3 Radius/diameter 3.4 Angle of bend
4. Fittings	4.1 Flare nut 4.2 Coupling 4.3 Elbow 4.4 Tube plug/cap 4.5 Union

5. Tubes	5.1 Copper tube 5.2 Aluminum tube 5.3 Steel tubes
6. Foreign materials	6.1 Water 6.2 Sand 6.3 Dust 6.4 Metal filings 6.5 Copper filings 6.6 Aluminum filings
7. Sealing material	7.1 Plastic caps 7.2 Rubber caps 7.3 Tapes 7.4 Tube plug 7.5 Tube caps
8. Brazing equipment	8.1 Oxy-acetylene welding set 8.2 LPG gas welding set 8.3 Blow torch

Curricular Content Guide

1. Underpinning Knowledge	1.1 Tube cutting tools and their application 1.2 Tube cutting procedure and techniques 1.3 Types of tubes seals and their use 1.4 Tube flaring tools and their application 1.5 Procedure of tube flaring 1.6 Method of checking flared tube quality 1.7 Swaging tool and its application 1.8 Procedure of swaging tube 1.9 Types of tube benders and application 1.10 Procedure and technique of bending copper/aluminum tubes 1.11 Types of equipment used for brazing and their application 1.12 Copper tube brazing procedure and techniques 1.13 Aluminum tube brazing procedure and technique 1.14 Determining brazed joint quality 1.15 Procedure of testing brazed connection
2. Underpinning Skills	2.1 Cutting tubes using appropriate cutting method and tool 2.2 Sealing tube ends to ensure non contamination with dirt and foreign materials 2.3 Flaring tube ends using appropriate flaring tool 2.4 Checking flared tube end for quality 2.5 Swaging tube end using appropriate swaging tool 2.6 Bending copper/aluminum tube using appropriate bending tool 2.7 Brazing copper tubes using appropriate brazing equipment 2.8 Brazing aluminum tubes using appropriate brazing equipment 2.9 Checking brazed joints for quality 2.10 Testing brazed connection in accordance with workplace requirements/specification.

3. Underpinning Attitudes	3.1 Patience 3.2 Commitment to occupational health and safety practices 3.3 Environmental concerns 3.4 Eagerness to learn 3.5 Tidiness and orderliness 3.6 Respect to peers and seniors in workplace
4. Resource Implications	1.1 Workplace (simulated or actual) 1.2 Refrigeration and air conditioning equipment, tools, materials, repair and training manual. 1.3 Work instruction sheet 1.4 Copper, aluminum and steel tube

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Cut tubes using appropriate cutting method and tool 1.2 Sealed tube ends to ensure non contamination with dirt and foreign materials 1.3 Flared tube ends using appropriate flaring tool 1.4 Checked flared tube end for quality 1.5 Swaged tube end using appropriate swaging tool 1.6 Bended copper/aluminum tube using appropriate bending tool 1.7 Brazed copper and aluminum tubes using appropriate brazing equipment 1.8 Tested brazed connection in accordance with workplace requirements/specification. 1.9 Cleaned workplace and stored materials, tools and equipment 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.

Unit of Competency: APPLY ELECTRICAL AND ELECTRONICS FUNDAMENTALS	Nominal Duration: 30 hrs.	Unit Code: SEIP-LIG-REF-2-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required for a worker to apply electrical fundamentals in refrigeration and air conditioning works. It specifically includes the tasks of explaining the fundamental principles of electricity and electronics, solving basic problems in electrical and electronic circuits, using electrical tools, instruments and equipment, maintaining and storing electrical tools/instruments.		

Elements and Performance Criteria:

(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. Explain fundamental principles of electricity and electronics	1.1 **Fundamental principles/theories** of electricity and electronics are described. 1.2 Application of OHM's law is explained. 1.3 Electrical and electronic devices are described. 1.4 **Basic electrical circuit** wiring is carried out. 1.5 Soldering is performed. 1.6 Electrical problems in application to electrical fundamentals are solved.
2. Use electrical switch, socket, cables, circuit breaker, magnetic contactor and electronics device, instruments and equipment	2.1 Electrical switch, socket, cables, circuit breaker, magnetic contactor, Auto control panel(ACP) and electronics device are identified, used and interpreted . 2.2 **Electrical/Electronic properties/parameters** are measured using appropriate measuring tool/instrument. 2.3 **Electrical/electronic tools** and **testing instruments** are used safely/properly.
3. Test power supply and electrical components	3.1 Electrical/electronic measuring Instruments are tested for usability and accuracy. 3.2 Power supply and **electrical/electronic components** are tested in accordance with manufacturer's specifications. 3.3 Defects of power supply and electrical/electronic components are identified and repaired where possible. 3.4 Safe working habits are maintained.
4. Perform basic electrical/ electronic circuit connections	4.1 **Electrical/electronic circuit** diagram is evaluated and analyzed. 4.2 Series-parallel circuits are made, connected and tested 4.3 Electrical/electronic circuit components (Diode, Bridge rectifier, transistor, resister etc) are identified and gathered. 4.4 Electrical/electronic components(Diode, Bridge rectifier, transistor, register etc) are tested, repaired and replaced where necessary. 4.5 Electrical/electronic circuit components are terminated in accordance with given circuit diagram. 4.6 Work instructions are followed to ensure safety at work. 4.7 Circuit is tested for proper operation in accordance with work

	instruction/circuit design. 4.8 Faults are identified and corrected.
5. Maintain and Store electrical/electronic tools/instruments	5.1 Electrical/ electronic tools/instruments are checked for proper operation. 5.2 Electrical/ electronic tools/instruments are maintained in accordance to manufacturer's specification. 5.3 Electrical/ electronic tools/instruments stored in accordance to workplace procedures/policy.

Range of Variables

Variable	**Range** (Includes but not limited to:)
1. Fundamental principles/theories	1.1 Ohms Law 1.2 Kirchhoff's law 1.3 Principles and theory of AC/DC circuits 1.4 Series and parallel circuits 1.5 Law of conductivity 1.6 Law of resistivity
2. Basic electrical circuit	2.1 Series circuits 2.2 Parallel circuits 2.3 Series-parallel circuits 2.4 One Lamp controlled from one point 2.5 One Lamp controlled from two point 2.6 Two Lamps controlled from two point, 2.7 Two Lamps controlled from three point 2.8 Tube Light Connection 2.9 Power supply circuit
3. Electrical/electronic properties/parameters	3.1 Voltage 3.2 Resistance 3.3 Current 3.4 Impedance 3.5 Capacitance 3.6 Resistance 3.7 Inductance 3.8 Reactance
4. Electrical and electronic tools and testing instruments	4.1 Electrical tools 4.1.1 Side cutter pliers 4.1.2 Set of screw drivers 4.1.3 Set of combination wrenches 4.1.4 Adjustable wrench 4.1.5 Wire stripper 4.1.6 Crimping tool 4.1.7 Electrician's knife 4.1.8 Electrical measuring tape 4.2 Electrical testing Instruments 4.2.1 Multi-tester (AVO) 4.2.2 Current tester

	4.2.3 Volt meter 4.2.4 Power meter 4.2.5 Megger tester 4.3 Electronics tools 4.3.1 Soldering iron. 4.3.2 Soldering iron stand. 4.3.3 Solder sucker. 4.3.4 Neon tester. 4.3.5 Cutting pliers. 4.3.6 Nose pliers. 4.3.7 Combination pliers. 4.3.8 Measuring tape. 4.3.9 Knife. 4.3.10 Tweezers. 4.3.11 Scissors. 4.3.11 Wire striper. 4.4 Electronic testing instrument 4.4.1 Analogue multi (AVO) meter. 4.4.2 Digital multi (AVO) meter. 4.4.3 Oscilloscope. 4.4.4 Signal generator. 4.4.5 Pattern generator. 4.4.6 LCR meter.
5. Electrical components	5.1 Power supply 5.2 Compressor motor 5.3 Relay 5.4 Timer 5.5 Thermostat 5.6 Switches 5.7 Fuse 5.8 Contactor relay 5.9 Lamps 5.10 Terminal block
6. Electronic components	6.1Resistor. 6.2 Diode. 6.3 Capacitor. 6.4 Inductor. 6.5 Transistor. 6.6 IC.
7. Electrical/electronic circuit diagram	7.1 Series circuit 7.2 Parallel circuit 7.3 Series-parallel circuit 7.4 Doorbell circuit 7.5 Lamp circuits 7.6 Refrigerator circuit

	7.7 Window air conditioner circuit 7.8 Deep freezer circuit

Curricular Content Guide

1. Underpinning Knowledge	1.1 Fundamental theories of electricity 1.2 Principles and theory of AC/DC current 1.3 Types of DC circuits and their application 1.4 AC circuits and their application 1.5 Differential electrical/electronic circuit diagrams applied in refrigeration and air conditioning 1.6 Circuit wiring, installation and maintenance 1.7 Electrical measurement and testing methods and techniques 1.8 Safety precautions when working with electrical circuits 1.9 Basic wiring circuits and their application 1.10 Electrical lighting systems on auxiliary outlets 1.11 National and international electrical code
2. Underpinning Skills	2.1 Carrying out basic electrical circuit diagramming and wiring 2.2 Describing relationships of the different types of electrical properties 2.3 Measuring electrical properties/parameters using appropriate measuring tool/instrument 2.4 Using electrical/electronic measuring tools and testing instruments safely/properly 2.5 Testing power supply and electrical/electronic components in accordance with manufacturer's specifications 2.6 Terminating electrical/electronic circuit components in accordance with given diagram 2.7 Testing circuit for proper operation in accordance with work instruction/circuit design 2.8 Storing electrical tools/instruments in accordance to workplace procedures/policy
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 Various kinds of electrical/electronic components, tools and equipment 4.3 Workplace rules and regulation policy manual 4.4 Pens 4.5 Papers 4.6 Work books

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Carried out basic electrical circuit diagramming and wiring 1.2 Described relationships of the different types of electrical properties 1.3 Measured electrical properties/parameters using appropriate measuring tool/instrument 1.4 Used electrical/electronic measuring tools and testing instruments safely/properly 1.5 Tested power supply and electrical components in accordance with manufacturer's specifications 1.6 Terminated electrical/electronic circuit components in accordance with given diagram 1.7 Tested circuit for proper operation in accordance with work instruction/circuit design 1.8 Stored electrical tools/instruments in accordance to workplace procedures/policy
2. Methods of Assessment	**Competency should be assessed by**: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning
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: **SERVICE AND MAINTAIN REFRIGERATORS AND FREEZERS**	**Nominal Duration:** 80hrs.	**Unit Code:** SEIP-LIG-REF-3-O

Unit Descriptor:

This unit covers the knowledge, skills and attitudes required to service and maintain refrigerators and freezers when performing refrigeration and air conditioning works. It specifically includes the tasks of preparing for servicing and maintenance works, troubleshooting refrigerator/freezer, maintaining/repairing electrical& electronic system, servicing mechanical refrigeration system, cleaning/maintaining workplace, tools and equipment.

Elements and Performance Criteria:

(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. Prepare for servicing and maintenance works	1.1 **Safe work practices** are maintained and **Personal Protective Equipment (PPEs)** are used. 1.2 Workplace area is inspected and hazards are eliminated 1.3 **Tools, equipment & materials** are gathered. 1.4 Tools, equipment & materials are checked for usability and quality. 1.5 Workplace is prepared for servicing activities. 1.6 Domestic Refrigerator/freezer is inspected and corresponding **technical information** is identified and interpreted.
2. Troubleshoot refrigerator/freezer	2.1 **Relevant information** regarding trouble/problem is asked from user/owner of unit. 2.2 Electrical wiring circuit is checked and traced. 2.3 Refrigerator/freezer is started and operated, if possible, and observed operation. 2.4 **Electrical, electronic** and **technical parameters** are observed and recorded. 2.5 **System trouble/problem** is identified and results/findings are recorded. 2.6 Electronic soldering circuit is checked and traced.
3. Maintain and repair refrigerator/freezer	3.1 **Refrigerant** is recovered, leaked tested and vacuumed 3.2 Electrical/electronic trouble/problem is identified. 3.3 Faulty **Electrical& electronic component/s** are tested and repaired/replaced where necessary. 3.4 Specifications of electrical/electronic component for replacement is checked and recorded. 3.5 **Electrical/electronic Maintenance activities** are carried out in accordance with **manufacturer's instructions/specification.** 3.6 Operation of electrical components and system is checked and tested for proper operation in accordance with manufacturer's specification.
4. Service mechanical refrigeration system	4.1 **Compressor operation fault** is identified. 4.2 Refrigerant compressor fault is repaired and tested for normal operation.

	4.3 **Mechanical refrigeration system fault** is identified and repaired/serviced in accordance with manufacturer's instructions/specifications. 4.4 **Servicing procedures** of refrigeration system components are carried out in accordance with manufacturer's instructions/specifications. 4.5 **Refrigerator/freezer** is tested for acceptable operating performance in accordance with manufacturer's specifications.
5. Clean/maintain workplace, tools and equipment	5.1 Workplace is cleaned and materials are stored in accordance with workplace requirements. 5.2 Tools and equipment are cleaned, checked for damaged and lubricated (if necessary) and stored in accordance with workplace conditions. 5.3 Damaged/defective tools and equipment are reported for repair/replacement.

Range of Variables

Variable	**Range** (Includes but not limited to):	
1. Tools, equipment & materials	1.1 Tools; 1.1.1 Multi tester (AVO) 1.1.2 Clamp meter 1.1.3 Side cutting pliers 1.1.4 Wire stripper 1.1.5 Screwdriver set 1.1.6 Terminal crimping plier 1.1.7 Measuring steel tape 1.1.8 Ball peen hammer 1.1.9 Tube cutter 1.1.10 Hand hacksaw 1.1.11 Swaging tool set 1.1.12 Flaring tool set 1.1.13 Bending tool 1.1.14 Files 1.2 **E**quipment 1.2.1 Vacuum pump 1.2.2 Refrigerant charging cylinder	1.2.3 Refrigerant recovery machine 1.2.4 Oxy acetylene welding outfit 1.2.5 Double Gauge Manifold 1.2.6 Drill press 1.2.7 Welding booth 1.2.8 Nitrogen Cylinder 1.2.9 Double stage Regulator 1.3 Materials 1.3.1 Insulation tapes 1.3.2 Electrical terminal connectors/clip 1.3.3 Wires/cables 1.3.4 Copper tubes 1.3.5 Aluminum tubes 1.3.6 Steel tube 1.3.7 Brazing flux 1.3.8 Brazing Rod 1.3.9 Cotton rag
2. Refrigerant	2.1 R-134a, R-600a, , R-410a, R-290, R-404, R-22, R-12(CFC, HCFC, HFC and HCs)	
3. Safe work practices	3.1 Proper and safe use of tools and equipment 3.2 Wearing of appropriate PPEs 3.3 Eliminating unsafe conditions in the workplace 3.4 Shutting off and locking electrical switches before start of work 3.5 Care in working with electricity 3.6 Awareness to working with high pressures	

	3.7 Awareness in working with refrigerant gasses/liquids 3.8 Releasing gas pressures before opening high pressure lines
4. PPE	4.1 Safety helmet 4.2 Safety shoes 4.3 Hand gloves 4.4 Apron 4.5 Safety eye glass 4.6 Goggles 4.7 Welding face mask
5. Technical information	5.1 Refrigerant recovered, vacuumed the system and tested 5.2 Type of refrigerant used, 5.3 High side systems pressure 5.4 Low side system pressure 5.5 Type of compressor used 5.6 Voltage of compressor motor 5.7 Full load current rating 5.8 Cycle (Hz) 5.9 Electrical/ circuit diagram 5.10 Electrical components 5.11 Type of evaporator coil 5.12 Type of condenser
6. Relevant information	6.1 Power supply 6.2 Electrical/electronic circuit 6.3 System operation 6.4 Compressor 6.5 Evaporator 6.6 Condenser 6.7 Expansion valve 6.8 Refrigerant charge 6.9 Leaks 6.10 Incidents prior to occurrence of problem
7. Electrical, electronic and mechanical parameters	Electrical parameters 7.1 input voltage 7.2 motor rated voltage 7.3 Motor full load current 7.4 Cycle 7.5 Motor phase; (single phase, three phase) Mechanical parameters 7.6 High side pressure 7.7 Low side pressure 7.8 Type of refrigerant 7.9 Type of expansion valve (refrigerant flow control) 7.10 Type of condenser, (Serpentine, compact, static, forced circulation) 7.11 Type of evaporator; (serpentine, compact, static, forced circulation) 7.12 Electronic parameters 7.13 Capacitance

	7.14 Resistance 7.15 Inductance 7.16 Reactance
8. System trouble/problem	8.1 Input electrical/electronic problem 8.2 Faulty Electrical/electronic circuit 8.3 Faulty compressor 8.4 Faulty refrigerant charge 8.5 System leak 8.6 Faulty mechanical system components
9. Electrical& electronic component/s	9.1 Compressor motor 9.2 Relays 9.3 Timers 9.4 Switches 9.5 Thermostat 9.6 Lamps 9.7 Timer relays 9.8 Wiring (includes terminals and connectors) 9.9 Pressure switches 9.10 Capacitors
10. Electrical/electronic Maintenance activities	10.1 Compressor motor replacement 10.2 Electrical/electronic components repair/replacement 10.3 Re-wiring 10.4 Checking/cleaning of terminals and contactors
11. Manufacturer's instructions/specification	11.1 Pressure testing 11.2 Vacuum pressure testing 11.3 Amount of refrigerant charge 11.4 Type of refrigerant charge 11.5 Tolerance for High side pressure 11.6 Tolerance for Low side pressure 11.7 Range of full load current 11.8 Compressor power and capacity
12. Compressor operation fault	12.1 Loose Connection 12.2 Broken/leaky valves 12.3 Stuck up piston 12.4 Broken crankshaft 12.5 Leaky manifolds 12.6 Compressor motor problem (for hermetic type)
13. Mechanical refrigeration system fault	13.1 Leaky line tubes, compressor oil, evaporator coil 13.2 Low refrigerant charge 13.3 High refrigerant charge 13.4 Partial pressure in system 13.5 Faulty expansion valve 13.6 Dirty condenser 13.7 Dirty evaporator 13.8 Faulty refrigerator/freezer door sealant
14. Servicing procedures	14.1 Installation and commissioning of new units 14.2 System checks and cleaning

	14.3 Replacement of refrigerant filter/drier 14.4 Replacement of system components 14.5 Electrical/electronic troubleshooting and repair 14.6 Retrofitting 14.7 Evacuation and charging of new refrigerant 14.8 Refrigerant recovery and re-cycling 14.9 Changing of tubes and brazing 14.10 Leak repair
15. Refrigerator/freezer	15.1 Household refrigerator (frost, no frost) 15.2 Reach in freezer 15.3 Deep freezer 15.4 Ice cream maker 15.5 Ice maker 15.6 Display Chiller 15.7 Display freezer

Curricular Content Guide

1. Underpinning Knowledge	1.1 Principles of Operation of refrigerator/freezer 1.2 Technical information for refrigerators and freezers 1.3 Procedure for Starting and operation of refrigerator/freezer, 1.4 Electrical/electronic circuits and components of different types of refrigerators and freezers 1.5 Electrical, and mechanical technical parameters of refrigerators and freezers 1.6 Procedure of Identifying and recording electrical system trouble/problem 1.7 Electrical/electronic maintenance activities and manufacturer's instructions/specification 1.8 Methods of checking and testing operation of electrical components 1.9 Procedure of Identifying and repairing/servicing mechanical refrigeration system fault 1.10 Servicing procedures for refrigeration system components 1.11 Testing procedure for refrigerator/freezer acceptable operating performance 1.12 Workplace requirements of cleaning, checking tools and equipment for damaged and storing
2. Underpinning Skills	2.1 Inspecting refrigerator/freezer and identifying corresponding technical information 2.2 Starting and operating refrigerator/freezer, if possible, and observing 2.3 Observing electrical, electronic and mechanical technical parameters and recording results/findings 2.4 Identifying and recording electrical/electronic system trouble/problem 2.5 Carrying out electrical maintenance activities in accordance

	with manufacturer's instructions/specification 2.6 Checking and testing operation of electrical components and system for proper operation in accordance with manufacturer's instruction/specification 2.7 Identifying and repairing/servicing mechanical refrigeration system fault in accordance with manufacturer's specifications 2.8 Carrying out servicing procedures for refrigeration system components in accordance with manufacturer's instructions/ specifications 2.9 Testing refrigerator/freezer for acceptable operating performance in accordance with manufacturer's specifications 2.10 Cleaning, checking tools and equipment for damaged and lubricated (if necessary) and storing in accordance with workplace conditions.
3. Underpinning Attitudes	3.1 Patience 3.2 Commitment to occupational health and safety practices 3.3 Environmental concerns 3.4 Eagerness to learn 3.5 Tidiness and orderliness 3.6 Respect for rights of peers and seniors in workplace
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Refrigeration and air conditioning equipment, tools, materials, repair and training manual. 4.3 Work instruction sheet 4.4 Refrigerator/freezer

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Inspected refrigerator/freezer and identified corresponding technical information 1.2 Started and operated refrigerator/freezer, if possible, and observed 1.3 Checked and tested operation of electrical components and system for proper operation in accordance with manufacturer's instruction/specification 1.4 Identified and repaired/serviced mechanical refrigeration system fault in accordance with manufacturer's specifications 1.5 Carried out servicing procedures of refrigeration system components in accordance with manufacturer's instructions/specifications 1.6 Tested refrigerator/freezer for acceptable operating performance in accordance with manufacturer's specifications
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning

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: **SERVICE AND MAINTAIN WINDOW TYPE AIR CONDITIONING SYSTEM**	**Nominal Duration:** 50 hrs.	**Unit Code:** SEIP-LIG-REF-4-O

Unit Descriptor:

This unit covers the knowledge, skills and attitudes required to service and maintain service window type air conditioning system when performing refrigeration and air conditioning works. It specifically includes the tasks of preparing for servicing and maintenance works, troubleshooting of window type air-conditioning system, maintaining/repairing electrical/electronic system, servicing mechanical refrigeration system, cleaning/maintaining workplace, tools and equipment.

Elements and Performance Criteria:

(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. Prepare for servicing and maintenance works	1.1 **Safe work practices** are maintained and **Personal Protective Equipment (PPE)** are used. 1.2 Workplace area is inspected and hazards are eliminated. 1.3 **Tools, equipment & materials** are gathered. 1.4 Tools, equipment & materials are checked for usability and quality. 1.5 Workplace is prepared for servicing activities. 1.6 Window type air conditioner is inspected and corresponding **technical information** is identified and interpreted.
2. Troubleshoot window air conditioner	2.1 **Relevant information** regarding trouble/problem is asked from user/owner of unit. 2.2 **Electrical** wiring circuit is checked and traced. 2.3 **Electronic circuit** is checked and traced. 2.4 Window air conditioner is started and operated, if possible, and observed operation. 2.5 **Electrical, electronic** and **mechanical parameters** are observed and recorded. 2.6 **System trouble/problem** is identified and results/findings are recorded.
3. Maintain/repair electrical /electronic system	3.1 Electrical trouble/problem is identified. 3.2 Faulty **Electrical and electronic component/s** is tested and repaired/replaced where necessary. 3.3 Specifications of electrical/electronic component for replacement is checked and recorded. 3.4 **Electrical Maintenance activities** are carried out in accordance with **manufacturer's instructions/specification.** 3.5 Operation of electrical/electronic components and system is checked and tested for proper operation in accordance with manufacturer's specification.
4. Service mechanical refrigeration system	4.1 **Compressor operation fault** is identified. 4.2 Compressor fault is repaired and tested for normal operation. 4.3 **Mechanical refrigeration system fault** is identified and

	repaired/serviced in accordance with manufacturer's instructions/specifications. 4.4 **Servicing procedures** of window type air conditioning system components are carried out in accordance with manufacturer's instructions/specifications. 4.5 Window air conditioner is tested for acceptable operating performance in accordance with manufacturer's specifications.
5. Clean/maintain workplace, tools and equipment	5.1 Workplace is cleaned and materials are stored in accordance with workplace requirements. 5.4 Tools and equipment are cleaned, checked for damaged and lubricated (if necessary) and stored in accordance with workplace conditions. 5.5 Damaged/defective tools and equipment are reported for repair/replacement.

Range of Variables

Variable	Range (Includes but not limited to:)	
1. Tools, equipment & materials	**1.1 Tools:** 1.1.1 Multi tester (AVO) 1.1.2 Clamp meter 1.1.3 Side cutting pliers 1.1.4 Wire stripper 1.1.5 Screwdriver set 1.1.6 Terminal crimping plier 1.1.7 Measuring steel tape 1.1.8 Ball peen hammer 1.1.9 Tube cutter 1.1.10 Hand hacksaw 1.1.11 Swaging tool set 1.1.12 Flaring tool set 1.1.13 Bending tool 1.1.14 Files 1.1.15 Soft Hammer 1.1.16 Chisel 1.1.17 Levelling instrument **1.2 Equipment:** 1.2.1 Vacuum pump 1.2.2 Refrigerant charging cylinder	1.2.3 Refrigerant recovery machine 1.2.4 Oxy acetylene welding outfit 1.2.5 Double Gauge Manifold 1.2.6 Drill press 1.2.7 Nitrogen Cylinder 1.2.8 Double stage Regulator **1.3 Materials:** 1.3.1 Insulation tapes 1.3.2 Electrical terminal connectors/clip 1.3.3 Insulating materials 1.3.4 Wires/cables 1.3.5 Charging Hose 1.3.6 Copper tubes 1.3.7 Aluminum tubes 1.3.8 Steel tube 1.3.9 Solder material 1.3.10 Brazing flux 1.3.11 Cotton rag
2. Safe work practices	2.1 Proper and safe use of tools and equipment 2.2 Wearing of appropriate PPEs 2.3 Eliminating unsafe conditions in the workplace 2.4 Shutting off and locking electrical switches before start of work 2.5 Care in working with electricity 2.6 Awareness to working with high pressures	

	2.7 Awareness in working with refrigerant gasses/liquids 2.8 Releasing gas pressures before opening high pressure lines
3. PPE	3.1 Safety helmet 3.2 Safety Belt 3.3 Safety shoes 3.4 Hand gloves 3.5 Apron
4. Technical information	4.1 Type of refrigerant used 4.2 High side systems pressure 4.3 Low side system pressure 4.4 Type of compressor used 4.5 Voltage of compressor motor 4.6 Full load current rating 4.7 Cycle/second (Hz) 4.8 Electrical circuit diagram 4.9 Electrical components 4.10 Type of evaporator coil 4.11 Type of condenser
5. Relevant information	5.1 Power supply 5.2 Electrical circuit 5.3 Electronic circuit 5.4 System operation 5.4.1 Compressor 5.4.2 Evaporator 5.4.3 Condenser 5.4.4 Expansion valve 5.4.5 Refrigerant charge 5.4.6 Leaks 5.5 Incidents prior to occurrence of problem
6. Electrical, electronic and mechanical parameters	6.1 Electrical/ electronic parameters 6.1.1 input voltage 6.1.2 motor rated voltage 6.1.3 Motor full load current 6.1.4 Cycle 6.1.5 Motor phase; (single phase, three phase) 6.1.6 Electronic circuits 6.1.7 Resistance 6.1.8 Inductance 6.1.9 Capacitance 6.1.10 Semiconductor devices 6.1.11 Transformer 6.2 Mechanical parameters 6.2.1 High side pressure 6.2.2 Low side pressure 6.2.3 Type of compressor; (Piston type, Rotary type) 6.2.4 Type of refrigerant 6.2.5 Type of expansion valve (refrigerant flow control) 6.2.6 Type of condenser,

	6.2.7 Type of evaporator
7. System trouble/problem	7.1 Input electrical problem 7.2 Faulty Electrical circuit 7.3 Electronic circuit problems 7.4 Electronic component problem 7.5 Faulty compressor 7.6 Faulty refrigerant charge 7.7 System leak 7.8 Faulty mechanical system components
8. Electrical/Electronic component/s	8.1 Compressor motor 8.2 Relays 8.3 Timers 8.4 Switches 8.5 Thermostat 8.6 Lamps 8.7 Timer relays 8.8 Wiring (includes terminals and connectors) 8.9 Pressure switches 8.10 Capacitors 8.11 Resistors 8.12 Diode 8.13 Inductors 8.14 Capacitors 8.15 Rectifiers 8.16 transformers
9. Electrical/electronic Maintenance activities	9.1 Compressor motor replacement 9.2 Electrical/ electronic components repair/replacement 9.3 Re-wiring 9.4 Checking/cleaning of terminals and contactors
10. Manufacturer's instructions/specification	10.1 Pressure testing 10.2 Vacuum pressure testing 10.3 Amount of refrigerant charge 10.4 Type of refrigerant charge 10.5 Tolerance for High side pressure 10.6 Tolerance for Low side pressure 10.7 Range of full load current 10.8 Compressor power and capacity
11. Compressor operation fault	11.1 Loose compression 11.2 Broken/leaky valves 11.3 Stuck up piston 11.4 Broken crankshaft 11.5 Leaky manifolds 11.6 Compressor motor problem (for hermetic type)
12. Mechanical refrigeration system fault	12.1 Leaky line tubes, compressor coil, evaporator coil 12.2 Low refrigerant charge 12.3 High refrigerant charge 12.4 Partial pressure in system

	12.5 Faulty expansion valve 12.6 Dirty condenser 12.7 Dirty evaporator 12.8 Faulty refrigerator/freezer door sealant
13. Servicing procedures	13.1 Installation and commissioning of new units 13.2 System checks and cleaning 13.3 Replacement of air filter 13.4 Replacement of refrigerant filter/drier 13.5 Replacement of system components 13.6 Electrical troubleshooting and repair 13.7 Retrofitting 13.8 Evacuation and charging of new refrigerant 13.9 Changing of tubes and brazing 13.10 Leak repair

Curricular Content Guide

1. Underpinning Knowledge	1.1 Principles of Operation of window type air conditioner 1.2 Technical information for window type air conditioning systems 1.3 Procedure for Starting and operation of window air conditioner 1.4 Electrical/electronic circuits and components of window air conditioner 1.5 Electrical/electronic and mechanical technical parameters of window air conditioner 1.6 Procedure of Identifying and recording electrical system trouble/problem 1.7 Electrical/ electronic maintenance activities and manufacturer's instructions/specification 1.8 Methods of checking and testing operation of electrical components 1.9 Procedure of Identifying and repairing/servicing mechanical refrigeration system fault 1.10 Servicing procedures for window air conditioner system components 1.11 Testing procedure for window air conditioner 1.12 Acceptable operating performance 1.13 Workplace requirements of cleaning, checking tools and equipment for damaged and storing
2. Underpinning Skills	2.1 Inspecting window air conditioner and identifying corresponding technical information 2.2 Starting and operating window air conditioner, if possible, and observing 2.3 Observing electrical/electronic and mechanical technical parameters and recording results/findings 2.4 Identifying and recording electrical/electronic system

	trouble/problem 2.5 Carrying out electrical/electronic maintenance activities in accordance with manufacturer's instructions/specification 2.6 Checking and testing operation of electrical/electronic components and system for proper operation in accordance with manufacturer's instruction/specification 2.7 Identifying and repairing/servicing mechanical refrigeration system fault in accordance with manufacturer's specifications 2.8 Carrying out servicing procedures for window air conditioner components in accordance with manufacturer's instructions/ specifications 2.9 Testing window air conditioner for acceptable operating performance in accordance with manufacturer's specifications 2.10 Cleaning, checking tools and equipment for damaged and lubricated (if necessary) and storing in accordance with workplace conditions.
3. Underpinning Attitudes	3.1 Patience 3.2 Commitment to occupational health and safety practices 3.3 Environmental concerns 3.4 Eagerness to learn 3.5 Tidiness and orderliness 3.6 Respect to peers and seniors in workplace
4. Resource Implications	4.5 Workplace (simulated or actual) 4.6 Refrigeration and air conditioning equipment, tools, materials, repair and training manual. 4.7 Work instruction sheet 4.8 Window type air conditioner

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Inspected window air conditioner and identified corresponding technical information 1.2 Started and operated window air conditioner, if possible, and observed 1.3 Observed electrical, electronic and mechanical technical parameters and recorded results/findings 1.4 Identified and recorded electrical/electronic system trouble/problem 1.5 Carried out electrical maintenance activities in accordance with manufacturer's instructions/specification 1.6 Checked and tested operation of electrical/electronic components and system for proper operation in accordance with manufacturer's instruction/specification 1.7 Identified and repaired/serviced mechanical refrigeration system fault in accordance with manufacturer's specifications 1.8 Carried out servicing procedures of window air conditioner

	system components in accordance with manufacturer's instructions/specifications 1.9 Tested window air conditioner for acceptable operating performance in accordance with manufacturer's specifications 1.10 Cleaned, checked tools and equipment for damaged and lubricated (if necessary) and stored in accordance with workplace conditions.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning
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: **SERVICE AND MAINTAIN SPLIT AND PACKAGE TYPE AIR CONDITIONING UNITS**	**Nominal Duration:** 80hrs.	**Unit Code:** SEIP-LIG-REF-5-O

Unit Descriptor:

This unit covers the knowledge, skills and attitudes required for a worker to service and maintain split and package type air conditioning units when performing refrigeration and air conditioning works. It specifically includes the tasks of preparing for servicing and maintenance works, trouble shooting split and package type air conditioning units, maintaining/repairing electrical/electronic system, servicing mechanical refrigeration system and components and cleaning/maintaining workplace, tools and equipment.

Elements and Performance Criteria:

(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. Prepare for servicing and maintenance works	1.1 **Safe work practices** are observed and **Personal Protective Equipment (PPE)** are used. 1.2 Workplace area is inspected and hazards are eliminated. 1.3 **Tools, equipment & materials** are gathered. 1.4 Tools, equipment & materials are checked for usability and quality. 1.5 Workplace is prepared for servicing activities. 1.6 Window type air conditioner is inspected and corresponding **technical information** is identified.
2. Troubleshoot split and package type air conditioning units	2.1 **Relevant information** regarding trouble/problem is asked from user/owner of unit. 2.2 Electrical wiring circuit is checked and traced. 2.3 Split and package type air conditioning units are started and operated, if possible, and observed operation. 2.4 **Electrical/electronic** and **mechanical l parameters** are observed and recorded. 2.5 **System trouble/problem** is identified and results/findings are recorded.
3. Maintain/repair electrical and electronic system	3.1 Electrical trouble/problem is identified 3.2 Faulty **Electrical/electronic component/s** is tested and repaired/replaced where necessary. 3.3 Specifications of electrical component for replacement is checked and recorded. 3.4 **Electrical/electronic Maintenance activities** are carried out in accordance with **manufacturer's instructions/specification.** 3.5 Operation of electrical components and system is checked and tested for proper operation in accordance with manufacturer's specification.
4. Service mechanical system and components	4.1 **Compressor operation fault** is identified and interpreted. 4.2 Compressor fault is repaired and tested for normal operation. 4.3 **Mechanical refrigeration system fault** is identified and repaired/serviced in accordance with manufacturer's

	instructions/specifications. 4.4 **Servicing procedures** of split type air conditioning system components are carried out in accordance with manufacturer's instructions/specifications. 4.5 **Split and package type air conditioning** units are tested for acceptable operating performance in accordance with manufacturer's specifications.
5. Clean/maintain workplace, tools and equipment	5.1 Workplace is cleaned and materials are stored in accordance with workplace requirements. 5.2 Tools and equipment are cleaned, checked for damaged and lubricated (if necessary) and stored in accordance with workplace conditions. 5.3 Damaged/defective tools and equipment are reported for repair/replacement.

Range of Variables

Variable	Range (Includes but not limited to)	
1. Tools, equipment and materials	**1.1 Tools:** 1.1.1 Multi tester (AVO) 1.1.2 Clamp meter 1.1.3 Side cutting pliers 1.1.4 Wire stripper 1.1.5 Screwdriver set 1.1.6 Adjustable wrench 1.1.7 Allen Key set 1.1.8 Chisel 1.1.9 Terminal crimping plier 1.1.10 Measuring steel tape 1.1.11 Ball peen hammer 1.1.12 Tube cutter 1.1.13 Hand hacksaw 1.1.14 Swaging tool set 1.1.15 Flaring tool set 1.1.16 Bending tool 1.1.17 Files **1.2 Equipment:** 1.2.1 Vacuum pump 1.2.2 Refrigerant charging cylinder	1.2.3 Refrigerant recovery machine 1.2.4 Oxy acetylene welding outfit 1.2.5 Power Drill machine 1.2.6 Double gauge manifold 1.2.7 Nitrogen Cylinder 1.2.8 Double stage regulator **1.3 Materials:** 1.3.1 Insulation tapes 1.3.2 Electrical terminal connectors 1.3.3 Wires/cables 1.3.4 Copper tubes 1.3.5 Aluminum tubes 1.3.6 Steel tube 1.3.7 Brazing flux 1.3.8 Brazing Rod 1.3.9 Insulating tube 1.3.10 MS Angle/Flat bar
2. Safe work practices	2.1 Proper and safe use of tools and equipment 2.2 Wearing of appropriate PPEs 2.3 Eliminating unsafe conditions in the workplace 2.4 Shutting off and locking electrical switches before start of work 2.5 Care in working with electricity 2.6 Awareness to working with high pressures	

	2.7 Awareness in working with refrigerant gasses/liquids 2.8 Releasing gas pressures before opening high pressure lines
3. PPE	3.1 Safety helmet 3.2 Safety Belt 3.3 Safety shoes 3.4 Hand gloves 3.5 Apron
4. Technical information	4.1 Type of refrigerant used 4.2 High side systems pressure 4.3 Low side system pressure 4.4 Type of compressor used 4.5 Voltage of compressor motor 4.6 Full load current rating 4.7 Cycle/second (Hz) 4.8 Electrical/electronic circuit diagram 4.9 Electrical/electronic components 4.10 Type of evaporator coil 4.11 Type of condensing unit 4.12 Length of copper tubes
5. Relevant information	5.1 Power supply 5.2 Electrical/electronic circuit 5.3 System operation 5.3.1 Condensing unit 5.3.2 Compressor 5.3.3 Evaporator 5.3.4 Condenser 5.3.5 Expansion valve 5.3.6 Refrigerant charge 5.3.7 Leaks 5.4 Incidents prior to occurrence of problem
6. Electrical, electronic and mechanical parameters	6.1 Electrical parameters 6.1.1 input voltage 6.1.2 motor rated voltage 6.1.3 Motor full load current 6.1.4 Cycle/sec(Hz) 6.1.5 Motor phase; (single phase, three phase) 6.2 Mechanical parameters 6.2.1 High side pressure 6.2.2 Low side pressure 6.2.3 Type of compressor; (Piston type, Rotary type) 6.2.4 Type of refrigerant 6.2.5 Type of expansion valve (refrigerant flow control) 6.2.6 Type of condensing unit 6.2.7 Type of evaporator (indoor unit) 6.3 Electronic parameters 6.3.1 Electronic circuits 6.3.2 Resistance 6.3.3 Inductance

	6.3.4 Capacitance 6.3.5 Semiconductor devices 6.3.6 Transformer
7. System trouble/problem	7.1 Input electrical problem 7.2 Faulty Electrical circuit 7.3 Faulty compressor 7.4 Faulty refrigerant charge 7.5 System leak 7.6 Faulty mechanical system components
8. Electrical and electronic component/s	8.1 Compressor motor 8.2 Contactor 8.3 Relays 8.4 Timers 8.5 Switches 8.6 Thermostat 8.7 Lamps 8.8 Timer relays 8.9 Wiring (includes terminals and connectors) 8.10 Pressure switches 8.11 Capacitors 8.12 Resistor 8.13 Diode. 8.14 Capacitor 8.15 Inductor 8.16 Transistor 8.17 IC
9. Electrical and electronic Maintenance activities	9.1 Compressor motor replacement 9.2 Electrical and electronic components repair/replacement 9.3 Re-wiring 9.4 Checking/cleaning of terminals and contactors
10. Manufacturer's instructions/specification	10.1 Pressure testing 10.2 Vacuum pressure testing 10.3 Amount of refrigerant charge 10.4 Type of refrigerant charge 10.5 Tolerance for High side pressure 10.6 Tolerance for Low side pressure 10.7 Range of full load current 10.8 Compressor power and capacity
11. Compressor operation fault	11.1 Loose connection 11.2 Broken/leaky valves 11.3 Stuck up piston 11.4 Broken crankshaft 11.5 Leaky manifolds 11.6 Compressor motor problem (for hermetic type)
12. Mechanical refrigeration system fault	12.1 Leaky line tubes, compressor oil, evaporator coil 12.2 Low refrigerant charge

	12.3 High refrigerant charge 12.4 Partial pressure in system 12.5 Faulty expansion valve 12.6 Dirty condenser 12.7 Dirty evaporator 12.8 Faulty refrigerator/freezer door sealant
13. Servicing procedures	13.1 Installation of new units 13.2 Indoor and outdoor units checks and cleaning 13.3 Replacement of air filter 13.4 Replacement of refrigerant filter/drier 13.5 Replacement of system components 13.6 Electrical troubleshooting and repair 13.7 Retrofitting 13.8 Evacuation and charging of new refrigerant 13.9 Changing of tubes and brazing 13.10 Leak repair
14. Split and package type air conditioning	14.1 Split type air conditioning units 14.1.1 Floor mounted indoor unit 14.1.2 Wall mounted indoor unit 14.1.3 Ceiling mounted indoor unit 14.1.4 Portable type unit 14.2 Package type air conditioning unit 14.2.1 floor mounted compact type 14.2.2 single ducted type 14.2.3 multiple ducted type 14.2.4 Variable Refrigerant Flow(VRF)

Curricular Content Guide

1. Underpinning Knowledge	1.1 Refrigerant use and types of refrigerant 1.2 Principles of Operation of split type air conditioning systems 1.3 Principles of operation of package type air conditioning units 1.4 Types of split type air conditioning systems 1.5 Technical information for split type air conditioning systems 1.6 Technical information for package type air conditioning systems 1.7 Procedure for Starting and operation of split and package type conditioner 1.8 Electrical/electronic circuits and components of split and package type air conditioners 1.9 Electrical, electronic and mechanical technical parameters of split and package type air conditioners 1.10 Procedure of Identifying and recording electrical system trouble/problem 1.11 Electrical/electronic maintenance activities and manufacturer's instructions/specification 1.12 Methods of checking and testing operation of electrical

	components 1.13 Procedure of Identifying and repairing/servicing mechanical refrigeration system fault 1.14 Servicing procedures for split and package air conditioner system components 1.15 Testing procedure for split and package air conditioner 1.16 Acceptable operating performance 1.17 Workplace requirements of cleaning, checking tools and equipment for damaged and storing
2. Underpinning Skills	2.1 Inspecting split and package air conditioner and identifying corresponding technical information 2.2 Starting and operating split and package air conditioner, if possible, and observing 2.3 Observing electrical, electronic and mechanical technical parameters and recording results/findings 2.4 Identifying and recording electrical/electronic system trouble/problem 2.5 Carrying out electrical/electronic maintenance activities in accordance with manufacturer's instructions/specification 2.6 Checking and testing operation of electrical/electronic components and system for proper operation in accordance with manufacturer's instruction/specification 2.7 Identifying and repairing/servicing mechanical refrigeration system fault in accordance with manufacturer's specifications 2.8 Carrying out servicing procedures for split and package air conditioner components in accordance with manufacturer's instructions/ specifications 2.9 Testing split and package air conditioners for acceptable operating performance in accordance with manufacturer's specifications 2.10 Cleaning, checking tools and equipment for damaged and lubricated (if necessary) and storing in accordance with workplace conditions.
3. Underpinning Attitudes	3.1 Patience 3.2 Commitment to occupational health and safety practices 3.3 Environmental concerns 3.4 Eagerness to learn 3.5 Tidiness and orderliness 3.6 Respect for rights of peers and seniors in workplace
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Refrigeration and air conditioning equipment, tools, materials, repair and training manual. 4.3 Work instruction sheet 4.4 Split and package type air conditioning manuals

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Inspected split and package type air conditioner and identified corresponding technical information 1.2 Started and operated split and package type air conditioner, if possible, and observed 1.3 Observed electrical, electronic and mechanical technical parameters and recorded results/findings 1.4 Identified and recorded electrical/electronic system trouble/problem 1.5 Carried out electrical maintenance activities in accordance with manufacturer's instructions/specification 1.6 Checked and tested operation of electrical/electronic components and system for proper operation in accordance with manufacturer's instruction/specification 1.7 Identified and repaired/serviced split and package type air conditioner system fault in accordance with manufacturer's specifications 1.8 Carried out servicing procedures of split and package type air conditioner system components in accordance with manufacturer's instructions/specifications 1.9 Tested split and package type air conditioner for acceptable operating performance in accordance with manufacturer's specifications 1.10 Cleaned, checked tools and equipment for damaged and lubricated (if necessary) and stored in accordance with workplace conditions.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning
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: **REPAIR REFRIGERATION COMPRESSOR**	**Nominal Duration:** 30hrs.	**Unit Code:** SEIP-LIG-REF-6-O

Unit descriptor:

This unit covers the knowledge, skills and attitudes required to repair refrigeration compressor when performing refrigeration and air conditioning works. It specifically includes the tasks of preparing for refrigeration compressor repairing, diagnosing fault of refrigeration compressor, repairing refrigeration compressor and components and cleaning/maintaining workplace, tools and equipment.

Elements and Performance Criteria:

(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. Prepare for refrigeration compressor servicing/repairing	1.1 **Safe work practices** are maintained and **Personal Protective Equipment (PPEs)** are used. 1.2 Workplace area is inspected and hazards are eliminated**.** 1.3 **Tools, equipment & materials** are gathered and interpreted. 1.4 Tools, equipment & materials are checked for usability and quality. 1.5 Workplace is prepared for repairing of refrigeration compressor. 1.6 **Compressor technical information** is identified interpreted and recorded.
2. Diagnose fault of compressor	2.1 **Type of faulty compressor** is identified. 2.2 **Relevant information** regarding trouble/problem is asked from user/owner of unit. 2.3 Refrigerant is recovered appropriately 2.4 Compressor is removed from refrigeration unit in accordance with workplace/manufacturer's instruction. 2.5 Compressor is disassembled in accordance with manufacturer's instruction/specification. 2.6 **Compressor parts/components** are checked and faults identified.
3. Repair compressor	3.1 **Repair procedure** is planned and necessary parts/components are gathered. 3.2 Faulty parts/components are repaired or replaced where necessary in accordance with workplace. 3.3 Compressor parts/components are assembled in accordance with manufacturer's instruction/specification. 3.4 Compressor is tested for normal operation in accordance with manufacturer's specifications. 3.5 Compressor is installed back into the Refrigeration system and oil level is tested. 3.6 Compressor leak is checked and operated
4. Clean/maintain workplace, tools and equipment	4.1 Workplace is cleaned and materials are stored in accordance with workplace requirements. 4.2 Tools and equipment are cleaned, checked for damaged and lubricated (if necessary) and stored in accordance with

	workplace conditions. 4.3 Damaged/defective tools and equipment are reported for repair/replacement.

Range of Variables

Variable	Range (Includes but not limited to:)	
1. Tools, equipment & materials	**1.1 Tools:** 1.1.1 Set of socket wrench 1.1.2 Set of combination wrench 1.1.3 Adjustable wrench 1.1.4 Screwdriver set 1.1.5 Steel rule 1.1.6 Vernier Caliper 1.1.7 Micrometer 1.1.8 Ball peen hammer 1.1.9 Tube cutter 1.1.10 Hand hacksaw 1.1.11 Swaging tool set 1.1.12 Flaring tool set 1.1.13 Bending tool 1.1.14 Files 1.1.15 Bench vice **1.2 Equipment:** 1.2.1 Portable grinder 1.2.2 Portable drill 1.2.3 Vacuum pump 1.2.4 Refrigerant charging cylinder	1.2.5 Refrigerant recovery machine 1.2.6 Oxy acetylene welding outfit 1.2.7 Drill press **1.3 Materials:** 1.3.1 Gasket material 1.3.2 Sealant 1.3.3 Welding electrodes 1.3.4 Brazing materials 1.3.5 O-rings 1.3.6 Valves 1.3.7 Bolts and nuts 1.3.8 Screws 1.3.9 Copper tubes 1.3.10 Steel tube 1.3.11 Brazing flux 1.3.12 Connector
2. Safe work practices	2.1 Proper and safe use of tools and equipment 2.2 Wearing of appropriate PPEs 2.3 Eliminating unsafe conditions in the workplace 2.4 Shutting off and locking electrical switches before start of work 2.5 Care in working with welding machine 2.6 Care when performing brazing process 2.7 Awareness to working with high pressures 2.8 Awareness in working with refrigerant gasses/liquids 2.9 Releasing gas pressures before opening high pressure lines	
3. PPE	3.1 Safety helmet 3.2 Safety shoes 3.3 Hand gloves 3.4 Apron	
4. Compressor technical information	4.1 Type of compressor 4.2 Types of Suction and discharge valves 4.3 Manufacturer's Serial number 4.4 Manufacturer's part numbers	

	4.5 Type of refrigerant used 4.6 Working pressure 4.7 Electrical specifications 4.8 Compressor oil
5. Type of compressor	5.1 Hermetic 5.2 Semi-hermetic 5.3 Split type 5.4 Reciprocating piston 5.5 Rotary type 5.6 Single stage 5.7 Multi stage
6. Relevant information	6.1 Time when trouble was detected 6.2 Abnormal noise 6.3 Power supply condition 6.4 Abnormal temperature 6.5 Abnormal pressures 6.6 Other abnormalities of operation observed 6.7 Incidents prior to occurrence of problem
7. Compressor parts/components	7.1 For reciprocating compressor 7.1.1 Cylinder head 7.1.2 Suction valves 7.1.3 Valve plate 7.1.4 Discharge valve 7.1.5 Piston 7.1.6 Connecting rod 7.1.7 Crankshaft 7.1.8 Bearings 7.1.9 Seals 7.1.10 Fly wheel 7.2 For rotary compressor 7.2.1 Suction port 7.2.2 Discharge port 7.2.3 Pressure regulating valve 7.2.4 Rotor 7.2.5 Cylinder 7.2.6 Shaft 7.2.7 Coupling 7.2.8 Seals 7.2.9 Check valves

Curricular Content Guide

1. Underpinning Knowledge	1.1 Types of compressor and their applications 1.2 Compressor testing procedure 1.3 Procedure of removing compressor from refrigeration system 1.4 Compressor disassembly procedure 1.5 Compressor parts/components checking and fault analysis 1.6 Parts and components of compressors and their functions

	1.7 Parts/components repair procedures 1.8 Compressor Testing procedure 1.9 Manufacturer's specifications for different types of compressor 1.10 Workplace requirements for tools and equipment Maintenance and storing in requirements
2. Underpinning Skills	2.1 Testing compressor, if possible, and observing operation 2.2 Removing compressor from refrigeration system in accordance with workplace/manufacturer's instruction 2.3 Disassembling compressor in accordance with manufacturer's instruction/specification 2.4 Checking compressor parts/components and identifying faults 2.5 Repairing faulty parts/components or replacing where necessary in accordance with workplace/manufacturer's instruction/specification 2.6 Assembling compressor parts/components in accordance with manufacturer's instruction/specification 2.7 Testing compressor for normal operation in accordance with manufacturer's specifications 2.8 Maintaining tools and equipment and storing in accordance with workplace requirements
3. Underpinning Attitudes	3.1 Patience 3.2 Commitment to occupational health and safety practices 3.3 Environmental concerns 3.4 Eagerness to learn 3.5 Tidiness and orderliness 3.6 Respect for rights of peers and seniors in workplace
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Refrigeration and air conditioning equipment, tools, materials, repair and training manual. 4.3 Work instruction sheet 4.4 Refrigerant compressor

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Tested compressor, if possible, and observed operation 1.2 Removed compressor from refrigeration system in accordance with workplace/manufacturer's instruction 1.3 Disassembled compressor in accordance with manufacturer's instruction/specification 1.4 Checked compressor parts/components and identified faults 1.5 Repaired faulty parts/components or replaced where necessary in accordance with workplace/manufacturer's instruction/specification

	1.6 assembled compressor parts/components in accordance with manufacturer's instruction/specification
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning
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

Assessment Guide

A Framework for Effective Assessment

Refrigeration and Air Conditioning

How to Use this Assessment Guide

- This Assessment Guide presents need-to-know information for Assessors and others who want to know more about the assessment process. A handy Table of Contents Guide on the next page shows you where to look.

- If you want the basics of assessment, its key terms and definitions, in a Question & Answer (Q&A) format, see Section One.

- If you want a knowledge of who does what, the key roles and responsibilities involved in assessment, see Section Two.

- If you want a "toolbox" of tools and templates, that you can select from depending on your assessment need, see Section Three.

- If you want to look at working samples of completed assessment tools, see the Appendices.

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1.24 What kinds of Assessment Methods can be used for Evidence gathering

1.25 Define the term “evidence gathering tools” giving examples
1.26 Define the term “portfolio.”
1.27 Outline a 6-step method for preparing an evidence plan.

1.28 Outline the steps (sequence of activities) involved in developing an assessment tool.
1.29 Describe the four dimensions of competency.

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Assessment Guide

Section One: Objectives linked to Key Terms & Definitions

Define assessment.

Assessment is a systematic process of collecting proof or evidence on whether or not a candidate has demonstrated competence in the performance of a work-related activity/task that is directly linked to a performance standard. The assessment confirms that the individual can perform to the standard expected in the workplace and/or the nationally approved competency standard.

Give an example of assessment.

A helpful example in this regard is the driving test. The driver must prove his competence to drive by demonstrating to the driving assessor his ability to do so. The driving assessor uses a checklist to assess the candidate and make the necessary recommendations, based on the evidence he has collected in observing the candidate's driving. S/He either records/recommends that the candidate is ***competent*** or ***not yet competent.***

What is the purpose of assessment?

The Purpose of Assessment is to confirm that a trainee can perform competently to the standards expected in the workplace.

What is Assessment based on?

- An effective Assessment is based on a Competency Standard.

- A Competency Standard describes the skills, knowledge, and attitudes needed to perform effectively in the workplace, not the classroom.

Define the term "competency."

Competency is the ability to do a task successfully. Aspects of competency include:

- The capacity to perform tasks to the required standard consistently
- The ability to respond to different needs in the workplace
- The ability to plan and integrate a variety of tasks to attain a work outcome

Describe what makes up a competency standard.

It must be noted that a competency standard is made up of individual units of competency that include elements of competency as well as the performance criteria needed to accomplish them.

Define the term "Assessment tool."

An assessment tool is, in effect, an evidence-gathering tool. It contains both the instrument used for the assessment and instructions for gathering evidence in the assessment process. As an assessment instrument it contains the context and conditions for the assessment; tasks to be administered to the learner; an outline of the evidence to be gathered for the learner; the criteria for judging the evidence; and the necessary housekeeping records for recording and reporting requirements.

Describe the difference between Conventional Testing & Competency Based Assessment.

Conventional Testing	CBT Assessment
• Emphasis on knowledge/memorization • Teachers/Training Providers have main role • Theory & practical Tests can become outdated	• Based on competency standards • Involve industry partners in crucial role • Assessment based on demonstration of work

• High cost & central control • Relatively inflexible	skills rather than classroom knowledge • Flexible delivery • Competencies widely recognized • Guidelines & Templates used

Describe briefly what makes up an assessment system.

An Assessment System must be understood as a well-coordinated set of documented policies and procedures, including assessment materials and tools, that ensure assessments are consistently valid, reliable, flexible, fair, and safe.

Define the purpose of the Assessor role.

The role of Assessor is the heart and soul of effective competency based assessment. Without this pivotal role, determining the competency of the trainee is mere guesswork.

Note:

- The Industry Assessor will be asked to provide specs and practical demonstration tests from his workplace that will provide the evidence for determining competency.
- The importance of this input cannot be overemphasized for it best matches and tests the required performance criteria from the Standard.

Describe the basic questions that an Assessor must ask when planning an Assessment.

Planning an Assessment: What Needs to Happen?

- Determine which Units of Competency need to be assessed?
- Determine what Assessment Methods will be used?
- Determine what evidence-based tools (specs) need to be developed by the Assessor to guide the assessment?

- Determine how long it will take?
- Determine when the assessment will occur?
- Determine where the assessment will take place?
- Determine how it will be recorded?

Give some Assessor Requirements/Competencies.

Requirements/Competencies of an Assessor-

- The ability to use assessment tools to gather evidence effectively is essential, adjusting the language where necessary to reflect the language/literacy/numeracy levels of the workplace and not to exceed them in order to ensure learner understanding. This will also entail an ability to respond to learner needs such as responding to learner disability.

- The skill to develop specifications and practical tests, based on performance criteria, that provide evidence of competency that will fast track the assessment process.
- The ability to clearly demonstrate current industry skills and competencies relevant to the Standard.

- The Assessor is selected/appointed by Industry to act as an Assessor because of his proven competencies.
- Knows what needs to be done to assess the performance criteria
- Demonstrates a high level of expertise in the technical area to be examined
- Can provide constructive feedback

Define the challenges of the Assessor Role.

Assessor Role: Challenges

- Needs to be objective and unbiased
- Must have interpersonal skills to relax nervous candidates or deal with those who are aggressive or emotional
- Must have ability to deal with those who have literacy problems or difficult dialect

Review some basic need-to-know elements concerning assessment.

Assessment Basics: Need to Know Elements

- Assessment to be conducted by Industry Assessor selected by industry
- Industry assessor must be familiar with units of competency outlined in the course standards
- Industry Assessor should drafts specs that reflect industry requirements for trainees and that are based on critical aspects of competency
- Industry assessor is responsible for making final judgment of **competent** or **not yet competent**
- Trainer will assist industry assessor
- Trainees must demonstrate competence based on the units of competency outlined in the standards
- All resources related to units of competency must be made available prior to the assessment event, e.g., tools, equipment, materials

Describe the trainer's role in the assessment process.

The Trainer acts as a primary resource for the Assessor and acts as a Facilitator.

Trainer ensures:

- All industry required tools, equipment, and materials are available for the assessment
- The training venue is booked and has sufficient space for demonstrations/tasks
- That all logistics such as admission slips, signature sheets, and records are readily available for distribution and collection
- That all teaching materials and Standard documents and Assessment tools are ready for the Assessor

Discuss the importance of principles of assessment and what is involved.

Principles of Assessment Table

Key Principles	Relevance/Meaning
Valid	Ensures assessment aligned with the Unit of Competency and is based on evidence that shows the learner can demonstrate skills and knowledge in other similar contexts (workplace)
Reliable	Evidence presented for assessment is consistently interpreted regardless of the Assessor

Flexible	Assesses competencies held by the learner regardless of where they have been acquired; reflects the individual learner's needs
Fair	The individual learner's needs or disability is considered in the assessment process; the learner is provided with information about the assessment process and given the opportunity to challenge the result of the assessment if warranted
Safe	The assessor has inspected the venue for assessment and determined that it is safe for all involved and that emergency evacuations are in place if needed

Define the term "evidence."

Evidence is information that is gathered and matched against a Unit of Competency to provide proof of competency.

State the different forms of evidence that can be collected.

Different forms of evidence that can be collected are-

- **Direct** such as demonstration test, or observation of Candidate
- **Indirect** such as Candidate's self-assessment or third party reports such as an employer interview

Describe and outline what is involved in "rules of evidence" and why they are important.

Rules of Evidence Table

Rules of Evidence	Meaning
Valid	The assessor is given assurance that the learner possesses the skills, knowledge, and attitudes described in the Unit of Competency and related assessment requirements

Sufficient	The assessor is assured that the quality, quantity, and relevance of the evidence is sufficient to enable a judgment to be made on the learner's competency
Authentic	The assessor is assured that the evidence provided for assessment is the learner's own work
Current	The assessor is assured that the assessment evidence demonstrates current competency of the learner. This evidence must be from the present or very recent past.

Describe the purpose of evidence gathering tools.

The Purpose of evidence gathering tools are-

- To help candidates understand what is expected of them
- To provide a focus for the assessment
- To identify what is needed to verify competency

State the use of the evidence guide.

The evidence guide provides useful advice on Unit of Competency assessment and must be read in conjunction with the performance criteria, required underpinning skills/knowledge/attitudes, range statement, and the critical aspects of competency for the Standard.

State why assessment evidence is important.

Evidence is the information gathered that provides proof that the performance criteria of a unit of competency has been met. Evidence can take many forms:

- **Observation:** watching the trainee perform
- **Questioning:** asking the trainee questions
- **Demonstration of specific skills:** seeing how the trainee performs a procedure or creates a final product
- **Examining** previous work the trainee has done

Describe the kinds of Assessment Methods that can be used for Evidence gathering purposes.

Various kinds of Assessment Methods can be used for Evidence gathering purposes. A wide range of assessment methods are available for Evidence- gathering purposes. Assessment methods are not limited to those listed below. The greater the range of assessment methods applied, the better the accuracy of the assessment.

Assessment Methods Table

Methods	Examples
Direct Observation of Candidate	Actual real-time activities in the workplace Work activities in a simulated workplace/training center
Questioning	Written questions; interviews; self-evaluation with questions; verbal questioning; questionnaires
Evidence compiled by Candidate	Portfolio; collection of work samples; products with supporting documentation; logbooks; information about life experience
Methods	Examples
Review of Product	Work samples and products; products as a result of a demonstration test/spec
Third Party Feedback	Reports/testimonials from Employers and Supervisors; evidence of training; interviews with Employers and Supervisors

Advice to the Assessor: use these methods and examples as a means of making your assessment valid, reliable, flexible, fair, and safe.

Define the term "evidence gathering tools" and give some examples of these tools.

Evidence gathering tools are the actual instruments that the Assessor uses to collect evidence. Evidence may be collected through:

- Demonstration of work activity
- Observation Checklist
- Question List
- Third party reports e.g. supervisor to verify consistent performance
- Review of candidate's portfolio
- Verifying the Candidate's capacity to deal with contingencies (unexpected things that come up)
- Written test

Define the term "portfolio."

A collection of evidence that may be presented by the Candidate to an Assessor to prove the Candidate's competence at a job or task.

What are some examples of Portfolio Evidence?

- Training results and certificates
- Training workbooks
- References from employers
- Job description and work experience
- Photos and videos
- Work journals
- Awards
- Work samples
- Letters and memos

Outline a 6-step method for preparing an evidence plan.

Steps in Preparing an Evidence Plan (Sequence of Steps to Follow)-

The Evidence Plan is the most important planning tool for an Assessor. A good evidence plan generates a list of the evidence that the Assessor must gather when conducting the assessment for a specific Unit of Competency. The following 6-Point Method for preparing an Evidence Plan provides a useful sequence of inter-related steps to follow:

1. Select Unit of Competency for assessment
2. Read full Unit of Competency
3. Identify evidence requirements based on:
    a. Elements and Performance Criteria
    b. Dimensions of Competence
    c. Underpinning skills knowledge
    d. Critical aspects of competency
4. Develop a list of evidence requirements
5. Identify best ways of collecting evidence (tools)
6. Document evidence plan

Outline the steps (sequence of activities) involved in developing an assessment tool.

Following are the steps (sequence of activities) involved in developing an assessment tool:

1. Select the Unit of Competency
2. Read the Unit of Competency
3. Identify the required evidence: critical aspects of competency
4. Identify the evidence gathering method
5. Complete the evidence plan
6. Select the appropriate template
7. Complete the template
8. Check the evidence gathering tools against the evidence plan and Unit of Competency
9. Check the tool with another Assessor for his opinion

Describe the four dimensions of competency.

Task Skills: the capacity to perform tasks in the workplace and demonstrate competence that meets the required Standard;

Task Management Skills: the ability to plan and integrate several tasks simultaneously that achieve a desired work outcome such as those skills involved in budgeting for a work operation, securing supplies and equipment for the work operation, completing the task in a timely, cost-effective manner, and ensuring safety practices are followed throughout;

Contingency Management Skills: the ability to respond to crises and breakdowns in the workplace, such as accidents and emergency situations that are unanticipated and require immediate action and resolution;

Job/Role Environment Skills: the capacity to own the responsibilities and expectations of the work environment that involves working with others effectively and participating in creating a work culture where all can contribute their best within the parameters of their job role

Assessment Guidelines

Section Two: Roles and Responsibilities

The Assessment System: Planning Guide for the Assessor

An Assessment System must be understood as a well-coordinated set of documented policies and procedures, including assessment materials and tools, that ensure assessments are consistently valid, reliable, flexible, fair, and safe.

Competency Assessment is a systematic process of collecting proof or evidence on whether or not a candidate has demonstrated competence in the performance of a work-related activity/task that is directly linked to a performance standard. The assessment confirms that the individual can perform to the standard expected in the workplace and/or the nationally approved competency standard.

Each **Unit of Competency** contained in a Standard describes a distinct part of a Mason's work and job profile. Within each Unit of Competency, the following components appear:

- Unit Title
- Unit Descriptor
- Elements of Competency
- Performance Criteria
- Range of Variables
- Evidence Guide

As a prelude to conducting assessments, the Assessor must be thoroughly familiar with all of the particulars and details of the Unit of Competency that is being assessed. This is a "must" for the role of the Assessor. He must be especially familiar with the Evidence Guide for gathering critical information.

The three sample assessment tools found below focus on the critical aspects of competency that can provide the required evidence to determine competency- the evidence guide. These sample assessment tools are as follows:

- Demonstration Checklist
- Observation Checklist
- Oral Questions Checklist

The duties of the Assessor include:

- Covering all of the key elements of the Unit of Competency under assessment
- Applying rigorously the Evidence Guide for the Unit of Competency as this contains the method and context of assessment, resources required for the assessment, the critical aspects of competency, and the required underpinning knowledge, skills, and attitudes
- Developing specifications (specs) for the task sheet for Demonstration as required
- Requiring the candidate to perform project tasks that cover interrelated units of competency- known as a "clustering."
- Making what can be termed "reasonable adjustments" for candidates with disabilities or for example, those candidates with regional dialects that prove difficult to understand

Note: These "reasonable adjustments" may involve reconfiguring a simulated workplace site so that a candidate's disability does not impede the assessment process, or for example, finding someone who can understand a regional dialect and assist the Assessor with essential communication skills.

Roles and Responsibilities of Assessor

Prior to any assessment, the Assessor should follow the specific instructions below to ensure a well-planned assessment event. In most cases s/he will be assisted by a Trainer. Nevertheless, s/he should make certain that good preparation has taken place for the assessment event.

1. Visit the assessment venue or workplace to ensure an adequate work area or platform containing:

- Sufficient space for working- ensure square meters of work space enough for task to be carried out effectively and safely
- Fire extinguisher and safety equipment within reach
- Emergency procedures in place
- All necessary tools, equipment, and materials ready at hand
- All necessary machinery in good working order

2. Assessment is drawn and extracted from the relevant Unit of Competency based on an approved Standard and on an Evidence plan that clearly focuses on critical aspects of competency.

3. The duration of time to assess the demonstration is clearly indicated, for example, 3 hours. This information is shared with the Candidate along with other pertinent information such as the sequence of tasks that he must follow, and the fact that he will be closely observed as the tasks are performed.

4. After the Candidate has performed the task, the Assessor will provide feedback to the Candidate on his performance.

5. The responsibility on finally deciding whether or not the Candidate was Competent or Not Yet Competent belongs to the accredited Assessor.

6. At the conclusion of the assessment, the Assessor will provide feedback on whether or not the Candidate was Competent or Not Yet Competent. S/He will also share information on next steps. These next steps include where to obtain the certificate related to the assessment or, if unsuccessful, how to re-try for competency within a specified period of time.

Roles and Responsibilities of Trainer

Prior to the assessment, you will have studied and become familiar with the Competency Standard for the industry occupation. You will also have met with or contacted the Assessor beforehand and discussed preparations and arrangements for the assessment. Your role will be to facilitate the assessment process and ensure all necessary resources are available, assisting the Assessor wherever possible. For example, once a draft spec has been produced by the Assessor, you will ensure it is fully consistent with the evidence plan and copied appropriately for use by both the Assessor and Candidate.

In addition to a confirming a suitable training venue and time, you will ensure that:

- Sufficient space is allotted for task work- square meters of work space enough for demonstration tasks to be carried out effectively and safely
- Fire extinguisher and safety equipment within reach if necessary
- Emergency procedures in place
- All necessary tools, equipment, and materials ready at hand
- All necessary machinery in good working order

Your duties include:

- **notifying** the Assessor and candidates of planned assessment events and their location
- **advising and assisting** the Assessor on planned assessment events
- **collecting** admission slips and signature sheets for assessment events
- **ensuring** all required forms and reporting mechanisms are in place and ready for distribution to the Assessor and to the Candidate
- **ensuring** all requisite forms are duly signed and forwarded to the SEIP Office, or certifying body
- **responding** to candidate queries and concerns such as re-assessment procedures
- **reconfiguring** workplace simulations so that candidates with disabilities are able to participate fully and without impediment
- **working** closely with the SEIP contact to ensure a successful assessment event

Roles and Responsibilities of Candidate

Prior to the assessment, you will have studied and become familiar with the Competency Standard for your industry.

1. Initially, you will be given information on the task you are to perform, and the estimated time you will require to perform it. These tasks are based on the critical aspects of competency related to the performance criteria within the approved Competency Standard.

Given the necessary instructions, and/or a task-related spec and the necessary tools, materials, and equipment, you will carry out and complete a work task. You will observe that there is:

- Sufficient space for working- square meters of work space enough for task to be carried out effectively and safely

- Fire extinguisher and safety equipment within reach if necessary
- Emergency procedures in place
- All necessary tools, equipment, and materials ready at hand
- All necessary machinery in good working order

2. Assessment is drawn and extracted from the relevant Unit of Competency based on the approved Competency Standard and on an Evidence plan (proof of competence) developed by the Assessor that clearly focuses on critical aspects of competency. The Evidence plan will be based on critical assessment tools such as demonstration/task; observation; oral questions.

3. The duration of time to assess the demonstration should be clearly indicated, for example, 3 hours. This information will be given to you along with other pertinent information such as the procedure or sequence of tasks that you must follow. It is important to note that you will be closely observed and assessed throughout the duration of your demonstration. You will be given time to ask questions and request clarification. You will also be given 10 minutes to familiarize yourself with the resources to be used in the assessment.

4. Based on your performance in demonstrating the task, you will be assessed by the Assessor to be Competent or Not Yet Competent. Regardless of the result you will be given feedback from the Assessor on your performance and the next steps.

5. After you have performed the task, the Assessor will provide feedback to you on your performance.

6. The responsibility on finally deciding whether or not you are Competent or Not Yet Competent belongs to the accredited Assessor.

7. At the conclusion of the assessment, the Assessor will provide feedback on whether or not you have been assessed to be **Competent** or **Not Yet Competent**. Both your signatures will be required on the Assessment Form. You will also be allowed to make comments on the Assessor's decision. The Assessor will then share information on next steps. These next steps include where to obtain the certificate related to the successful assessment or, if unsuccessful, how to re-try for competency within a specified period of time.

Section Three: Tools and Templates

This toolbox of Tools and Templates offers a wide range of assessment tools that will facilitate evidence gathering and other assessment-related needs. Evidence gathering, however, should not be limited to these tools and templates alone. The toolbox should be revised or expanded as necessary, to include other tools and templates that are deemed relevant.

- Demonstration Checklist
- Observation Checklist
- Oral Questions Checklist
- Evidence Plan (Overall Summary)
- Assessor Job Sheet and Specifications (Spec) Form
- Competency Assessment Results
- Assessor Planning Checklist Tool
- All About Questioning Techniques for Use in Assessment
- Quick Guide to Conducting Competency Assessments
- Assessor's Quick Start

Demonstration Checklist

Candidate's name:	
Assessor's name:	
Qualification:	
Project-Based Assessment Title	
Units of competency covered:	
Date of assessment:	
Time of assessment:	
Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐

Observation Checklist

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:			
Code:			
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec-if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist

Candidate's name:	
Assessor's name	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	
Reference Standard:	

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for competent/non yet competent.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		

Feedback to Candidate:

Candidate's overall performance was (circle):	Satisfactory	Not Satisfactory
The Candidate's underpinning knowledge was (circle):	Satisfactory	Not Satisfactory

Assessor Signature:	Date:

Candidate Signature:	Date:

EVIDENCE PLAN: Overall Summary

QUALIFICATION:	
Project-Based Assessment Title	
Units of competency covered	

Ways in which evidence will be collected: [tick the column] The evidence must show that the candidate …...	Observation with Questioning	Demonstration with Questioning	Written Examination	Portfolio
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				

Assessor Job Sheet and Specifications (Spec) Form

This Spec is in reference to the_____ Standard, and has been developed by an Industry Representative/Assessor.

The Result* indicates either C for Competent, or NYC for Not Yet Competent.

Unit of Competency	Elements Reviewed	Critical Aspects of Competency Covered	Result*: C/NYC

JOB #1 Procedure for Developing Specification (Spec): List the steps involved in performing the task/spec successfully. It will cover, in logical order, the critical aspects of competency listed above that will determine if the candidate is **Competent** or **Not Yet Competent.**

1.	
2.	
3.	
4.	
5.	

Tools and Equipment Required for Spec completion: List all tools, equipment, and materials required in completing Job #1:

Tools	Equipment	Materials

Assessor Name: Date:

Competency Assessment Results

Candidate's name:	
Assessor's name	
Qualification Title:	
Date of Assessment:	
Assessment Venue:	
Reference Standard:	
Unit of Competency:	

Assessment Unit	Competent	Not Yet Competent

Assessor's Recommendation and Comments:

Overall Assessment:

Yes: The Candidate successfully met the required evidence/standards and demonstrated all of the competencies necessary for certification in the Qualification and Units of Competency listed above.

No: The Candidate did not meet the evidence requirements. Re-assessment is recommended.

Assessor Signature:	Date:
Candidate Signature:	Date:
Assessment Center Manager Signature:	

ASSESSMENT PLANNING CHECKLIST TOOL

Assessor's name:	
Date:	

Directions: Circle the 'Yes' or 'No' response to each item.

1.	The Assessor is familiar with the unit(s) of competency being assessed	Yes	No
2.	The Assessor has verified that the workplace or training center has the correct equipment, machinery, tools, and materials necessary to complete all of the relevant aspects of the unit of competency	Yes	No
3.	The Assessor has ensured that all materials and equipment were assembled and arranged in advance.	Yes	No
4.	The Assessor has all the necessary tools, templates, and specifications needed to assess the trainee including a variety of assessment tools covering practical demonstration, observation, oral question, and (where necessary) written tests relevant to the competency specified in the standard	Yes	No
5.	The Assessor has met with the trainer prior to the assessment event to discuss his/her role.	Yes	No
6.	The Assessor will discuss the performance test with the trainee and address any concerns prior to giving the test	Yes	No
7.	The Assessor will discuss and record with the trainee the results of their performance	Yes	No

Action to be taken on "No" responses:

General Guidelines for Effective Questioning

- Keep questions short and focused on one key concept
- Ensure that questions are structured
- Test the questions to check that they are not ambiguous
- Use `open-ended questions such as `what if...?' and `why...?' questions, rather than closed questions
- Keep questions clear and straight forward and ask one at a time
- Use words that the candidate is able to understand
- Look at the candidate when asking questions
- Check to ensure that the candidate fully understands the questions
- Ask the candidate to clarify or re-phrase their answer if the assessor does not understand the initial response
- Confirm the candidate's response by repeating the answer back in his/her own words
- Encourage a conversational approach with the candidate when appropriate, to put him or her at ease
- Use questions or statements as prompts for keeping focused on the purpose of the questions and the kind of evidence being collected
- Use language at a suitable level for the candidate
- Listen carefully to the answers for opportunities to find unexpected evidence
- Follow up responses with further questions, if useful, to draw out more evidence or to make links between knowledge areas
- Compile a list of acceptable responses to ensure reliability of assessments

Recording responses

When using oral questioning, you may need a tool that has a structured approach (see below) and also enables you to record a candidate's responses. If the candidate's response is insufficient the assessor should record why on the recording sheet or checklist. This provides information that can be used later, if necessary, to explain to the candidate where he or she needs to develop their skills and/or knowledge to achieve the required competence.

Recording sheet for oral questioning (template)

Candidate's Name		
Assessor or Observer's Name		
Unit of Competency)		
Code		
Date of Assessment		
Location		
Task/Procedure		
Questions to be Answered by candidate	Response/Answer*	Satisfactory (Yes/No)
What would you do if …		
What would you do if …		
What would you do if …		
How do you …		
What are …		
Why did you… (Clarification)		
Follow up Questions		
The candidate's knowledge was:	Satisfactory Unsatisfactory	
Feedback to candidate:		

Candidate signature:	Date:
Assessor/Observer's Signature:	Date:

ASSESSOR GUIDE TO CONDUCTING COMPETENCY ASSESSMENTS

1. BEFORE THE ASSESSMENT	2. DAY OF ASSESSMENT	3. DURING THE ASSESSMENT	4. POST ASSESSMENT
- Review unit(s) of competency to be assessed especially evidence to be collected against performance criteria - Ensure the workplace or training center complies with all safety requirements and that high risk areas are clearly marked - Identify/request essential assessment resources: • tools and equipment • supplies and materials • personal protective equipment • print resources and rating sheets • Have trainees contacted if they have to bring any resources for the assessment, e.g. logbook	-Verify attendance through signed attendance sheet - Provide overview of what is to happen throughout day Orient the trainees to: • purpose of assessment • qualification to be assessed • assessment procedures to be followed • address needs of trainees and provide information on evidence requirements and assessment process • make all announcements just before start of assessment	Give clear instructions to trainees on what they are required to do: • time limits and expectations • all equipment and tools must be of the same quality for all trainees • written and verbal instructions translated into local dialects as needed • encourage questions • avoid providing any assistance to trainees during assessment • stop process if accident imminent • keep focused on evidence being valid, reliable, fair, flexible, and safe • Record details of evidence collected	Provide feedback on outcome of assessment process re: • give clear feedback on assessment decision • provide information on overcoming any gaps in competency assessment • provide opportunity to discuss assessment process and outcome **Prepare required assessment reports:** • all rating sheets signed by trainee as well as Assessor • maintain records of assessment procedures, evidence collected, and assessment outcome • verify assessment results/outcomes with training center **Prepare** recommendations for issuance of national certificate

Assessor's Quick Start

1. Identify the Unit(s) of Competency from the Program Standard that you are going to assess.

2. Review the Critical Aspects of Competency from the Unit of Competency that will be the basis of your Evidence Guide.

3. Select the Assessment Tools that you will use to gather evidence.
    i. Demonstration Checklist
    ii. Observation Checklist
    iii. Oral Questions Checklist

4. Create spec sheet(s) for the Unit of Competency to be examined.

5. Review the assessment procedure with the Candidate and ask if there are any questions.

6. Complete the assessment using the assessment tools in the order above. You are free to use other tools as well if you wish.

7. Determine whether Candidate is **Competent** or **Not-Yet-Competent**

8. Complete all necessary record sheets.

9. Give feedback to the Candidate.

Demonstration Checklist: Perform Tube Processing Operation Demonstration

Candidate's name:	
Assessor's name:	
Qualification:	Refrigeration and Air Conditioning
Project-Based Assessment Title	
Units of competency covered:	Perform Tube Processing Operation (SEIP-LIG-REF-1-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Cut tubes using proper cutting method and tool	☐	☐	☐
2. Seal tube ends to ensure non contamination with dirt and foreign materials	☐	☐	☐
3. Flare tube ends using proper flaring tool	☐	☐	☐
4. Check flared tube end for quality	☐	☐	☐
5. Swag tube end using proper swaging tool	☐	☐	☐
6. Bend copper/aluminum tube using proper bending tool	☐	☐	☐
7. Braze copper/aluminum tube using proper brazing tool	☐	☐	☐
8. Test brazed connection in accord with workplace requirements/spec	☐	☐	☐
9. Clean workplace and store materials, tools, and equipment in accord with workplace requirements	☐	☐	☐

Observation Checklist: Perform Tube Processing Operation

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Perform Tube Processing Operation		
Code:	SEIP-LIG-REF-1-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Cut tubes using proper cutting method and tool			
2. Seal tube ends to ensure non contamination with dirt and foreign materials			
3. Flare tube ends using proper flaring tool			
4. Check flared tube end for quality			
5. Swag tube end using proper swaging tool			
6. Bend copper/aluminum tube using proper bending tool			
7. Braze copper/aluminum tube using proper brazing tool			
8. Test brazed connection in accord with workplace requirements/spec			
9. Clean workplace and store materials, tools, and equipment in accord with workplace requirements			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist: Perform Tube Processing Operation

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Perform Tube Processing Operation
Reference Standard:	**Refrigeration and Air Conditioning**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. Why are tube ends sealed?		
2. Describe a procedure of tube flaring?		
3. What potential safety hazards are there in this work?		
4. What are the common PPEs used?		
5. Describe some common sealing materials?		
6. For what reason are tubes reamed after cutting?		
7. What procedure is used in bending an aluminum tube?		
8. What environmental concerns arise in this type of work?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Apply Electrical and Electronic Fundamentals

Candidate's name:	
Assessor's name:	
Qualification:	Refrigeration and Air Conditioning
Project-Based Assessment Title	
Units of competency covered:	Apply Electrical and electronic Fundamentals (SEIP-LIG-REF-2-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Carry out basic electrical circuit diagramming and wiring	☐	☐	☐
2. Describe relationships of different types of electrical properties	☐	☐	☐
3. Measure electrical properties/parameters using proper measuring tool/instrument	☐	☐	☐
4. Use electrical measuring tools and testing instruments safely/properly	☐	☐	☐
5. Test power supply and electrical components in accord with given diagram	☐	☐	☐
6. Terminate electrical circuit components in accord with given diagram	☐	☐	☐
7. Test circuit for proper operation in accord with instruction/circuit design	☐	☐	☐
8. Store electrical tools/instruments in accord with workplace procedures/policy	☐	☐	☐
	☐	☐	☐

Observation Checklist: Apply Electrical and Electronic Fundamentals

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Apply Electrical Fundamentals		
Code:	SEIP-LIG-REF-2-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec-if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Explain fundamental principles of electricity and electronics			
2. Use electrical switch, socket, cables, circuit breaker, magnetic contactor and electronics device, instruments and equipment			
3. Test power supply and electrical components			
4. Perform basic electrical/ electronic circuit connections			
1.			
2.			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist: Apply Electrical and Electronic Fundamentals

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Apply Electrical and Electronic Fundamentals
Reference Standard:	**Refrigeration and Air Conditioning**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. What is "Ohm's law?"		
2. How important is the electrical diagram?		
3. What is meant by "capacitance?"		
4. When would you use a Megger tester?		
5. Why is it important to commit to occupational health & safety?		
6. How are AC circuits different from DC circuits?		
7. How often should electrical tools be checked?		
8. How important is a knowledge of the international electrical code?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Service & Maintain Refrigerators & Freezers

Candidate's name:	
Assessor's name:	
Qualification:	Refrigeration and Air Conditioning
Project-Based Assessment Title	
Units of competency covered:	Service & Maintain Refrigerators & Freezers (SEIP-LIG-REF-3-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Inspect refrigerator/freezer and identify corresponding technical information	☐	☐	☐
2. Start and operate refrigerator/freezer and observe	☐	☐	☐
3. Observe electrical and mechanical technical parameters and record results/findings	☐	☐	☐
4. Identify and record electrical system trouble/problem	☐	☐	☐
5. Carry out electrical maintenance activities in accord with manufacturer's instruction/specification	☐	☐	☐
6. Check and test operation of electrical components and system for proper operation in accord with manufacturer's instruction/specification	☐	☐	☐
7. Identify and repair/service mechanical refrigeration system fault in accord with manufacturer's specifications	☐	☐	☐
8. Carry out servicing procedures of refrigeration system components in accord with manufacturer's instruction/specification	☐	☐	☐
9. Test domestic refrigerator/freezer for acceptable operating performance in accord with manufacturer's specifications	☐	☐	☐
10. Clean/check tools and equipment for damage and lubricate if needed and store in accord with workplace conditions	☐	☐	☐

Observation Checklist: Service & Maintain Refrigerators & Freezers

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Service & Maintain Refrigerators & Freezers		
Code:	SEIP-LIG-REF-3-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Inspect refrigerator/freezer and identify corresponding technical information			
2. Start and operate refrigerator/freezer and observe			
3. Observe electrical and mechanical technical parameters and record results/findings			
4. Identify and record electrical system trouble/problem			
5. Carry out electrical maintenance activities in accord with manufacturer's instruction/specification			
6. Check and test operation of electrical components and system for proper operation in accord with manufacturer's instruction/specification			
7. Identify and repair/service mechanical refrigeration system fault in accord with manufacturer's specifications			
8. Carry out servicing procedures of refrigeration system components in accord with manufacturer's instruction/specification			
9. Test domestic refrigerator/freezer for acceptable operating performance in accord with manufacturer's specifications			
10. Clean/check tools and equipment for damage and lubricate if needed and store in accord with workplace conditions			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:		Date:	
Assessor's Signature:		Date:	

Oral Questions Checklist: Service & Maintain Refrigerators & Freezers

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Perform Tube Processing Operation
Reference Standard:	**Refrigeration and Air Conditioning**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. What steps are involved in troubleshooting a problem?		
2. Is it important to have an awareness of refrigerant gasses/liquids?		
3. What should be done before opening high pressure lines?		
4. What are the different types of evaporators?		
5. What are some common mechanical refrigeration system faults?		
6. How important is occupational health & safety in this work?		
7. To what extent are manufacturer's specifications important?		
8. What are some common compressor operation faults?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Service & Maintain Window Type Air Conditioning System

Candidate's name:	
Assessor's name:	
Qualification:	Refrigeration and Air Conditioning
Project-Based Assessment Title	
Units of competency covered:	Service & Maintain Window Type AC System (SEIP-LIG-REF-4-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Inspect window air conditioner and identify corresponding technical information	☐	☐	☐
2. Start and operate window air conditioner and observe	☐	☐	☐
3. Observe electrical and mechanical technical parameters and record results/findings	☐	☐	☐
4. Identify and record electrical system trouble/problem	☐	☐	☐
5. Carry out electrical maintenance activities in accord with manufacturer's instruction/specification	☐	☐	☐
6. Check and test operation of electrical components and system for proper operation in accord with manufacturer's instruction/specification	☐	☐	☐
7. Identify and repair/service mechanical refrigeration system fault in accord with manufacturer's specifications	☐	☐	☐
8. Carry out servicing procedures of window air conditioner system components in accord with manufacturer's instruction/specification	☐	☐	☐
9. Test window air conditioner for acceptable operating performance in accord with manufacturer's specifications	☐	☐	☐
10. Clean/check tools and equipment for damage and lubricate if needed and store in accord with workplace conditions	☐	☐	☐

Observation Checklist: Service & Maintain Window Type AC System

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Unit of Competency:	Service & Maintain Window Type AC System
Code:	SEIP-LIG-REF-4-0
Name of Workplace/Training Center	
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided

During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):

	YES	NO
1. Inspect window air conditioner and identify corresponding technical information		
2. Start and operate window air conditioner and observe		
3. Observe electrical and mechanical technical parameters and record results/findings		
4. Identify and record electrical system trouble/problem		
5. Carry out electrical maintenance activities in accord with manufacturer's instruction/specification		
6. Check and test operation of electrical components and system for proper operation in accord with manufacturer's instruction/specification		
7. Identify and repair/service mechanical refrigeration system fault in accord with manufacturer's specifications		
8. Carry out servicing procedures of window air conditioner system components in accord with manufacturer's instruction/specification		
9. Test window air conditioner for acceptable operating performance in accord with manufacturer's specifications		
10. Clean/check tools and equipment for damage and lubricate if needed and store in accord with workplace conditions		

Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**
Feedback to Candidate:		
Candidate's Signature:		Date:
Assessor's Signature:		Date:

Oral Questions Checklist: Service & Maintain Window Type AC System

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Service & Maintain Window Type AC System
Reference Standard:	**Refrigeration and Air Conditioning**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. To what extent should PPEs be used for this type of work?		
2. How important is a knowledge of manufacturer's instructions/specifications re: air conditioning work?		
3. What is meant by mechanical parameters?		
4. How important are periodic system checks and cleaning?		
5. How important is communication with the user/owner of the unit?		
6. To what extent is commitment to occupational health & safety important?		
7. Is keeping a record of the electrical system trouble/problem important?		
8. Is it necessary to lubricate any tools?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Service & Maintain Split & Package Type AC Units

Candidate's name:	
Assessor's name:	
Qualification:	Refrigeration and Air Conditioning
Project-Based Assessment Title	
Units of competency covered:	Service & Maintain Split & Package Type AC Units (SEIP-LIG-REF-5-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Inspect split and package type air conditioner and identify corresponding technical information	☐	☐	☐
2. Start and operate split and package type air conditioner and observe	☐	☐	☐
3. Observe electrical and mechanical technical parameters and record results/findings	☐	☐	☐
4. Identify and record electrical system trouble/problem	☐	☐	☐
5. Carry out electrical maintenance activities in accord with manufacturer's instruction/specification	☐	☐	☐
6. Check and test operation of electrical components and system for proper operation in accord with manufacturer's instruction/specification	☐	☐	☐
7. Identify and repair/service split and package type ac system fault in accord with manufacturer's specifications	☐	☐	☐
8. Carry out servicing procedures of split and package type air conditioner system components in accord with manufacturer's instruction/specification	☐	☐	☐
9. Test split and package type air conditioner for acceptable operating performance in accord with manufacturer's specifications	☐	☐	☐
10. Clean/check tools and equipment for damage and lubricate if needed and store in accord with workplace conditions	☐	☐	☐

Observation Checklist: Service & Maintain Split & Package Type AC Units

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Service & Maintain Split & Package Type AC Units		
Code:	SEIP-LIG-REF-1-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Inspect split and package type air conditioner and identify corresponding technical information			
2. Start and operate split and package type air conditioner and observe			
3. Observe electrical and mechanical technical parameters and record results/findings			
4. Identify and record electrical system trouble/problem			
5. Carry out electrical maintenance activities in accord with manufacturer's instruction/specification			
6. Check and test operation of electrical components and system for proper operation in accord with manufacturer's instruction/specification			
7. Identify and repair/service split and package type ac system fault in accord with manufacturer's specifications			
8. Carry out servicing procedures of split and package type air conditioner system components in accord with manufacturer's instruction/specification			
9. Test split and package type air conditioner for acceptable operating performance in accord with manufacturer's specifications			
10. Clean/check tools and equipment for damage and lubricate if needed and store in accord with workplace conditions			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:		Date:	
Assessor's Signature:		Date:	

Oral Questions Checklist: Service & Maintain Split & Package Type AC Units

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Service & Maintain Split & Package Type AC Units
Reference Standard:	**Refrigeration and Air Conditioning**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. How important are environmental concerns?		
2. How are waste materials disposed of?		
3. How often should you check the quality and serviceability of your tools and equipment?		
4. To what extent is tidiness important on the job?		
5. What do you do in the case of an electrical fire?		
6. Where are servicing procedures of ac components commonly found?		
7. When should electrical switches be shut off and locked?		
8. What is involved in pressure testing?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Repair Refrigerant Compressor

Candidate's name:	
Assessor's name:	
Qualification:	Refrigeration and Air Conditioning
Project-Based Assessment Title	
Units of competency covered:	Repair Refrigerant Compressor (SEIP-LIG-REF-6-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Test live refrigerant compressor and observe operation	☐	☐	☐
2. Remove refrigerant compressor from refrigeration system in accord with workplace/manufacturer's instruction	☐	☐	☐
3. Disassemble refrigerant compressor in accord with manufacturer's instruction/specification	☐	☐	☐
4. Check compressor parts/components and identify faults	☐	☐	☐
5. Repair faulty parts/components or replace where necessary in accord with manufacturer's instruction/specification	☐	☐	☐
6. Assemble refrigerant compressor parts/components in accord with manufacturer's instruction/specification	☐	☐	☐
7. Test refrigerant compressor for normal operation in accord with manufacturer's instruction/specification	☐	☐	☐
8. Maintain tools and equipment and store in accord with workplace requirements	☐	☐	☐
	☐	☐	☐

Observation Checklist: Repair Refrigerant Compressor

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Repair Refrigerant Compressor		
Code:	SEIP-LIG-REF-6-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec-if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Test live refrigerant compressor and observe operation			
2. Remove refrigerant compressor from refrigeration system in accord with workplace/manufacturer's instruction			
3. Disassemble refrigerant compressor in accord with manufacturer's instruction/specification			
4. Check compressor parts/components and identify faults			
5. Repair faulty parts/components or replace where necessary in accord with manufacturer's instruction/specification			
6. Assemble refrigerant compressor parts/components in accord with manufacturer's instruction/specification			
7. Test refrigerant compressor for normal operation in accord with manufacturer's instruction/specification			
8. Maintain tools and equipment and store in accord with workplace requirements			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:		Date:	
Assessor's Signature:		Date:	

Oral Questions Checklist: Repair Refrigerant Compressor

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Repair Refrigerant Compressor
Reference Standard:	**Refrigeration and Air Conditioning**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response	
Indicate Y or N in the box provided	**YES**	**NO**
1. What is a hermetic refrigerant?		
2. What is a testing procedure for a refrigerant compressor?		
3. What is a Vernier caliper used for?		
4. How important are work instruction sheets?		
5. Is abnormal noise a symptom of a problem?		
6. Why is a commitment to health & safety important?		
7. How important is it to keep a record of work done?		
8. What is involved in the preparation for refrigerant compressor repair?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**