TRAINING REGULATIONS

LAND-BASED TRANSPORT MOBILE AIR-CONDITIONING (MAC) SERVICING NC II

HEATING, VENTILATING, AIR-CONDITIONING AND REFRIGERATION TECHNOLOGY SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
East Service Road, South Luzon Expressway (SLEX), Taguig City, Metro Manila

Technical Education and Skills Development Act of 1994
(Republic Act No. 7796)

Section 22, "Establishment and Administration of the National Trade Skills Standards" of the RA 7796 known as the TESDA Act mandates TESDA to establish national occupational skills standards. The Authority shall develop and implement a certification and accreditation program in which private industry group and trade associations are accredited to conduct approved trade tests, and the local government units to promote such trade testing activities in their respective areas in accordance with the guidelines to be set by the Authority.

The Training Regulations (TR) serve as basis for the:

1 Registration and delivery of training programs;
2 Development of curriculum and assessment instruments; and
3 Competency assessment and certification
.

Each TR has four sections:

Section 1 **Definition of Qualification** describes the qualification and defines the competencies that comprise the qualification.

Section 2 **Competency Standards** gives the specifications of competencies required for effective work performance.

Section 3 **Training Arrangements** contains information and requirements in designing training program for certain qualification. It includes curriculum design; training delivery; trainee entry requirements; tools, equipment and materials; training facilities; trainer's qualification; and institutional assessment.

Section 4 **Assessment and Certification Arrangements** describes the policies governing assessment and certification procedures.

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TRAINING REGULATIONS FOR
LAND-BASED TRANSPORT MOBILE AIR-CONDITIONING (MAC)
SERVICING NC II

SECTION 1. LAND-BASED TRANSPORT MOBILE AIR-CONDITIONING (MAC) SERVICING NC II QUALIFICATION

The Land-Based Transport Mobile Air-Conditioning (MAC) Servicing NC II Qualification consists of competencies that a person must achieve to enable him/her to service, maintain, troubleshoot and repair as well as start-up, test and commission land-based transport mobile vehicle air-conditioning systems/units. This qualification covers the mobile air-conditioning units of cars, vans, buses, trucks and trains.

This Qualification is packaged from the competency map of **HVAC/R Sector** as shown in Annex A.

The Units of Competency comprising this Qualification include the following:

CODE NO.	BASIC COMPETENCIES
400311210	Participate in workplace communication
400311211	Work in a team environment
400311212	Solve/address general workplace problems
400311213	Develop career and life decisions
400311214	Contribute to workplace innovation
400311215	Present relevant information
400311216	Practice occupational safety and health policies and procedures
400311217	Exercise efficient and effective sustainable practices in the workplace
400311218	Practice entrepreneurial skills in the workplace

CODE NO.	COMMON COMPETENCIES
HVC713201	Prepare materials and tools
HVC311202	Interpret technical drawing and plans
HVC311201	Observe procedures, specifications and manuals of instructions
HVC311203	Perform mensurations and calculations
HVC713202	Perform basic benchworks
HVC724201	Check basic electrical circuits
HVC311204	Maintain tools, instruments and equipment
HVC315201	Perform housekeeping and safety practices
HVC311205	Document work accomplished

CODE NO.	CORE COMPETENCIES
HVC723348	Service and maintain mobile air-conditioning units
HVC723349	Troubleshoot and repair mobile air-conditioning systems
HVC723350	Perform start-up, test and commissioning for mobile air-conditioning systems

A person who has achieved this Qualification is competent to be:

- Mobile Air-Conditioning (MAC) Technician

SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in Land-Based Transport Mobile Air-Conditioning (MAC) Servicing NC II.

BASIC COMPETENCIES

UNIT OF COMPETENCY : PARTICIPATE IN WORKPLACE COMMUNICATION

UNIT CODE : 400311210

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Obtain and convey workplace information	1.1 Specific and relevant information is accessed from ***appropriate sources*** 1.2 Effective questioning, active listening and speaking skills are used to gather and convey information 1.3 Appropriate ***medium*** is used to transfer information and ideas 1.4 Appropriate non- verbal communication is used 1.5 Appropriate lines of communication with supervisors and colleagues are identified and followed 1.6 Defined workplace procedures for the location and ***storage*** of information are used 1.7 Personal interaction is carried out clearly and concisely	1.1 Effective communication 1.2 Different modes of communication 1.3 Medium of communication in the workplace 1.4 Organizational policies 1.5 Communication procedures and systems 1.6 Lines of communication 1.7 Technology relevant to the enterprise and the individual's work responsibilities 1.8 Workplace etiquette	1.1 Following simple spoken language 1.2 Performing routine workplace duties following simple written notices 1.3 Participating in workplace meetings and discussions 1.4 Preparing work-related documents 1.5 Estimating, calculating and recording routine workplace measures 1.6 Relating/ Interacting with people of various levels in the workplace 1.7 Gathering and providing basic information in response to workplace requirements 1.8 Basic business writing skills 1.9 Interpersonal skills in the workplace 1.10 Active-listening skills
2. Perform duties following workplace instructions	2.1 Written notices and instructions are read and interpreted in accordance with organizational guidelines 2.2 Routine written instruction are followed	2.1 Effective verbal and non-verbal communication 2.2 Different modes of communication 2.3 Medium of communication in the workplace	2.1 Following simple spoken instructions 2.2 Performing routine workplace duties following simple written notices 2.3 Participating in workplace meetings

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	based on established procedures 2.3 Feedback is given to workplace supervisor-based instructions/ information received 2.4 ***Workplace interactions*** are conducted in a courteous manner 2.5 Where necessary, clarifications about routine workplace procedures and matters concerning conditions of employment are sought and asked from appropriate sources 2.6 Meetings outcomes are interpreted and implemented	2.4 Organizational/ Workplace policies 2.5 Communication procedures and systems 2.6 Lines of communication 2.7 Technology relevant to the enterprise and the individual's work responsibilities 2.8 Effective questioning techniques (clarifying and probing) 2.9 Workplace etiquette	and discussions 2.4 Completing work-related documents 2.5 Estimating, calculating and recording routine workplace measures 2.6 Relating/ Responding to people of various levels in the workplace 2.7 Gathering and providing information in response to workplace requirements 2.8 Basic questioning/ querying 2.9 Skills in reading for information 2.10 Skills in locating
3. Complete relevant work-related documents	3.1 Range of ***forms*** relating to conditions of employment are completed accurately and legibly 3.2 Workplace data is recorded on standard workplace forms and documents 3.3 Errors in recording information on forms/ documents are identified and properly acted upon 3.4 Reporting requirements to supervisor are completed according to organizational guidelines	3.1 Effective verbal and non-verbal communication 3.2 Different modes of communication 3.3 Workplace forms and documents 3.4 Organizational/ Workplace policies 3.5 Communication procedures and systems 3.6 Technology relevant to the enterprise and the individual's work responsibilities	3.1 Completing work-related documents 3.2 Applying operations of addition, subtraction, division and multiplication 3.3 Gathering and providing information in response to workplace requirements 3.4 Effective record keeping skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Appropriate sources	May include: 1.1. Team members 1.2. Suppliers 1.3. Trade personnel 1.4. Local government 1.5. Industry bodies
2. Medium	May include: 2.1. Memorandum 2.2. Circular 2.3. Notice 2.4. Information discussion 2.5. Follow-up or verbal instructions 2.6. Face to face communication
3. Storage	May include: 3.1. Manual filing system 3.2. Computer-based filing system
4. Workplace interactions	May include: 4.1. Face to face 4.2. Telephone 4.3. Electronic and two-way radio 4.4. Written including electronic, memos, instruction and forms, 4.5. Non-verbal including gestures, signals, signs and diagrams
5. Forms	May include: 5.1. HR/Personnel forms, telephone message forms, safety reports

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Prepared written communication following standard format of the organization 1.2. Accessed information using workplace communication equipment/systems 1.3. Made use of relevant terms as an aid to transfer information effectively 1.4. Conveyed information effectively adopting the formal or informal communication
2. Resource Implications	The following resources should be provided: 2.1. Fax machine 2.2. Telephone 2.3. Notebook / Writing materials 2.4. Computer with internet connection
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1. Demonstration with oral questioning 3.2. Interview 3.3. Written test 3.4. Third-party report
4. Context for Assessment	4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center.

UNIT OF COMPETENCY: WORK IN TEAM ENVIRONMENT

UNIT CODE : 400311211

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes to identify one's roles and responsibilities as a member of a team.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Describe team role and scope	1.1. The ***role and objective of the team*** is identified from available ***sources of information*** 1.2. Team parameters, reporting relationships and ***responsibilities*** are identified from team discussions and appropriate external sources	1.1 Group structure 1.2 Group development 1.3 Sources of information	1.1 Communicating with others, appropriately consistent with the culture of the workplace 1.2 Developing ways in improving work structure and performing respective roles in the group or organization
2. Identify one's role and responsibility within team	2.1. Individual role and responsibilities within the team environment are identified 2.2. Roles and objectives of the team is identified from available ***source of information*** 2.3. Team parameters, reporting relationships and responsibilities are identified based on team discussions and appropriate external sources	2.1. Team roles and objectives 2.2. Team structure and parameters 2.3. Team development 2.4. Sources of information	2.1. Communicating with others, appropriately consistent with the culture of the workplace 2.2. Developing ways in improving work structure and performing respective roles in the group or organization
3. Work as a team member	3.1. Effective and appropriate forms of communications are used and interactions undertaken with team members based on company practices 3.2. Effective and appropriate contributions is made to complement team activities and objectives based on ***workplace context*** 3.3. Protocols in reporting are observed based on standard company practices 3.4. Contribute to the development of team work plans based on an understanding of team's role and objectives	3.1. Communication process 3.2. Workplace communication protocol 3.3. Team planning and decision making 3.4. Team thinking 3.5. Team roles 3.6. Process of team development 3.7. Workplace context	3.1. Communicating with others, appropriately consistent with the culture of the workplace 3.2. Interacting effectively with others 3.3. Deciding as an individual and as a group using group think strategies and techniques 3.4. Contributing to Resolution of issues and concerns

RANGE OF VARIABLES

VARIABLE	RANGE
1. Role and objective of team	May include but not limited to: 1.1. Work activities in a team environment with enterprise or specific sector 1.2. Limited discretion, initiative and judgement maybe demonstrated on the job, either individually or in a team environment
2. Sources of information	May include but not limited to: 2.1. Standard operating and/or other workplace procedures 2.2. Job procedures 2.3. Machine/equipment manufacturer's specifications and instructions 2.4. Organizational or external personnel 2.5. Client/supplier instructions 2.6. Quality standards 2.7. OHS and environmental standards
3. Workplace context	May include but not limited to: 3.1. Work procedures and practices 3.2. Conditions of work environments 3.3. Legislation and industrial agreements 3.4. Standard work practice including the storage, safe handling and disposal of chemicals 3.5. Safety, environmental, housekeeping and quality guidelines

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Worked in a team to complete workplace activity 1.2. Worked effectively with others 1.3. Conveyed information in written or oral form 1.4. Selected and used appropriate workplace language 1.5. Followed designated work plan for the job
2. Resource Implications	The following resources should be provided: 2.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2. Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1. Role play involving the participation of individual member to the attainment of organizational goal 3.2. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork 3.3. Socio-drama and socio-metric methods 3.4. Sensitivity techniques 3.5. Written Test
4. Context for Assessment	4.1. Competency may be assessed in workplace or in a simulated workplace setting 4.2. Assessment shall be observed while task are being undertaken whether individually or in group

UNIT OF COMPETENCY: SOLVE/ADDRESS GENERAL WORKPLACE PROBLEMS

UNIT CODE : 400311212

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to apply problem-solving techniques to determine the origin of problems and plan for their resolution. It also includes addressing procedural problems through documentation, and referral.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify routine problems	1.1 Routine ***problems or procedural problem*** areas are identified 1.2 Problems to be investigated are defined and determined 1.3 Current conditions of the problem are identified and documented	1.1 Current industry hardware and software products and services 1.2 Industry maintenance, service and helpdesk practices, processes and procedures 1.3 Industry standard diagnostic tools 1.4 Malfunctions and resolutions	1.1 Identifying current industry hardware and software products and services 1.2 Identifying current industry maintenance, services and helpdesk practices, processes and procedures. 1.3 Identifying current industry standard diagnostic tools 1.4 Describing common malfunctions and resolutions. 1.5 Determining the root cause of a routine malfunction
2. Look for solutions to routine problems	2.1 Potential solutions to problem are identified 2.2 Recommendations about possible solutions are developed, ***documented***, ranked and presented to ***appropriate person*** for decision	2.1 Current industry hardware and software products and services 2.2 Industry service and helpdesk practices, processes and procedures 2.3 Operating systems 2.4 Industry standard diagnostic tools 2.5 Malfunctions and resolutions. 2.6 Root cause analysis	2.1 Identifying current industry hardware and software products and services 2.2 Identifying services and helpdesk practices, processes and procedures. 2.3 Identifying operating system 2.4 Identifying current industry standard diagnostic tools 2.5 Describing common malfunctions and resolutions. 2.6 Determining the root cause of a routine malfunction
3. Recommend solutions to problems	3.1 Implementation of solutions are ***planned*** 3.2 Evaluation of implemented solutions are planned 3.3 Recommended solutions are documented and submit to appropriate person for confirmation	3.1 Standard procedures 3.2 Documentation produce	3.1 Producing documentation that recommends solutions to problems 3.2 Following established procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Problems/Procedural Problem	May include but not limited to: 1.1 Routine/non – routine processes and quality problems 1.2 Equipment selection, availability and failure 1.3 Teamwork and work allocation problem 1.4 Safety and emergency situations and incidents 1.5 Work-related problems outside of own work area
2. Appropriate person	May include but not limited to: 2.1 Supervisor or manager 2.2 Peers/work colleagues 2.3 Other members of the organization
3. Document	May include but not limited to: 3.1 Electronic mail 3.2 Briefing notes 3.3 Written report 3.4 Evaluation report
4. Plan	May include but not limited to: 4.1 Priority requirements 4.2 Co-ordination and feedback requirements 4.3 Safety requirements 4.4 Risk assessment 4.5 Environmental requirements

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Determined the root cause of a routine problem 1.2 Identified solutions to procedural problems. 1.3 Produced documentation that recommends solutions to problems. 1.4 Followed established procedures. 1.5 Referred unresolved problems to support persons.
2. Resource Implications	2.1 Assessment will require access to a workplace over an extended period, or a suitable method of gathering evidence of operating ability over a range of situations.
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Case Formulation 3.2 Life Narrative Inquiry 3.3 Standardized test The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components.
4. Context for Assessment	4.1 Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY : DEVELOP CAREER AND LIFE DECISIONS

UNIT CODE : 400311213

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes in managing one's emotions, developing reflective practice, and boosting self-confidence and developing self-regulation.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Manage one's emotion	1.1. ***Self-management strategies*** are identified 1.2. Skills to work independently and to show initiative, to be conscientious, and persevering in the face of setbacks and frustrations are developed 1.3. Techniques for effectively handling negative emotions and ***unpleasant situation*** in the workplace are examined	1.1. Self-management strategies that assist in regulating behavior and achieving personal and learning goals (e.g. Nine self-management strategies according to Robert Kelley) 1.2. Enablers and barriers in achieving personal and career goals 1.3. Techniques in handling negative emotions and unpleasant situation in the workplace such as frustration, anger, worry, anxiety, etc.	1.1. Managing properly, one's emotions and recognizing situations that cannot be changed and accept them and remain professional 1.2. Developing self-discipline, working independently and showing initiative to achieve personal and career goals 1.3. 1Showing confidence, and resilience in the face of setbacks and frustrations and other negative emotions and unpleasant situations in the workplace
2. Develop reflective practice	2.1. Personal strengths and achievements, based on self-assessment strategies and teacher feedback are contemplated 2.2. Progress when seeking and responding to feedback from teachers to assist them in consolidating strengths, addressing weaknesses and fulfilling their potential are monitored 2.3. Outcomes of personal and academic challenges by reflecting on previous problem solving and decision-making strategies and feedback from peers and teachers are predicted	2.1. Basic SWOT analysis 2.2. Strategies to improve one's attitude in the workplace 2.3. Gibbs' Reflective Cycle/Model (Description, Feelings, Evaluation, Analysis, Conclusion, and Action plan)	2.1. Using the basic SWOT analysis as self-assessment strategy 2.2. Developing reflective practice through realization of limitations, likes/ dislikes; through showing of self-confidence 2.3. Demonstrating self-acceptance and being able to accept challenges

3. Boost self-confidence and develop self-regulation	3.1. Efforts for continuous self-improvement are demonstrated 3.2. Counter-productive tendencies at work are eliminated 3.3. Positive outlook in life are maintained.	3.1. Four components of self-regulation based on Self-Regulation Theory (SRT) 3.2. Personality development concepts 3.3. Self-help concepts (e. g., 7 Habits by Stephen Covey, transactional analysis, psycho-spiritual concepts)	3.1. Performing effective communication skills – reading, writing, conversing skills 3.2. Showing affective skills – flexibility, adaptability, etc. 3.3. Self-assessment for determining one's strengths and weaknesses

RANGE OF VARIABLES

VARIABLE	RANGE
1. Self-management strategies	May include but not limited to: 1.1 Seeking assistance in the form of job coaching or mentoring 1.2 Continuing dialogue to tackle workplace grievances 1.3 Collective negotiation/bargaining for better working conditions 1.4 Share your goals to improve with a trusted co-worker or supervisor 1.5 Make a negativity log of every instance when you catch yourself complaining to others 1.6 Make lists and schedules for necessary activities
2. Unpleasant situation	May include but not limited to: 2.1 Job burn-out 2.2 Drug dependence 2.3 Sulking

EVIDENCE GUIDE

1 Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Express emotions appropriately 1.2 Work independently and show initiative 1.3 Consistently demonstrate self-confidence and self-discipline
2 Resource Implications	The following resources should be provided: 2.1 Access to workplace and resource s 2.2 Case studies
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Demonstration or simulation with oral questioning 3.2 Case problems involving work improvement and sustainability issues 3.3 Third-party report
4 Context for Assessment	4.1 Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions

UNIT OF COMPETENCY : CONTRIBUTE TO WORKPLACE INNOVATION

UNIT CODE : 400311214

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to make a pro-active and positive contribution to workplace innovation.

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify opportunities to do things better.	1.1 ***Opportunities for improvement*** are identified proactively in own area of work. 1.2 ***Information*** are gathered and reviewed which may be relevant to ideas and which might assist in gaining support for idea.	1.1 Roles of individuals in suggesting and making improvements. 1.2 Positive impacts and challenges in innovation. 1.3 Types of changes and responsibility. 1.4 Seven habits of highly effective people.	1.1 Identifying opportunities to improve and to do things better. Involvement. 1.2 Identifying the positive impacts and the challenges of change and innovation. 1.3 Identifying examples of the types of changes that are within and outside own scope of responsibility
2. Discuss and develop ideas with others	2.1 ***People who could provide input*** to ideas for improvements are identified. 2.2 Ways of approaching people to begin sharing ideas are selected. 2.3 Meeting is set with relevant people. 2.4 Ideas for follow up are review and selected based on feedback. 2.5 ***Critical inquiry method*** is used to discuss and develop ideas with others.	2.1 Roles of individuals in suggesting and making improvements. 2.2 Positive impacts and challenges in innovation. 2.3 Types of changes and responsibility. 2.4 Seven habits of highly effective people.	2.1 Identifying opportunities to improve and to do things better. Involvement. 2.2 Identifying the positive impacts and the challenges of change and innovation. 2.3 Providing examples of the types of changes that are within and outside own scope of responsibility 2.4 Communicating ideas for change through small group discussions and meetings.
3. Integrate ideas for change in the workplace.	3.1 Critical inquiry method is used to integrate different ideas for change of key people. 3.2 Summarizing, analyzing and generalizing skills are used to extract salient points in the pool of ideas. 3.3 ***Reporting skills*** are likewise used to communicate results. 3.4 ***Current Issues and concerns*** on the systems, processes and procedures, as well as the need for simple innovative practices are identified.	3.1 Roles of individuals in suggesting and making improvements. 3.2 Positive impacts and challenges in innovation. 3.3 Types of changes and responsibility. 3.4 Seven habits of highly effective people. 3.5 Basic research skills.	3.1 Identifying opportunities to improve and to do things better. Involvement. 3.2 Identifying the positive impacts and the challenges of change and innovation. 3.3 Providing examples of the types of changes that are within and outside own scope of responsibility. 3.4 Communicating ideas for change through small group discussions and meetings. 3.5 Demonstrating skills in analysis and interpretation of data.

RANGE OF VARIABLES

VARIABLES	RANGE	
1. Opportunities for improvement	May include: 1.1 Systems. 1.2 Processes. 1.3 Procedures.	 1.4 Protocols. 1.5 Codes. 1.6 Practices.
2. Information	May include: 2.1 Workplace communication problems. 2.2 Performance evaluation results. 2.3 Team dynamics issues and concerns. 2.4 Challenges on return of investment 2.5 New tools, processes and procedures. 2.6 New people in the organization.	
3. People who could provide input	May include: 3.1 Leaders 3.2 Managers 3.3 Specialists 3.4 Associates 3.5 Researchers 3.6 Supervisors	3.7 Staff 3.8 Consultants (external) 3.9 People outside the organization in the same field or similar expertise/industry. 3.10 Clients
4. Critical inquiry method	May include: 4.1 Preparation. 4.2 Discussion. 4.3 Clarification of goals. 4.4 Negotiate towards a Win-Win outcome. 4.5 Agreement. 4.6 Implementation of a course of action. 4.7 Effective verbal communication. See pages: Verbal Communication and Effective Speaking. 4.8 Listening. 4.9 Reducing misunderstandings is a key part of effective negotiation. 4.10 Rapport Building. 4.11 Problem Solving. 4.12 Decision Making. 4.13 Assertiveness. 4.14 Dealing with Difficult Situations.	
5. Reporting skills	May include: 5.1 Data management. 5.2 Coding. 5.3 Data analysis and interpretation. 5.4 Coherent writing. 5.5 Speaking.	

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified opportunities to do things better. 1.2 Discussed and developed ideas with others on how to contribute to workplace innovation. 1.3 Integrated ideas for change in the workplace. 1.4 Analyzed and reported rooms for innovation and learning in the workplace.
2. Resource Implications	The following resources should be provided: 2.1 Pens, papers and writing implements. 2.2 Cartolina. 2.3 Manila papers.
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Psychological and behavioral Interviews. 3.2 Performance Evaluation. 3.3 Life Narrative Inquiry. 3.4 Review of portfolios of evidence and third-party workplace reports of on-the-job performance. 3.5 Sensitivity analysis. 3.6 Organizational analysis. 3.7 Standardized assessment of character strengths and virtues applied.
4. Context for Assessment	4.1 Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY : PRESENT RELEVANT INFORMATION

UNIT CODE : 400311215

UNIT DESCRIPTOR : This unit of covers the knowledge, skills and attitudes required to present data/information appropriately.

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Gather data/ information	1.1 Evidence, facts and information are collected 1.2 Evaluation, terms of reference and conditions are reviewed to determine whether data/information falls within project scope	1.1 Organisational protocols 1.2 Confidentiality 1.3 Accuracy 1.4 Business mathematics and statistics 1.5 Data analysis techniques/procedures 1.6 Reporting requirements to a range of audiences 1.7 Legislation, policy and procedures relating to the conduct of evaluations 1.8 Organisational values, ethics and codes of conduct	1.1 Describing organisational protocols relating to client liaison 1.2 Protecting confidentiality 1.3 Describing accuracy 1.4 Computing business mathematics and statistics 1.5 Describing data analysis techniques/ procedures 1.6 Reporting requirements to a range of audiences 1.7 Stating legislation, policy and procedures relating to the conduct of evaluations 1.8 Stating organisational values, ethics and codes of conduct
2. Assess gathered data/ information	2.1 Validity of data/ information is assessed 2.2 Analysis techniques are applied to assess data/ information. 2.3 Trends and anomalies are identified 2.4 ***Data analysis techniques*** and procedures are documented 2.5 Recommendations are made on areas of possible improvement.	2.1 Business mathematics and statistics 2.2 Data analysis techniques/ procedures 2.3 Reporting requirements to a range of audiences 2.4 Legislation, policy and procedures relating to the conduct of evaluations 2.5 Organisational values, ethics and codes of conduct	2.1 Computing business mathematics and statistics 2.2 Describing data analysis techniques/ procedures 2.3 Reporting requirements to a range of audiences 2.4 Stating legislation, policy and procedures relating to the conduct of evaluations 2.5 Stating organisational values, ethics and codes of conduct

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Record and present information	3.1 Studied data/information are recorded. 3.2 Recommendations are analysed for action to ensure they are compatible with the project's scope and terms of reference. 3.3 Interim and final reports are analysed and outcomes are compared to the criteria established at the outset. 3.4 Findings are presented to stakeholders.	3.1 Data analysis techniques/ procedures 3.2 Reporting requirements to a range of audiences 3.3 Legislation, policy and procedures relating to the conduct of evaluations 3.4 Organisational values, ethics and codes of conduct	3.1 Describing data analysis techniques/ procedures 3.2 Reporting requirements to a range of audiences 3.3 Stating legislation, policy and procedures relating to the conduct of evaluations 3.4 Stating organisational values, ethics and codes of conduct practices

RANGE OF VARIABLES

VARIABLES	RANGE
1. Data analysis techniques	May include but not limited to: 1.1. Domain analysis 1.2. Content analysis 1.3. Comparison technique

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Determine data / information 1.2 Studied and applied gathered data/information 1.3 Recorded and studied data/information These aspects may be best assessed using a range of scenarios what ifs as a stimulus with a walk-through forming part of the response. These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.
2. Resource Implications	**Specific resources for assessment** 2.1. Evidence of competent performance should be obtained by observing an individual in an information management role within the workplace or operational or simulated environment.
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1. Written Test 3.2. Interview 3.3. Portfolio The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components.
4. Context for Assessment	4.1. In all workplace, it may be appropriate to assess this unit concurrently with relevant teamwork or operation units.

UNIT OF COMPETENCY : PRACTICE OCCUPATIONAL SAFETY AND HEALTH POLICIES AND PROCEDURES

UNIT CODE : 400311216

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to identify OSH compliance requirements, prepare OSH requirements for compliance, and perform tasks in accordance with relevant OSH policies and procedures

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify OSH compliance requirements	1.1 Relevant ***OSH requirements, regulations, policies and procedures*** are identified in accordance with workplace policies and procedures 1.2 OSH activity non-conformities are conveyed to ***appropriate personnel*** 1.3 ***OSH preventive and control requirements*** are identified in accordance with OSH work policies and procedures	1.1. OSH preventive and control requirements 1.2. Hierarchy of Controls 1.3. Hazard Prevention and Control 1.4. General OSH principles 1.5. Work standards and procedures 1.6. Safe handling procedures of tools, equipment and materials 1.7. Standard emergency plan and procedures in the workplace	1.1. Communication skills 1.2. Interpersonal skills 1.3. Critical thinking skills 1.4. Observation skills
2. Prepare OSH requirements for compliance	2.1 OSH work activity material, tools and equipment requirements are identified in accordance with workplace policies and procedures 2.2. Required OSH materials, tools and equipment are acquired in accordance with workplace policies and procedures 2.3. Required OSH materials, tools and equipment are arranged/ placed in accordance with OSH work standards	2.1. Resources necessary to execute hierarchy of controls 2.2. General OSH principles 2.3. Work standards and procedures 2.4. Safe handling procedures of tools, equipment and materials 2.5. Different OSH control measures	2.1. Communication skills 2.2. Estimation skills 2.3. Interpersonal skills 2.4. Critical thinking skills 2.5. Observation skills 2.6. Material, tool and equipment identification skills
3. Perform tasks in accordance with relevant OSH policies and procedures	3.1 Relevant OSH work procedures are identified in accordance with workplace policies and procedures 3.2 Work Activities are executed in accordance with OSH work standards 3.3 ***Non-compliance work activities*** are reported to appropriate personnel	3.1. OSH work standards 3.2. Industry related work activities 3.3. General OSH principles 3.4. OSH Violations Non-compliance work activities	3.1 Communication skills 3.3 Interpersonal skills 3.4 Troubleshooting skills 3.5 Critical thinking skills 3.6 Observation skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. OSH Requirements, Regulations, Policies and Procedures	May include: 1.1 Clean Air Act 1.2 Building code 1.3 National Electrical and Fire Safety Codes 1.4 Waste management statutes and rules 1.5 Permit to Operate 1.6 Philippine Occupational Safety and Health Standards 1.7 Department Order No. 13 (Construction Safety and Health) 1.8 ECC regulations
2. Appropriate Personnel	May include: 2.1 Manager 2.2 Safety Officer 2.3 EHS Offices 2.4 Supervisors 2.5 Team Leaders 2.6 Administrators 2.7 Stakeholders 2.8 Government Official 2.9 Key Personnel 2.10 Specialists 2.11 Himself
3. OSH Preventive and Control Requirements	May include: 3.1 Resources needed for removing hazard effectively 3.2 Resources needed for substitution or replacement 3.3 Resources needed to establishing engineering controls 3.4 Resources needed for enforcing administrative controls 3.5 Personal Protective equipment
4. Non OSH-Compliance Work Activities	May include non-compliance or observance of the following safety measures: 4.1 Violations that may lead to serious physical harm or death 4.2 Fall Protection 4.3 Hazard Communication 4.4 Respiratory Protection 4.5 Power Industrial Trucks 4.6 Lockout/Tag-out 4.7 Working at heights (use of ladder, scaffolding) 4.8 Electrical Wiring Methods 4.9 Machine Guarding 4.10 Electrical General Requirements 4.11 Asbestos work requirements 4.12 Excavations work requirements

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Convey OSH work non-conformities to appropriate personnel 1.2. Identify OSH preventive and control requirements in accordance with OSH work policies and procedures 1.3. Identify OSH work activity material, tools and equipment requirements in accordance with workplace policies and procedures 1.4. Arrange/Place required OSH materials, tools and equipment in accordance with OSH work standards 1.5. Execute work activities in accordance with OSH work standards 1.6. Report OSH activity non-compliance work activities to appropriate personnel
2. Resource Implications	The following resources should be provided: 2.1 Facilities, materials tools and equipment necessary for the activity
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation/Demonstration with oral questioning 3.2 Third party report
4. Context for Assessment	4.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY : **EXERCISE EFFICIENT AND EFFECTIVE SUSTAINABLE PRACTICES IN THE WORKPLACE**

UNIT CODE : **400311217**

UNIT DESCRIPTOR : This unit covers knowledge, skills and attitude to identify the efficiency and effectiveness of resource utilization, determine causes of inefficiency and/or ineffectiveness of resource utilization and convey inefficient and ineffective environmental practices

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify the efficiency and effectiveness of resource utilization	1.1. Required resource utilization in the workplace is measured using appropriate techniques 1.2. Data are recorded in accordance with workplace protocol 1.3. Recorded data are compared to determine the efficiency and effectiveness of resource utilization according to established ***environmental work procedures***	1.1. Importance of Environmental Literacy 1.2. Environmental Work Procedures 1.3. Waste Minimization 1.4. Efficient Energy Consumptions	1.1 Recording Skills 1.2 Writing Skills 1.3 Innovation Skills
2. Determine causes of inefficiency and/or ineffectiveness of resource utilization	2.1. Potential causes of inefficiency and/or ineffectiveness are listed 2.2. Causes of inefficiency and/or ineffectiveness are identified through deductive reasoning 2.3. Identified causes of inefficiency and/or ineffectiveness are validated thru established environmental procedures	2.1. Causes of environmental inefficiencies and ineffectiveness	2.1. Deductive Reasoning Skills 2.2. Critical thinking 2.3. Problem Solving 2.4. Observation Skills
3. Convey inefficient and ineffective environmental practices	3.1. Efficiency and effectiveness of resource utilization are reported to ***appropriate personnel*** 3.2. Concerns related resource utilization are discussed with appropriate personnel 3.3. Feedback on information/ concerns raised are clarified with appropriate personnel	3.1. Appropriate Personnel to address the environmental hazards 3.2. Environmental corrective actions	3.1. Written and Oral Communication Skills 3.2. Critical thinking 3.3. Problem Solving 3.4. Observation Skills 3.5. Practice Environmental Awareness

RANGE OF VARIABLES

VARIABLE	RANGE	
1. Environmental Work Procedures	May include: 1.1. Utilization of Energy, Water, Fuel Procedures 1.2. Waster Segregation Procedures 1.3. Waste Disposal and Reuse Procedures 1.4. Waste Collection Procedures 1.5. Usage of Hazardous Materials Procedures 1.6. Chemical Application Procedures 1.7. Labeling Procedures	
2. Appropriate Personnel	May include: 2.1. Manager 2.2. Safety Officer 2.3. EHS Offices 2.4. Supervisors 2.5. Team Leaders	2.6. Administrators 2.7. Stakeholders 2.8. Government Official 2.9. Key Personnel 2.10. Specialists 2.11. Himself

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Measured required resource utilization in the workplace using appropriate techniques 1.2. Recorded data in accordance with workplace protocol 1.3. Identified causes of inefficiency and/or ineffectiveness through deductive reasoning 1.4. Validate the identified causes of inefficiency and/or ineffectiveness thru established environmental procedures 1.5. Report efficiency and effectives of resource utilization to appropriate personnel 1.6. Clarify feedback on information/concerns raised with appropriate personnel
2. Resource Implications	The following resources should be provided: 2.1 Workplace 2.2 Tools, materials and equipment relevant to the tasks 2.3 PPE 2.4 Manuals and references
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Demonstration 3.2 Oral questioning 3.3 Written examination
4. Context for Assessment	4.1 Competency assessment may occur in workplace or any appropriately simulated environment 4.2 Assessment shall be observed while task are being undertaken whether individually or in-group

UNIT OF COMPETENCY : PRACTICE ENTREPRENEURIAL SKILLS IN THE WORKPLACE

UNIT CODE : 400311218

UNIT DESCRIPTOR : This unit covers the outcomes required to apply entrepreneurial workplace best practices and implement cost-effective operations

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Apply entrepreneurial workplace best practices	1.1. ***Good practices*** relating to workplace operations are observed and selected following workplace policy. 1.2. Quality procedures and practices are complied with according to workplace requirements. 1.3. Cost-conscious habits in ***resource utilization*** are applied based on industry standards.	1.1. Workplace best practices, policies and criteria 1.2. Resource utilization 1.3. Ways in fostering entrepreneurial attitudes: 1.3.1. Patience 1.3.2. Honesty 1.3.3. Quality-consciousness 1.3.4. Safety-consciousness 1.3.5. Resourcefulness	1.1. Communication skills 1.2. Complying with quality procedures
2. Communicate entrepreneurial workplace best practices	2.1. Observed good practices relating to workplace operations are communicated to ***appropriate person***. 2.2. Observed quality procedures and practices are communicated to appropriate person 2.3. Cost-conscious habits in resource utilization are communicated based on industry standards.	2.1. Workplace best practices, policies and criteria 2.2. Resource utilization 2.3. Ways in fostering entrepreneurial attitudes: 2.3.1. Patience 2.3.2. Honesty 2.3.3. Quality-consciousness 2.3.4. Safety-consciousness 2.3.5. Resourcefulness	2.1. Communication skills 2.2. Complying with quality procedures 2.3. Following workplace communication protocol
3. Implement cost-effective operations	3.1. Preservation and optimization of workplace resources is implemented in accordance with enterprise policy 3.2. Judicious use of workplace tools, equipment and materials are observed according to manual and work requirements. 3.3. Constructive contributions to office operations are made according to enterprise requirements. 3.4. Ability to work within one's allotted time and finances is sustained.	3.1. Optimization of workplace resources 3.2. 5S procedures and concepts 3.3. Criteria for cost-effectiveness 3.4. Workplace productivity 3.5. Impact of entrepreneurial mindset to workplace productivity 3.6. Ways in fostering entrepreneurial attitudes: 3.6.1. Quality-consciousness 3.6.2. Safety-consciousness	3.1. Implementing preservation and optimizing workplace resources 3.2. Observing judicious use of workplace tools, equipment and materials 3.3. Making constructive contributions to office operations 3.4. Sustaining ability to work within allotted time and finances

RANGE OF VARIABLES

VARIABLE	RANGE
1. Good practices	May include: 1.1 Economy in use of resources 1.2 Documentation of quality practices
2. Resources utilization	May include: 2.1 Consumption/ use of consumables 2.2 Use/Maintenance of assigned equipment and furniture 2.3 Optimum use of allotted /available time

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1. Demonstrated ability to identify and sustain cost-effective activities in the workplace 1.2. Demonstrated ability to practice entrepreneurial knowledge, skills and attitudes in the workplace.
2. Resource Implications	The following resources should be provided: 2.1. Simulated or actual workplace 2.2. Tools, materials and supplies needed to demonstrate the required tasks 2.3. References and manuals 2.3.1 Enterprise procedures manuals 2.3.2 Company quality policy
3. Methods of Assessment	Competency in this unit should be assessed through: 3.1. Interview 3.2. Third-party report
4. Context of Assessment	4.1. Competency may be assessed in workplace or in a simulated workplace setting 4.2. Assessment shall be observed while tasks are being undertaken whether individually or in-group

COMMON COMPETENCIES

UNIT OF COMPETENCY: PREPARE MATERIALS AND TOOLS

UNIT CODE : HVC713201

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in identifying, requesting and receiving construction materials and tools based on the required performance standards.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify materials	1.1. ***Materials*** are listed as per job requirements 1.2. Quantity and ***description of materials*** conformed to the job requirements 1.3. Tools and accessories are identified according to job requirements	1.1. Types and uses of HVAC/R materials and tools 1.2. Different forms for preparation of materials, tools and accessories 1.3. Requisition procedures	1.1. Preparing materials and tools 1.2. Proper handling of tools and equipment 1.3. Following Instructions
2. Request materials and tools	2.1. Materials and tools needed are requested according to the list prepared 2.2. Request is done as per company standard operating procedures 2.3. Substitute materials and tools are provided without sacrificing cost and quality of the work	2.1. Standard procedures in requisition of materials and tools 2.2. Listing of different HVAC/R materials and tools 2.3. Probable substitute materials	2.1. Preparing requisition slip 2.2. Communication skills 2.3. Identifying HVAC/R materials and tools
3. Receive and inspect materials and tools	3.1. Materials and tools issued are inspected as per quantity and specification 3.2. Tools, accessories and materials checked for damages according to enterprise procedures 3.3. Materials and tools are set aside to appropriate location nearest to the workplace	3.1. Safety requirements in inspection of materials and tools 3.2. Standard procedures in checking materials and tools 3.3. 5S principles	3.1. Applying safety procedures in the workplace 3.2. Preparing materials and tools 3.3. Proper handling of tools and equipment 3.4. Following Instructions

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials and tools	1.1 Air-conditioning 1.2 Refrigeration
2. Description of materials and tools	2.1 Brand name 2.2 Size 2.3 Capacity 2.4 Kind of application
3. Company standard procedures	3.1 Job Order 3.2 Requisition Slip 3.3 Borrower Slip

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Listed materials and tools according to quantity and job requirements 1.2 Requested materials and tools according to the list prepared and as per company standard operating procedures 1.3 Inspected issued materials and tools as per quantity and job specifications 1.4 Tools provided with appropriate safety devices
2. Resource Implications	The following resources should be provided: 2.1 Workplace location 2.2 Materials relevant to the unit of competency 2.3 Technical plans, drawings and specifications relevant to the activities
3. Methods of Assessment	Competency in this unit must be assessed through: 3.1 Direct observation and oral questioning
4. Context for Assessment	4.1 Competency may be assessed in the workplace or in a simulated workplace 4.2 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

UNIT OF COMPETENCY: INTERPRET TECHNICAL DRAWINGS AND PLANS

UNIT CODE : HVC311202

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in analyzing and interpreting symbols, data and work plan based on the required performance standards.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Analyze signs, symbols and data	1.1 ***Technical plans*** are obtained according to job requirements 1.2 Signs, symbols and data are identified according to job specifications 1.3 Signs symbols and data are determined according to ***classification*** or as appropriate in ***drawing***	1.1 Trade Mathematics 1.1.1 Linear measurement 1.1.2 Dimension 1.1.3 Unit conversion 1.2 Blueprint Reading and Plan Specification 1.2.1 Electrical, mechanical plan, symbols and abbreviations 1.2.2 Drawing standard symbols 1.3 Basic Technical Drawing 1.4 Types Technical Plans 1.5 Various Types of Drawings 1.6 Notes and Specifications	1.1 Interpreting drawing/ orthographic drawing 1.2 Interpreting technical plans 1.3 Matching specification details with existing resources 1.4 Following instructions 1.5 Handling of drawing instruments
2. Interpret technical drawings and plans	2.1 Necessary ***tools, materials*** and equipment are identified according to the ***plan*** 2.2 Supplies and materials are listed according to specifications 2.3 Components, assemblies or objects are recognized as required 2.4 Dimensions are identified as appropriate to the plan 2.5 Specification details are matched with existing/available resources in line with job requirements 2.6 Work plan is drawn following the specifications	2.1 Trade Mathematics 2.1.1 Linear measurement 2.1.2 Dimension 2.1.3 Unit conversion 2.2 Blueprint Reading and Plan Specification 2.2.1 Electrical, mechanical plan, symbols and abbreviations 2.2.2 Drawing standard symbols 2.3 Basic Technical Drawing 2.4 Types Technical Plans 2.5 Various Types of Drawings 2.6 Notes and Specifications	2.1 Interpreting drawing/ orthographic drawing 2.2 Interpreting technical plans 2.3 Matching specification details with existing resources 2.4 Following instructions 2.5 Handling of drawing instruments
3. Apply freehand sketching	3.1 Where applicable, correct freehand sketching is produced in accordance with the job requirements	3.1 Trade Mathematics 3.1.1 Linear measurement 3.1.2 Dimension 3.1.3 Unit conversion 3.2 Blueprint Reading and Plan Specification	3.1 Interpreting drawing/ orthographic drawing 3.2 Interpreting technical plans

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		3.2.1 Electrical, mechanical plan, symbols and abbreviations 3.2.2 Drawing standard symbols 3.3 Basic Technical Drawing 3.4 Types Technical Plans 3.5 Various Types of Drawings 3.6 Notes and Specifications	3.3 Matching specification details with existing resources 3.4 Following instructions 3.5 Handling of drawing instruments

RANGE OF VARIABLES

VARIABLE	RANGE
1. Technical plans	Including but not limited to: 1.1. Electrical Plans 1.2. Architectural Plans 1.3. Welding Procedures Specifications (WPS)
2. Classification	Including but not limited to: 2.1. Electrical 2.2. Mechanical
3. Drawing	Including but not limited to: 3.1. Drawing symbols 3.2. Alphabet of lines 3.3. Orthographic views - Front view - Right side view/left side view - Top view - Pictorial 3.4. Schematic diagram 3.5. Electrical drawings 3.6. Structural drawings 3.7. Welding symbols
4. Tools and materials	Including but not limited to: 4.1. Compass 4.2. Divider 4.3. Rulers 4.4. Triangles 4.5. Drawing tables 4.6. Computer
5. Work plan	Including but not limited to: 5.1. Job requirements 5.2. Installation instructions 5.3. Components instruction

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires that the candidate: 1.1 Identified and determined signs, symbols and data according to work plan, job requirements and classifications 1.2 Identified tools and equipment in accordance with job requirements 1.3 Listed supplies and materials according to blueprint specifications 1.4 Drawn work plan following specifications 1.5 Demonstrated ability to determine job specifications based on working/technical drawing
2. Resource implications	The following resources should be provided: 2.1 Workplace 2.2 Drawings and specification relevant to task 2.3 Materials and instrument relevant to proposed activity
3. Methods of assessment	Competency should be assessed through: 3.1 Direct Observation 3.2 Questions/Interview 3.3 Written test related to required knowledge
4. Context of assessment	4.1 Competency assessment may occur in workplace or any appropriate simulated environment 4.2 Assessment shall be observed while task are being undertaken whether individually or in group 4.3 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

UNIT OF COMPETENCY: OBSERVE PROCEDURES, SPECIFICATIONS AND MANUALS OF INSTRUCTION

UNIT CODE : HVC311201

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in identifying, interpreting, applying services to specifications and manuals, and storing manuals.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify and access specification/ manuals	1.1 Appropriate manuals are identified and accessed as per job requirements 1.2 Version and date of manual is checked to ensure correct specification and procedure are identified	1.1 Types of manuals used in HVAC/R sector 1.2 Identification of symbols used in the manuals	1.1 Reading and comprehension skills required to identify and interpret construction manuals and specifications 1.2 Identifying manuals and specifications 1.3 Accessing information and data
2. Interpret manuals	2.1 Relevant sections, chapters of specifications/ manuals are located in relations to the work to be conducted 2.2 Information and procedure in the manual are interpreted in accordance to industry practices	2.1 Types of manuals used in HVAC/R sector 2.2 Types of symbols used in the manuals 2.3 System of measurements 2.4 Unit conversion	2.1 Interpreting symbols and specifications 2.2 Accessing information and data 2.3 Applying conversion of units of measurements
3. Apply information in manual	3.1 ***Manual*** is interpreted according to job requirements 3.2 Work steps are correctly identified in accordance with manufacturer's specification 3.3 Manual data is applied according to the given task 3.4 All correct sequencing and adjustments are interpreted in accordance with information contained on the manual or specifications	3.1 Types of manuals used in HVAC/R sector 3.2 Types and application of symbols in manuals 3.3 Unit conversion	3.1 Applying information from manuals
4. Store manuals	4.1 Manual or specification are stored appropriately to ensure prevention of damage, ready access and updating of information when required in accordance with company requirements	4.1 Types of manuals used in HVAC/R sector 4.2 Manual storing and maintaining procedures	4.1 Storing and maintaining manuals

RANGE OF VARIABLES

VARIABLE	RANGE
1. Manual	Kinds of Manuals: 1.1 Installation Manual 1.1.1 Manufacturer's Specification Manual 1.2 Owner's Manual 1.2.1 Maintenance Procedure Manual 1.2.2 Periodic Maintenance Manual

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires that the candidate: 1.1 Identified and accessed specification/manuals as per job requirements 1.2 Interpreted manuals in accordance to industry practices 1.3 Applied information in manuals according to the given task 1.4 Stored manuals in accordance with company requirements
2. Resource Implications	The following resources should be provided: 2.1 All manuals/catalogues relative to HVAC/R sector
3. Methods of Assessment	Competency should be assessed through: 3.1 Direct Observation 3.2 Questions/Interview Assessment of required knowledge and practical skills may be combined
4. Context for Assessment	4.1 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines 4.2 Assessment may be conducted in the workplace or a simulated environment

UNIT OF COMPETENCY: PERFORM MENSURATIONS AND CALCULATIONS

UNIT CODE : HVC311203

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in identifying and measuring objects based on the required performance standards.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Select measuring instruments	1.1. Object or component to be measured is identified, classified and interpreted to the appropriate regular ***geometric shape*** 1.2. Measuring tools are selected/ identified as per object to be measured or job requirements 1.3. Correct specifications are obtained from relevant sources 1.4. Appropriate ***measuring instruments*** are selected according to job requirements 1.5. Alternative measuring tools are used without sacrificing cost and quality of work	1.1. Category of measuring instruments 1.2. Types and uses of measuring instruments 1.3. Shapes and Dimensions 1.4. Formulas for volume, areas, perimeters of plane and geometric figures	1.1. Identifying and selecting measuring instruments 1.2. Visualizing objects and shapes
2. Carry out measurements and calculations	2.1. Accurate ***measurements and calculations*** are obtained to job requirements 2.2. Alternative measuring tools are used without sacrificing cost and quality of work 2.3. Calculation needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x) and division (/) including but not limited to: trigonometric functions, algebraic computations 2.4. Calculations involving fractions, percentages and mixed numbers are used to complete workplace tasks 2.5. Numerical computation is self-checked and corrected for accuracy 2.6. Instruments are read to the limit of accuracy of the tool 2.7. Systems of measurement identified and converted according to job requirements/ISO 2.8. Work pieces are measured according to job requirements	2.1. Calculation & measurement 2.2. Four fundamental operations 2.3. Linear measurement 2.4. Dimensions 2.5. Unit conversion 2.6. Ratio and proportion	2.1. Performing calculation by addition, subtraction, multiplication and division; 2.2. Interpreting formulas for volume, areas, perimeters of plane and geometric figures 2.3. Handling of measuring instruments

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Maintain measuring instruments	3.1. Measuring instruments are not dropped to avoid damage 3.2. Measuring instruments are cleaned before and after using. 3.3. Proper storage of instruments undertaken according to manufacturer's specifications and standard operating procedures.	3.1. Types of measuring instruments and their uses 3.2. Safe handling procedures in using measuring instruments 3.3. Four fundamental operation of mathematics 3.4. Formula for volume, area, perimeter and other geometric figures	3.1. Handling and maintaining measuring instruments

RANGE OF VARIABLES

VARIABLE	RANGE	
1. Geometric Shape	Including but I not limited to: 1.1 Round 1.2 Square 1.3 Rectangular 1.4 Triangle 1.5 Sphere 1.6 Conical	
2. Measuring instruments	Including but not limited to: 2.1 Micrometer (In-out, depth) 2.2 Vernier caliper (out, inside) 2.3 Dial gauge with mag, std. 2.4 Straight edge 2.5 Thickness gauge 2.6 Torque gauge 2.7 Small hole gauge 2.8 Telescopic gauge 2.9 Try-square	2.10 Protractor 2.11 Combination gauge 2.12 Steel rule 2.13 Voltmeter 2.14 Ammeter 2.15 Mega-ohmmeter 2.16 KWH meter 2.17 Gauges 2.18 Thermometers
3. Measurements and calculations	3.1 Linear 3.2 Volume 3.3 Area 3.4 Wattage 3.5 Voltage 3.6 Resistance 3.7 Amperage 3.8 Frequency 3.9 Impedance 3.10 Conductance 3.11 Capacitance	3.12 Displacement 3.13 Inside diameter 3.14 Circumference 3.15 Length 3.16 Thickness 3.17 Outside diameter 3.18 Taper 3.19 Out of roundness 3.20 Oil clearance 3.21 End play/thrust clearance

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires that the candidate: 1.1 Selected and prepared appropriate measuring instruments in accordance with job requirements 1.2 Performed measurements and calculations according to job requirements/ ISO
2. Resource Implications	The following resources should be provided: 2.1 Workplace location 2.2 Problems to solve 2.3 Measuring instrument appropriate to carry out tasks 2.4 Instructional materials relevant to the propose activity Assessment of required knowledge and practical skills may be combined
3. Methods of Assessment	Competency should be assessed through: 3.1 Actual demonstration 3.2 Direct observation 3.3 Written test/questioning related to required knowledge
4. Context for Assessment	4.1 Competency assessment may occur in workplace or any appropriate simulated environment 4.2 Assessment shall be observed while task are being undertaken whether individually or in group 4.3 Competency assessment must be undertaken in accordance with the TESDA assessment guidelines

UNIT OF COMPETENCY: PERFORM BASIC BENCHWORKS

UNIT CODE : HVC713202

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in preparing materials, tools and equipment, lay-outing dimensions and performing basic benchwork based on the required performance standards.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare materials, tools and equipment	1.1. ***Work plan*** is interpreted to determine job requirements 1.2. ***Materials, tools and equipment*** are identified and prepared according to job requirements 1.3. Materials are checked according to the required specifications 1.4. Tools and equipment conditions are checked following the standard operating procedures (SOPs)	1.1. Communication skills 1.2. Materials, tools and equipment; uses and specifications 1.3. Material estimation 1.4. Mensuration	1.1. Interpretation skills 1.2. Handling of tools and materials
2. Lay-out and mark dimensions/features on workplace	2.1. Metallic and non-metallic materials are selected according to the requirements specified in the blueprint 2.2. ***Dimensions/features*** are laid-out/marked according to job specifications/blueprint and within the required tolerance 2.3. Dimensions are checked against the actual work plan	2.1. Metallic and non-metallic materials 2.2. Measuring tools; functions and use 2.3. Trade mathematics 2.4. Mensuration 2.5. Calculation 2.6. Conversion 2.7. Plan specifications 2.8. Quality assurance	2.1. Measuring and lay-outing 2.2. Blueprint reading 2.3. Communication skills
3. Perform required basic metal works	3.1. ***Work instructions are followed*** to ensure work safety 3.2. ***Basic metal works*** are performed applying knowledge on safety procedures and according to job requirements 3.3. Workpieces are clamped in ***workholding device*** to avoid damage and accidents 3.4. Work pieces are cut, chipped or filed according to required measurements, tolerance specified in the blueprint and free from burrs and sharp edges 3.5. Drilling is performed according to recommended sequence	3.1. Tools and equipment: use and specifications 3.2. Grinding, cutting, drilling, filing techniques 3.3. Basic welding principles and application 3.4. Applied occupational health and safety (OH&S)	3.1. Using tools and equipment 3.2. Basic metal works skills ○ Grinding ○ Cutting ○ Drilling ○ Filing ○ Threading ○ Reaming ○ Welding 3.3. Practice safety skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	and specifications 3.6. Proper usage of materials, tools and equipment is observed 3.7. Appropriate ***PPE*** and safety procedures are applied 3.8. Worksite is cleaned and cleared of all debris and left in safe state in accordance with OHS regulations		

RANGE OF VARIABLES

VARIABLE	RANGE	
1. Work plan	1.1 Job requirements 1.2 Schedule of work	
2. Materials	2.1 Steel brackets 2.2 Grinding disc 2.3 Drill bit 2.4 Flat/angle bars	2.5 Fastening screws 2.6 Masonry
3. Tools and equipment	3.1 Portable grinder 3.2 Hacksaw 3.3 File 3.4 Markers 3.5 Screw drivers 3.6 Ballpein hammer 3.7 L-square/steel square 3.8 Steel rule	3.9 Measuring tools 3.10 PPE 3.11 Portable electric drill 3.12 Bench wire 3.13 Tri-square 3.14 Flaring tool 3.15 Swaging tool 3.16 Reamer
4. Metallic materials	4.1 Mild steel plate 4.2 Flat bar 4.3 Square bar 4.4 Angle bar 4.5 Round bar	4.6 G.I. sheet 4.7 B.I. sheet 4.8 Beam
5. Non-metallic materials	5.1 PVC 5.2 Rubber 5.3 Wood 5.4 Fiber glass	5.5 Plastic 5.6 Ceramics
6. Dimensions	6.1 Measurements 6.2 Tolerances	
7. Work instructions	7.1 Work plan 7.2 Blueprint 7.3 Manufacturer's specifications	
8. Personal Protective Equipment (PPE)	8.1 Safety shoes 8.2 Gloves 8.3 Appropriate Goggles 8.4 Working clothes/coverall/apron 8.5 Respiratory mask 8.6 Face mask	
9. Basic metal works	9.1 Sheet metal 9.2 Cutting 9.3 Filing 9.4 Drilling	9.5 Arc welding 9.6 Gas welding 9.7 Flaring 9.8 Swaging
10. Workholding device	10.1 Machine vise 10.2 Pliers 10.3 Vise grip	
11. Manual	11.1 Procedure's manual 11.2 Instructional manual	

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires that the candidate: 1.1 Interpreted work plan to determine job requirements 1.2 Identified and prepared supplies, materials, tools and equipment in accordance with job requirements 1.3 Selected and used appropriate processes, tools and equipment to carry out task 1.4 Laid-out and checked dimensions in accordance with job requirements and within the tolerances 1.5 Followed work instructions to ensure safety 1.6 Performed benchworks in accordance with job requirements 1.7 Cleaned worksite and left in safe state in accordance with OHSA regulations
2. Resource implications	The following resources should be provided: 2.1 Workplace 2.2 Work plan 2.3 Materials, tools and equipment relevant to the proposed activity/task
3. Methods of assessment	Competency should be assessed through: 3.1 Actual demonstration 3.2 Direct observation 3.3 Written/questioning related to required knowledge
4. Context of assessment	4.1 Competency assessment may occur in workplace or any appropriate simulated environment 4.2 Assessment shall be observed while task are being undertaken whether individually or in group 4.3 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

UNIT OF COMPETENCY: PERFORM BASIC ELECTRICAL WORKS

UNIT CODE : HVC724201

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in preparing materials, tools and equipment, testing electrical components and basic repairing in electricity based on the required performance standards.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare electrical tools and test instruments	1.1. ***Work plan*** is interpreted to determine job requirements 1.2. ***Electrical tools and instruments*** are identified and prepared according to job requirements 1.3. Electrical tools and instruments are checked for conditions and calibrated as required	1.1. Uses of tools and testing instruments 1.2. Calibration of testing instruments 1.3. Safe handling and proper care of tools and testing instruments	1.1. Interpretation skills 1.2. Handling of tools and materials 1.3. Calibration skills 1.4. Communication skills (oral and written)
2. Test power supply and electrical components	2.1. Instruments are tested in accordance with PEC 2.2. Power supply and electrical components are checked in accordance with manufacturer's specifications/PEC 2.3. Defects of power supply and electrical components are identified and recorded 2.4. Safe working habits is observed	2.1. Functions and uses of testing instruments 2.2. Basic electricity 2.3. Electrical safety and hazards 2.4. Testing procedures	2.1. Usage of testing instruments 2.2. Basic troubleshooting skills 2.3. Practice safety skills
3. Perform basic electrical repair	3.1. ***Work instructions*** are followed to ensure safety work 3.2. Loose connections are tightened in accordance with PEC 3.3. Defective electrical components are replaced and tested in accordance with PEC 3.4. Work place is cleaned and in safe state in line with OHSA regulations	3.1. Types of electrical parts and fixtures 3.2. Testing procedures 3.3. Electrical safety and hazards 3.4. Applied occupational health & safety (OH & S) 3.5. Electrical joints and splices	3.1. Basic electrical servicing and troubleshooting skills 3.2. Wire splicing skills 3.3. Practice safety skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work plan	1.1. Job requirements 1.2. Schedule of work
2. Materials	2.1. Solid, stranded wire 2.2. Service plug/outlet 2.3. HVAC/R electrical components 2.4. Soldering lead 2.5. Terminal clips 2.6. Moulding 2.7. Fuses 2.8. PVC/Mold flux 2.9. Electrical tape
3. Tools and equipment	3.1. Clamp ammeter 3.2. Multi tester 3.3. Insulation tester 3.4. PPE 3.5. Soldering gun/iron 3.6. Wire stripper 3.7. Measuring tool 3.8. Markers 3.9. Crimping tools 3.10. Screw drivers 3.11. Electrician pliers 3.12. Electric drill 3.13. Long nose
4. Work instructions	4.1. Work plan 4.2. Schematic diagrams 4.3. Installation instruction

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires that the candidate: 1.1 Interpreted work plan to determine job requirements 1.2 Selected and used appropriate processes, tools and equipment to carry out task 1.3 Identified electrical tools and instruments are tested in accordance with PEC 1.4 Replaced defective tools and instruments 1.5 Checked power supply and electrical components in accordance with PEC 1.6 Cleaned work place and left in safe state in line with OHSA regulations 1.7 Completed electrical wiring in HVAC/R units based in manufacturer's specifications and PEC 1.8 Communicated effectively to ensure safety works
2. Resource Implications	The following resources should be provided: 2.1 Work place 2.2 Work plan 2.3 Materials, tools and equipment relevant to the proposed activity/task
3. Methods of Assessment	Competency should be assessed through: 3.1 Direct observation 3.2 Written test/questioning relevant to required knowledge
4. Context of Assessment	4.1 Competency assessment may occur in workplace or any appropriate simulated environment 4.2 Assessment shall be observed while task are being undertaken whether individually or in group 4.3 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

UNIT OF COMPETENCY: MAINTAIN TOOLS AND EQUIPMENT

UNIT CODE : HVC311205

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in checking condition, performing preventive maintenance and storing of tools and equipment based on the required performance standards.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Check condition of tools and equipment	1.1. ***Materials, tools and equipmen***t are identified according to classification and job requirements 1.2. Non-functional tools and equipment are segregated and labeled according to classification 1.3. Safety of tools and equipment are observed in accordance with manufacturer's instructions 1.4. Condition of ***PPE*** are checked in accordance with manufacturer's instructions	1.1. Safety Practices o Use of PPE o Handling of tools and equipment o Good housekeeping 1.2. Materials, Tools and Equipment o Types and uses of lubricants o Types and uses of cleaning materials o Types and uses of HVAC/R tools o Types and uses of HVAC/R equipment 1.3. Operational conditions of HVAC/R tools and equipment 1.4. HVAC/R tools and equipment defects	1.1. Maintaining tools and equipment 1.2. Handling of tools and equipment 1.3. Identifying tools and equipment defects
2. Perform basic preventive maintenance	2.1. Appropriate lubricants are identified according to types of equipment 2.2. Tools and equipment are lubricated according to preventive maintenance schedule or manufacturer's specifications 2.3. Measuring instruments are checked and calibrated in accordance with manufacturer's instructions 2.4. Tools are cleaned and lubricated according to standard procedures 2.5. Defective instruments, equipment and accessories are inspected and replaced according to manufacturer's specifications 2.6. Tools are inspected, repaired and replaced every after use 2.7. Work place are cleaned and in safe state in line with OHSA regulations	2.1. Safety Practices o Use of PPE o Handling of tools and equipment o Good housekeeping 2.2. Materials, Tools and Equipment o Types and uses of lubricants o Types and uses of cleaning materials 2.3. Preventive Maintenance o Methods and techniques o Procedures	2.1. Handling of tools and equipment 2.2. Performing preventive maintenance

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Store tools and equipment	3.1. Inventory of tools, instruments and equipment are conducted and recorded as per company practices 3.2. Tools and equipment are stored safely in appropriate locations in accordance with manufacturer's specifications or company procedures	3.1. Safety Practices ○ Use of PPE ○ Handling of tools and equipment ○ Storing procedures and techniques ○ Storage conditions/ locations	3.1. Storing tools and equipment 3.2. Handling of tools and equipment

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials	Including but not limited to: 1.1 Lubricants 1.2 Cleaning materials 1.3 Rust remover 1.4 Rugs 1.5 Spare parts
2. Tools and equipment	Including but not limited to: 2.1 Tools - Cutting tools - hacksaw, crosscut saw, rip saw - Boring tools - auger, brace, grinlet, hand drill - Holding tools - vise grip, C-clamp, bench vise - Threading tools - die and stock, taps 2.2 Measuring instruments/Equipment
3. PPE	Including but not limited to: 3.1 Goggles 3.2 Gloves 3.3 Safety shoes 3.4 Aprons/Coveralls
4. Forms	4.1 Maintenance schedule forms 4.2 Requisition Slip 4.3 Inventory Form Slip 4.4 Inspection Form Slip 4.5 Procedures

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires that the candidate: 1.1 Selected and used appropriate processes, tools and equipment to carry out task 1.2 Identified functional and non-functional tools and equipment 1.3 Checked, lubricated and calibrated tools, equipment and instruments according to manufacturer's specifications 1.4 Replaced defective tools, equipment and its accessories 1.5 Observed and applied safe handling of tools and equipment and safety work practices 1.6 Prepared and submitted inventory report, where applicable 1.7 Maintained work place in accordance with OHSA regulations 1.8 Stored tools and equipment safely in appropriate locations and in accordance with company practices
3. Resource Implications	The following resources should be provided: 2.1 Work place 2.2 Maintenance Schedule 2.3 Maintenance materials, tools and equipment relevant to the proposed activity/task
3. Methods of Assessment	Competency should be assessed through: 3.1 Direct observation 3.2 Written test/questioning relevant to required knowledge
4. Context for Assessment	4.1 Competency assessment may occur in workplace or any appropriate simulated environment 4.2 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

UNIT OF COMPETENCY : PERFORM HOUSEKEEPING AND SAFETY PRACTICES FOR RAC SERVICING

UNIT CODE : HVC7315201

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes needed to work safely in the workplace including sorting, cleaning and dispensing materials, tools and equipment, identifying and minimizing hazards, responding and recording accidents and following basic security.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Sort materials, tools and equipment	1.1. Materials, tools and equipment are classified according to its kinds 1.2. Appropriate areas for materials, tools and equipment are designated	1.1. Classification of tools, equipment and materials 1.2. Selection of appropriate areas for storing materials, tools and equipment 1.3. Sorting procedures and considerations 1.4. 5S principles	1.1. Applying 5S (sorting) 1.2. Identifying tools and materials
2. Clean workplace area, materials, tools and equipment	2.1. Cleaning materials are identified and used as per procedure 2.2. Workplace areas, materials, tools and equipment are cleaned as per company practices 2.3. Workplace are in safe state in accordance with safety regulations/company practices	2.1. Cleaning materials, types and applications. 2.2. Procedures in cleaning workplace area, tools and equipment. 2.3. Consideration of a safe workplace area, tools and equipment	2.1. Applying 5S (cleaning)
3. Systematize dispensing and retrieval of materials, tools and equipment	3.1. Systems for requesting, borrowing and returning of materials, tools and equipment is in-place and implemented 3.2. Forms used are completely filled-up and filed 3.3. Borrowed tools, and equipment are returned to designated area 3.4. Consumable materials are requested in exact quantity	3.1. Procedures in dispensing and retrieval of materials; tools, and equipment 3.2. Things to be considered in returning the borrowed tools and equipment.	3.1. Applying 5S (systematize) 3.2. documentation skills
4. Identify and minimize/ eliminate hazards	4.1. ***Hazards*** in the work area are recognized and reported to designated personnel and appropriate control actions are taken 4.2. Workplace policies and procedures for controlling risks are established and followed accurately 4.3. Workplace procedures for dealing with ***emergencies*** are followed whenever necessary	4.1. Composition of safety committee 4.2. Policies and procedures in controlling risk 4.3. Safety signs and first aid 4.4. Safety signs and hazards warning preparation 4.5. Equipment and safety devices	4.1. Hazard identification skills 4.2. Practice safety skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	within the scope of responsibilities and competencies 4.4. ***Safety signs and hazard warnings*** are displayed and observed at all times in line with workplace health and safety regulations 4.5. Equipment and safety devices/***PPE*** are used/handled according to company or manufacturer's procedures and guidelines 4.6. Work areas are kept clean, free from obstacles and emergency exits are know and kept clear at all times 4.7. Safe manual handling/fighting techniques and safe equipment operation techniques are employed at all times	4.6. Safe handling technique in using equipment and safe devices. 4.7. Identification of Safety Signs and Symbols	
5. Respond and record accidents	5.1. Workplace accidents are identified 5.2. Workplace emergency ***first-aid procedures/ treatment*** are followed/carried out correctly in accordance with ***standards/regulations*** and enterprise procedures/policies 5.3. Medical assistance/rescue is coordinated with concerned personnel in line with organizational policies 5.4. Accident/incident records maintained in accordance with standard operating procedures	5.1. Types of accidents 5.2. Procedures in applying first aid/ treatment 5.3. First aid supplies 5.4. Steps in responding to and recording accidents	5.1. First aid application skills 5.2. Coordination skills 5.3. Documentation skills
6. Follow basic security	6.1. ***Security policies***/ procedures are followed according to enterprise practices and *appropriate* legislation 6.2. Security related events are recorded/reported on the relevant forms 6.3. Staff are advised of enterprise security procedures and correct methods of implementation	6.1. Basic security procedures 6.2. Security signs and symbols 6.3. Loss control management 6.3.1. Hazards 6.3.2. Safety signs	6.1. Coordination skills 6.2. Reporting skills 6.3. Documentation skills 6.4. Practice safety skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hazards	Hazards that may be present in the workplace include but not limited to: 1.1. Flammable materials 1.2. Running machinery/equipment 1.3. Toxic substances 1.4. Debris 1.5. Open flames 1.6. Loose objects/fixtures 1.7. Chemicals 1.8. Electrical faults 1.9. Hot metals
2. Emergencies	Emergencies may include but not limited to: 2.1. Fire 2.2. Explosion 2.3. Spills 2.4. Falls 2.5. Electrocution 2.6. Injuries caused by falling objects 2.7. Injuries caused by sharp objects 2.8. Injuries caused by wrong usage of tools
3. Safety signs, symbols and hazard warnings	Safety signs and symbols include but not limited to: 3.1. 3.1 Industry recognized hazard warning signs and safety symbols - Danger-High Voltage - Unauthorized Persons Keep Out - No Smoking - Poisonous Gases - Caution - Men working on line wires 3.2. Internationally recognized hazard warning signs and safety symbols
4. Personal Protective Equipment (PPE)	PPE may include but not limited to: 4.1. Goggles 4.2. Gas mask 4.3. Working gloves 4.4. Safety shoes 4.5. Face shield 4.6. Insulating mat 4.7. Over-all apron 4.8. Hard hat 4.9. Safety belt 4.10. Protective eyewear
5. First-aid Treatment	First-aid treatment includes but is not limited to: 5.1. CPR 5.2. Mouth to mouth resuscitation 5.3. Application of tourniquet 5.4. Application of pressure to bleeding wounds or cuts 5.5. First-aid treatment for burned victims

VARIABLE	RANGE
6. Standards and Regulations	6.1. Philippine Electrical Code 6.2. Philippine OH&S Standards 6.3. Building Code 6.4. Philippine Environmental Standards 6.5. Welding Procedures Specifications 6.6. Clean Air Act
7. Security policies	7.1. Wearing of ID 7.2. Logging-in and out 7.3. Wearing of uniform 7.4. Observance of safety/security signs and symbols

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires that the candidate: 1.1. Classified materials, tools and equipment according to kind 1.2. Cleaned workplace areas, materials, tools and equipment as per standard procedures 1.3. Implemented systematize dispensing and retrieval of materials, tools and equipment 1.4. Identified and described safety working practices relating to all tasks undertaken in the workplace 1.5. Identified and selected appropriate equipment and safety devices for particular workplace tasks and activities 1.6. Interpreted hazard warnings and safety signs correctly and described the application of these warnings and signs in the work activities 1.7. Workplace emergency first-aid procedures/treatment are carried out in accordance with OHSA standards/legislation and enterprise procedures 1.8. Responded/maintained accidents/incidents records in accordance with SOPs 1.9. Followed security procedures/policies in accordance with enterprise practices and legislation 1.10. Workplace kept in safe state in accordance with safety Regulations
2. Resource Implications	The following resources should be provided: 2.1. Work place 2.2. Materials, tools and equipment relevant to the proposed activity/task 2.3. Safety signs 2.4. Safety devices 2.5. Accident reporting procedures 2.6. First-aid materials and guidelines
3. Methods of Assessment	Competency should be assessed through: 3.1. Direct observation while task is being undertaken 3.2. Written test/questioning relevant to required knowledge Assessment of required knowledge and practical skills may be combined
4. Context for Assessment	4.1. Competency assessment may occur in workplace or any appropriate simulated environment 4.2. Assessment shall be observed while task are being undertaken whether individually or in group in accordance with the approved industry OHSA regulations 4.3. Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

UNIT OF COMPETENCY: DOCUMENT WORK ACCOMPLISHED

UNIT CODE : HVC311205

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in documenting work accomplished.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify forms and data	1.1. ***Forms*** are selected based on the reports to be prepared 1.2. ***Data*** are collected based on the reports to be prepared	1.1. Selecting and interpreting forms 1.2. Interpreting work accomplished 1.3. Data gathering techniques	1.1. Documentation skills 1.2. Interpretation skills 1.3. Data gathering skills
2. Prepare reports	2.1. ***Reports*** are completed using standard form as per company procedures 2.2. Reports provide details of work completed, further action to be taken and other details as per company procedures 2.3. Reports are completed and submitted within specified time to the concerned personnel/supervisor	2.1. Details of work completion 2.2. Kinds of reports 2.3. Preparation of reports	2.1. Documentation skills 2.2. Report preparation skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Forms	1.1 Warranty Paper Request 1.2 Operating Log Sheet 1.3 Requisition Forms
2. Data	2.1 Current draw 2.2 Operating 2.3 Unit specifications 2.4 Records of work accomplished 2.5 Further work required 2.6 Spare parts used
3. Reports	3.1 Start-up commissioning Report 3.2 Warranty Paper Request 3.3 Turn-over Report 3.4 Operating Log Sheet 3.5 Service Report 3.6 Trouble Call Report 3.7 Requisition

EVIDENCE GUIDE

1. Critical aspects of Competency	Competency requires evidence that the candidate: 1.1 Prepared reports used terminology and language appropriate to all users 1.2 Prepared reports to include alternatives, views, approaches and other findings and recommendations for consideration by the supervisor 1.3 Prepared reports are coherent and based on actual findings/analysis/results 1.4 Prepared reports are accomplished, completed as per standard format and submitted within specified time to the concerned supervisor
2. Resource Implications	Things necessary to conduct method of assessment: 2.1 Work place location 2.2 Materials relevant to the proposed activity
3. Methods of Assessment	Competency in this unit must be assessed through: 3.1 Direct observation 3.2 Questions related to required knowledge
4. Context for Assessment	4.1 Competency may be assessed in the work place or in a simulated work place setting

CORE COMPETENCIES

UNIT OF COMPETENCY: SERVICE AND MAINTAIN MOBILE AIR-CONDITIONING (MAC) UNITS

UNIT CODE : HVC723348

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to service and maintain MAC units for cars and vans as well as buses, trucks and trains.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Clean and replace air filter	1.1. ***Air filter*** is identified and removed following standard operating procedures (SOPs) 1.2. Air filter is checked for damage and replaced if required in line with SOPs 1.3. Air filter is cleaned using the correct tools and cleaning procedures 1.4. Air filter is replaced in accordance with filter specifications	1.1 Protective personal equipment/safety gears 1.2 Proper handling of tools, equipment and accessories 1.3 Safety signs and symbols 1.4 Good housekeeping 1.5 Types of air filters 1.6 Cleaning agents 1.7 Pressure washer operation 1.8 Compressed air operation 1.9 Servicing and maintenance procedures 1.10 Procedures in cleaning and/or replacing air filter 1.11 Manufacturer's service manual 1.12 RAC Code of Practice 1.13 RA 11058 provisions	1.1 Interpreting diagrams 1.2 Preparing materials 1.3 Proper handling of tools and equipment 1.4 Assembling and disassembling 1.5 Cleaning skills 1.6 Interpersonal skills
2. Recover/ recycle refrigerants	2.1. Unit is assessed for recovery/recycling activities following SOP 2.2. Equipment for recovery/ recycling is set-up based on manufacturer's instruction 2.3. Optimum recovery/recycling of refrigerant is performed in line with RAC Code of Practice 2.4. Flammable refrigerants are handled properly according to international standards	2.1 Protective personal equipment/safety gears 2.2 Proper handling of tools, equipment and accessories 2.3 Safety signs and symbols 2.4 Good housekeeping 2.5 RA 11058 provisions 2.6 Identification of types of refrigerants 2.7 Cleaning agents 2.8 Flushing solution 2.9 System analyzer/Gauge manifold 2.10 Refrigerant identifier 2.11 Recovery/recycling machine 2.12 Refrigerant cylinder 2.13 Fundamentals of refrigeration 2.14 Refrigeration system 2.15 Proper storage of refrigerants 2.16 Recovery and recycling	2.1 Interpreting diagrams 2.2 Preparing materials 2.3 Proper handling of tools and equipment 2.4 Identification of refrigerants 2.5 Setting up recovery/ recycling machine 2.6 Interpersonal skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		process 2.17 RAC Code of Practice 2.18 RA 11058 provisions	
3. Service evaporator/ condenser assembly	3.1. Tools are selected in dismantling the evaporator/ condenser as per standard operating procedures (SOPs) 3.2. Evaporator/condenser are pulled out and disassembled as per manufacturer's service manual 3.3. High pressure washer and compressed air are used in cleaning evaporator/condensing coil based on established enterprise procedures 3.4. Evaporator/condenser coil fins are straightened in accordance with service procedure 3.5. ***Cleaning agent*** or non-corrosive chemical is used in cleaning and maintaining evaporator/ condensing coil, fins and other ***body accessories*** as per standard operating procedures (SOPs) 3.6. Condenser fan motor and evaporator blower assembly are maintained as per standard operating procedures 3.7. Evaporator/condenser assembly is flushed using updated environment friendly flushing solution and oxygen-free nitrogen (OFN) as per manufacturer's service manual 3.8. Evaporator/condenser are assembled as per manufacturer's service manual	3.1. Protective personal equipment/safety gears 3.2. Handling of tools, equipment and accessories 3.3. Safety signs and symbols 3.4. Good housekeeping 3.5. Types of cleaning solution 3.6. Types of evaporator/ condenser assembly 3.7. Cleaning agents 3.8. Updated environment friendly flushing solution and oxygen-free nitrogen (OFN) 3.9. Pressure washer 3.10. Nitrogen and nitrogen regulator 3.11. Electrical/electric controls 3.12. Basic electricity/ electronics 3.13. Fundamentals of refrigeration cycle 3.14. Refrigeration system 3.15. Cleaning evaporator/ condenser assembly procedures 3.16. Servicing and maintenance procedures 3.17. RAC Code of Practice 3.18. RA 11058 provisions	3.1 Interpreting diagrams 3.2 Preparing materials 3.3 Proper handling of tools and equipment 3.4 Assembling and disassembling 3.5 Skills in using high pressure washer and compressed air 3.6 Skills in flushing 3.7 Interpersonal skills
4. Perform leak testing, evacuation	4.1. Leak testing is performed as per manufacturer's service manual	4.1 Protective personal equipment/safety gears 4.2 Handling of tools,	4.1 Interpreting diagrams 4.2 Preparing

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
and charging	4.2. Evacuation is performed following SOP 4.3. Charging is performed following SOP 4.4. Operating parameters are checked following SOP	equipment and accessories 4.3 Safety signs and symbols 4.4 Good housekeeping 4.5 Types of refrigerants 4.6 Parts of refrigerant circuit 4.7 System analyzer/Gauge manifold 4.8 Refrigerant identifier 4.9 Vacuum pump 4.10 Vacuummeter 4.11 Weighing scale 4.12 Thermometer 4.13 Refrigerant cylinder 4.14 Electrical/electric controls 4.15 Basic electricity/ electronics 4.16 Fundamentals of refrigeration cycle 4.17 Refrigeration system 4.18 Automotive Electrical System 4.19 Leak testing procedure 4.20 Evacuation procedure 4.21 Charging procedure 4.22 RAC Code of Practice 4.23 DENR-EMB DAO No. 2004-08 4.24 RA 11058 provisions	materials 4.3 Proper handling of tools and equipment 4.4 Leak testing 4.5 Evacuation 4.6 Charging 4.7 Operating parameters reading 4.8 Aluminum brazing skills 4.9 Interpersonal skills
5. Service compressor assembly, pulley and belt	5.1. Magnetic clutch is serviced in line with manufacturer's instruction 5.2. Alignment of compressor, pulley and belt tension are maintained in line with SOP 5.3. ***Compressor parameters*** are checked in line with manufacturers service manual 5.4. Belt is checked for damaged and replace, if necessary, as per manufacturer's service manual 5.5. Loose tube and hose fittings are serviced in line with manufacturer's instruction	5.1. Protective personal equipment/safety gears 5.2. Handling of tools, equipment and accessories 5.3. Safety signs and symbols 5.4. Good housekeeping 5.5. Types of compressor 5.6. Types of belts 5.7. Compressor parameters 5.8. Parts of refrigerant circuit 5.9. Belt tensioner 5.10. Belt tension gauge 5.11. Compressor assembly 5.12. Belts and pulleys 5.13. Servicing and maintenance procedures 5.14. RAC Code of Practice 5.15. RA 11058 provisions	5.1. Interpreting diagrams 5.2. Preparing materials 5.3. Proper handling of tools and equipment 5.4. Checking alignment 5.5. Checking belt tensions 5.6. Interpersonal skills
6. Service electrical power and control	6.1. ***Proper instrument*** is used in checking power supply and diagnosing electrical control system	6.1. Protective personal equipment/safety gears 6.2. Handling of tools, equipment and accessories	6.1. Interpreting diagrams 6.2. Preparing materials

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
circuits	6.2. Loose connections/ wirings are checked, repaired and reported in line with SOP 6.3. Fuse and terminal sockets are checked in line with SOP 6.4. ***Electrical controls*** are serviced in line with SOP 6.5. Motor controls for train system are checked in line with manufacturer's specifications 6.6. Grounding is checked in line with SOP	6.3. Safety signs and symbols 6.4. Good housekeeping 6.5. Types of electrical controls 6.6. Fuses and terminal sockets 6.7. VOM multi-tester 6.8. Electrical/electric controls 6.9. Basic electricity/ electronics 6.10. Automotive Electrical System 6.11. Electrical troubleshooting techniques 6.12. Basic motor control wiring and maintenance 6.13. RAC Code of Practice 6.14. RA 11058 provisions	6.3. Proper handling of tools and equipment 6.4. Testing motor control and electrical system 6.5. Diagnostic skills 6.6. Interpersonal skills
7. Accomplish service and maintenance report	7.1 All defects and problems encountered are reported in line with enterprise policies and procedures. 7.2 Observation and recommendation are properly reported in line with enterprise policies and procedures.	7.1 Service report forms 7.2 Mensuration 7.3 Enterprise policies and procedures	7.1 Filling up report forms 7.2 Interpersonal skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Air filter	May include: 1.1. Disposable 1.2. Reusable/Washable
2. Cleaning agent	May include: 2.1. Soap powder 2.2. Liquid soap 2.3. Anti-bacterial spray
3. Other body accessories	May include 3.1. base pan/hose 3.2. drip tray 3.3. shroud/housing 3.4. vents/grilles 3.5. propeller blade 3.6. centrifugal fan (blower) 3.7. auxiliary fan
4. Compressor parameters	May include: 4.1. Revolution speed 4.2. Pressure (suction and discharge) 4.3. Refrigerant
5. Proper instrument	May include: 5.1. VOM multi-tester
6. Electrical controls	May include: 6.1. Switches 6.1.1. AC switch or On/Off Switch 6.1.2. Temperature selector 6.1.3. Blower speed selector ▪ Resistor type ▪ Transistor type 6.1.4. Water temperature sensor 6.1.5. Thermostat ▪ Mechanical ▪ Electrical/Electronics 6.1.6. Pressure switch/sensor 6.1.7. Electronic controls 6.2. Relay/contactor/timer/solenoids 6.3. Damper motors 6.4. Basic PLC controller

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1. Cleaned and/or replaced air filter parts/components 1.2. Recovered and recycled refrigerants 1.3. Cleaned evaporator/condenser assemblies 1.4. Performed leak testing, evacuation and charging 1.5. Serviced compressor assembly, pulley and belt 1.6. Serviced electrical power and control circuits 1.7. Accomplished service report.
2. Resource Implications	The following resources must be provided: 2.1. Access to work place location 2.2. Access to vehicle with air conditioning unit 2.3. Tools, equipment and materials relevant to the proposed activity 2.4. Service manual
3. Methods of Assessment	Competency should be assessed through: 3.1. Written test 3.2. Direct observation/demonstration with oral questioning 3.3. Portfolio
4. Context for Assessment	4.1. Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: TROUBLESHOOT AND REPAIR MOBILE AIR-CONDITIONING (MAC) SYSTEMS

UNIT CODE : HVC723349

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in troubleshooting and repairing MAC systems for cars and vans as well as buses, trucks and trains.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for troubleshooting and repair	1.1. Appropriate wiring diagrams, charts and manuals are interpreted in line with the job requirements 1.2. Appropriate materials, tools and equipment are selected based on job requirements 1.3. Work safety is observed during preparation according to established operating standards	1.1. Protective personal equipment/safety gears 1.2. Handling of tools, equipment and accessories 1.3. Good housekeeping 1.4. Specifications of materials, tools and equipment 1.5. VOM multi-tester 1.6. System analyser/Gauge manifold 1.7. Refrigerant identifier 1.8. Clamp ammeter 1.9. Electrical and mechanical instruments 1.10. Troubleshooting and repair procedures 1.11. RAC Code of Practice 1.12. RA 11058 provisions 1.13. Manufacturers' service manual	1.1. Interpreting schematic diagram 1.2. Preparing materials 1.3. Proper handling of tools/ equipment 1.4. Proper lifting skills
2. Identify and repair faults/ troubles	2.1. Appropriate ***PPE*** are selected and used in line with job requirements 2.2. ***Components*** are ***tested*** following manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy 2.3. ***Faults/problems*** with components are diagnosed in line with manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy 2.4. Remedial action is taken to overcome faults/problems in line manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy	2.1. Protective personal equipment/safety gears 2.2. Handling of tools, equipment and accessories 2.3. Safety signs and symbols 2.4. Good housekeeping 2.5. Types of materials required according to identified fault 2.6. Types of tools, instruments and equipment according to identified fault 2.7. Errors codes as per manufacturer's specifications 2.8. Automotive engine operation and cooling system 2.9. VOM multi-tester 2.10. Electrical/electric	2.1. Interpreting schematic diagram 2.2. Proper handling of electrical tools/equipment 2.3. Testing and repairing electrical system 2.4. Testing and repairing mechanical system 2.5. Interpersonal skills 2.6. Aluminum brazing skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	2.5. Work is completed safely in line with workplace safety guidelines 2.6. Report on testing procedure, including faults and minor repair, is completed in line with manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy	controls 2.11. Basic electricity/ electronics 2.12. Fundamentals of refrigeration cycle 2.13. Fan motors 2.14. Compressor 2.15. Refrigeration system 2.16. Refrigerants 2.17. Automotive Electrical System 2.18. Aluminum brazing 2.19. RAC Code of Practice 2.20. RA 11058 provisions	
3. Perform refrigerant recovery/ recycling on mobile air-conditioning unit	3.1. Safe working practices are observed throughout the task as per enterprise procedure 3.2. Suitable tools and equipment are selected and used based on job requirement 3.3. Optimum recovery of refrigerant is performed in line with RAC Code of Practice 3.4. Refrigerants recovery/recycling is performed according to manufacturer's recommendations and RAC Code of Practice	3.1. Protective personal equipment/safety gears 3.2. Handling of tools, equipment and accessories 3.3. Safety signs and symbols 3.4. Good housekeeping 3.5. Types of refrigerants 3.6. Parts of refrigerant circuit 3.7. System analyser/Gauge manifold 3.8. Refrigerant identifier 3.9. Weighing scale 3.10. Recovery/recycling Machine 3.11. Recovery cylinder 3.12. Fundamentals of refrigeration cycle 3.13. Recovery and recycling process 3.14. RAC Code of Practice 3.15. DENR-EMB DAO No. 2004-08 3.16. RA 11058 provisions	3.1. Proper handling of refrigerant and refrigeration oil 3.2. Setting up of recovery/ recycling machine 3.3. Recovery/ recycling refrigerants 3.4. Interpersonal skills
4. Test-run repaired unit	4.1. Unit is tested in line with troubleshooting/repair procedures 4.2. Operating parameters are checked and measured in line with manufacturer's testing procedures 4.3. Report on repair and testing of unit is prepared in line with enterprise procedures	4.1. Protective personal equipment/safety gears 4.2. Handling of tools, equipment and accessories 4.3. Safety signs and symbols 4.4. Good housekeeping 4.5. Manufacturer's testing procedures 4.6. Operating parameters 4.7. Point of location for parameter reading	4.1. Applying procedures and techniques in testing repaired units 4.2. Interpreting parameter readings 4.3. Applying safety standards 4.4. Filling up of service reports forms

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		4.8. Safety standards in testing repaired unit 4.9. Service report forms 4.10. RA 11058 provisions	4.5. Using testing instrument 4.6. Data gathering skills 4.7. Interpersonal skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Components	May include but not limited to: 1.1. Switches 1.1.1. AC switch or On/Off Switch 1.1.2. Temperature selector 1.1.3. Blower speed selector ▪ Resistor type ▪ Transistor type 1.1.4. Water temperature sensor 1.1.5. Thermostat/ ▪ Mechanical ▪ Electrical 1.1.6. Thermistor ▪ Electronics 1.1.7. Sensor ▪ Electronics 1.1.8. Pressure switch/sensor 1.1.9. Electronic controls 1.2. Relay/contactor/timer/solenoid 1.3. Damper motors 1.4. Compressor 1.4.1. Magnetic coil/clutch 1.4.2. Pulley assembly 1.4.3. Shaft seal and O-rings 1.5. Fan motors
2. PPE	Includes but not limited to: 2.1. Mask 2.2. Safety shoes 2.3. Safety goggles 2.4. Apron 2.5. Gloves
3. Test	May include: 3.1. Insulation 3.2. Resistance 3.3. Mechanical 3.4. Continuity 3.5. Timing Sequence 3.6. Leak
4. Faults/problem	May include faults/problem on: 4.1. Electrical components 4.2. Mechanical components 4.3. Electro-mechanical components 4.4. Electronic components

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Planned and prepared for troubleshooting and repair 1.2 Identified and repaired faults/troubles 1.3 Performed refrigerant recovery/recycling and retrofitting/ conversion on mobile air-conditioning unit 1.4 Tested-run repaired unit
2. Resource Implications	The following resources must be provided: 2.1 Access to work place location and mockup unit 2.2 Tools and equipment appropriate to troubleshooting and repair 2.3 Materials relevant to the proposed activity 2.4 Drawings and specifications relevant to the task
3. Methods of Assessment	Competency must be assessed through: 3.1 Written test 3.2 Direct observation/Demonstration with oral questioning 3.3 Portfolio
4. Context for Assessment	4.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: PERFORM START-UP, TEST AND COMMISSIONING OF MOBILE AIR CONDITIONING UNIT

UNIT CODE : HVC723350

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes of a technician to perform start-up, testing and commissioning of installed or newly installed MAC unit for cars and vans as well as buses, trucks and trains.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare for start-up, test and commissioning of MAC unit	1.1. Work instructions are read and interpreted to determine job requirements 1.2. Tools and equipment are selected in accordance with job requirements 1.3. Pre-start-up, testing and commissioning checks are completed and complied with manufacturer's manuals. 1.4. Commissioning method and program are produced and recording sheets are prepared in accordance with manufacturer's manuals. 1.5. PPEs are selected in line with job requirements	1.1. Safety signs and symbols 1.2. Manufacturer's manual 1.3. Forms: 1.3.1. work instruction sheet 1.3.2. job order sheet 1.3.3. data sheet 1.3.4. commissioning report form 1.4. Tools and testing instruments/ train diagnostic system 1.5. Personal protective equipment	1.1. Interpret work instructions 1.2. Selection of forms for commissioning 1.3. Selection and safe handling of tools and testing instruments 1.4. selection of proper personal protective equipment 1.5. train diagnostic skills
2. Conduct start-up, test and commissioning of MAC unit	2.1. ***Electrical related checks*** are performed based on manufacturer's manuals. 2.2. ***Refrigerant piping and fitting connection related checks*** are performed based on manufacturer's manuals 2.3. ***Compressor assembly related checks*** are performed based on manufacturer's manuals. 2.4. Temperature and airflow check is performed based on manufacturer's manual 2.5. ***Control panel related checks*** are performed based on manufacturer's manuals and site	2.1. Basic electricity 2.2. Operation of generator 2.3. Electrical control test procedures 2.4. Interlocking control sequence 2.5. Refrigerant piping 2.6. Compressor test procedures 2.7. Power supply test procedures 2.8. Condenser/ evaporator assembly test procedures 2.9. Leak testing procedure 2.10. Refrigerant type test procedure 2.11. Temperature and airflow check procedure 2.12. System operating	2.1. Performing electrical related testing 2.2. Performing pipe and tubing leak testing 2.3. Performing compressor assembly tests 2.4. Performing evaporator/ condenser assembly test 2.5. Performing identification of refrigerants 2.6. Filling-up of start-up and commissioning reports

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	conditions 2.6. System operating pressure and temperature are checked in accordance with manufacturer's manual 2.7. Start-up, testing and commissioning reports are accomplished in line with enterprise policies and procedures	pressure and temperature check procedure 2.13. Start-up and commissioning forms	

RANGE OF VARIABLES

VARIABLE	RANGE
1. Electrical related checks	This includes: 1.1 Power supply source checks 1.2 Safety and circuit protection checks 1.3 Electrical wiring and harness checks 1.4 Grounding systems checks
2. Refrigerant piping and fitting connection related checks	May include: 2.1 Leak testing 2.2 Pipe insulation inspection 2.3 Pipe and fittings inspection
3. Compressor assembly related checks	May include: 3.1 Belt tension and pulley alignment 3.2 Terminal connection inspection 3.3 Compressor and magnetic clutch assembly alignment and clearance
4. Control panel related checks	May include: 4.1 Air flow selector 4.2 Air inlet selector 4.3 Temperature selector 4.4 Blower speed selector 4.5 AC switch

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Prepared for start-up, testing and commissioning of MAC 1.2 Conducted start-up, testing and commissioning of MAC
2. Resource Implications	The following resources **MUST** be provided: 2.1 Work place location 2.2 Tools and equipment appropriate in performing start-up, testing and commissioning refrigeration and air-conditioning systems 2.3 Materials relevant to the proposed activity 2.4 Drawings and specifications relevant to the task
3. Methods of Assessment	Competency must be assessed through: 3.1 Written test 3.2 Direct observation/Demonstration with oral questioning 3.3 Portfolio
4. Context for Assessment	4.1 Competency may be assessed in the work place or in a simulated work place setting

SECTION 3 TRAINING ARRANGEMENTS

These guidelines are set to provide technical and vocational education and training (TVET) providers with information and other important requirements to consider when designing training programs for Land-Based Transport Mobile Air-Conditioning (MAC) NC II.

3.1 CURRICULUM DESIGN

TESDA shall provide the training on the development of competency-based curricula to enable training providers develop their own curricula with the components mentioned below.

Delivery of knowledge requirements for the basic, common and core units of competency specifically in the areas of mathematics, science/technology, communication/language and other academic subjects shall be contextualized. To this end, TVET providers shall develop a Contextual Learning Matrix (CLM) to include green technology, issues on health and drugs and catering to persons with disabilities (PWD's) to accompany their curricula.

Course Title: **LAND-BASED TRANSPORT MAC SERVICING**
PQF Level: **NC II**

Nominal Training Duration: 37 Hours (Basic)
35 Hours (Common)
240 Hours (Core)
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312 Hours
400 Hours - Supervised Industry Learning (SIL)*
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712 Hours - TOTAL

* SIL can be delivered thru Dual Training System (DTS)/Dualized Training Program (DTP) or Enterprise-based Training

Course Description:

This course is designed to equip individual with operational skills in mobile air-conditioning (MAC) servicing which covers competencies that services and maintains, troubleshoots and repairs MAC units as well as competencies in starting-up, testing and commissioning. This includes classroom learning activities and practical work in actual work site or simulation area.

Upon completion of the course, the learners are expected to demonstrate the above-mentioned competencies to be employed. To obtain this, all units prescribed for this qualification must be achieved:

BASIC COMPETENCIES

(37 hours)

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration

1. Participate in workplace communication	1.1. Obtain and convey workplace information	• Describe Organizational policies
		• Read:
		  ○ Effective communication
		  ○ Written communication
		  ○ Communication procedures and systems
		• Identify:
		  ○ Different modes of communication
		  ○ Medium of communication
		  ○ Flow of communication
		  ○ Available technology relevant to the enterprise and the individual's work responsibilities
		• Prepare different Types of question
		• Gather different sources of information
		• Apply storage system in establishing workplace information
		• Demonstrate Telephone courtesy
			• Group discussion
			• Lecture
			• Demonstration
				• Oral evaluation
				• Written examination
				• Observation
					2 hours

	1.2. Perform duties following workplace instructions	• Read:
		  ○ Written notices and instructions
		  ○ Workplace interactions and procedures
		• Read instructions on work related forms/documents
		• Perform workplace duties scenario following workplace instructions
			• Group discussion
			• Lecture
			• Demonstration
				• Oral evaluation
				• Written examination
				• Observation
					2 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration

	1.3. Complete relevant work-related documents	• Describe Communication procedures and systems
		• Read
		  ○ Meeting protocols
		  ○ Nature of workplace meetings
		  ○ Workplace interactions
		  ○ Barriers of communication
		• Read instructions on work related forms/documents
		• Practice:
		  ○ Estimate, calculate and record routine workplace measures
		  ○ Basic mathematical processes of addition, subtraction, division and multiplication
		• Demonstrate office activities in:
		  ○ workplace meetings and discussions scenario
		• Perform workplace duties scenario following simple written notices
		• Follow simple spoken language
		• Identify the different Non-verbal communication
		• Demonstrate ability to relate to people of social range in the workplace
		• Gather and provide information in response to workplace requirements
		• Complete work related documents
			• Group discussion
			• Lecture
			• Demonstration
			• Role play
				• Oral evaluation
				• Written examination
				• Observation
					2 hours

2. Work in a team environment	2.1. Describe team role and scope	• Discussion on the team roles and scope
		• Participate in the discussion
		  ○ Definition of Team
		  ○ Difference between team and group
		  ○ Objectives and goals of team
		• Locate needed information from the different sources of information
			• Lecture/ Discussion
			• Group work
			• Individual work
			• Role play
				• Role play
				• Case study
				• Written test
					1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration

	2.2. Identify one's role and responsibility within team	• Role play
		  ○ Individual role and responsibility
		• Role play
		  ○ Understanding individual differences
		• Discussion on gender sensitivity
			• Role play
			• Lecture/ Discussion
				• Role play
				• Written test
					1 hour

	2.3. Work as a team member	• Participate in group planning activities • Role play : Communication protocols • Participate in the discussion of standard work procedures and practices	• Group work • Role play • Lecture/ Discussion	• Role play • Written test	1 hour
3. Solve/address routine problems	3.1. Identify routine problems	• Review of the current industry hardware and software products and services • Identify correctly the industry maintenance, service and helpdesk practices, processes and procedures • Make use of the industry standard diagnostic tools • Share best practices in determining basic malfunctions and resolutions to general problems in the workplace • Analyze routine/procedural problems	• Group discussion • Lecture • Demonstration • Role playing	• Case Formulation • Life Narrative Inquiry (Interview) • Standardized test	1 hour
	3.2. Look for solutions to routine problems	• Review of the current industry hardware and software products and services • Identify correctly the industry maintenance, service and helpdesk practices, processes and procedures • Make use of the industry standard diagnostic tools • Share best practices in determining basic malfunctions and resolutions to general problems in the workplace • Formulate possible solutions to problems and document procedures for reporting	• Group discussion • Lecture • Demonstration • Role playing	• Case Formulation • Life Narrative Inquiry (Interview) • Standardized test	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	3.3. Recommend solutions to problems	• Discuss standard operating procedures and documentation processes	• Group discussion • Lecture • Demonstration • Role playing	• Case Formulation • Life Narrative Inquiry (Interview) • Standardized test	1 hour
4. Develop Career and Life Decisions	4.1. Manage one's emotion	• Demonstrate self-management strategies that assist in regulating behavior and achieving personal and learning goals • Explain enablers and barriers in achieving personal and career goals • Identify techniques in handling negative emotions and unpleasant situation in the workplace such as frustration, anger, worry, anxiety, etc. • Manage properly one's emotions and recognize situations that cannot be changed and accept them and remain professional • Recall instances that demonstrate self-discipline, working independently and showing initiative to achieve personal and career goals • Share experiences that show confidence, and resilience in the face of setbacks and frustrations and other negative emotions and unpleasant situations in the workplace	• Discussion • Interactive Lecture • Brainstorming • Demonstration • Role-playing	• Demonstration or simulation with oral questioning • Case problems involving workplace diversity issues	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	4.2. Develop reflective practice	• Enumerate strategies to improve one's attitude in the workplace • Explain Gibbs' Reflective Cycle/Model (Description, Feelings, Evaluation, Analysis, Conclusion, and Action plan) • Use basic SWOT analysis as self-assessment strategy • Develop reflective practice through realization of limitations, likes/ dislikes; through showing of self-confidence • Demonstrate self-acceptance and being able to accept challenges	• Small Group Discussion • Interactive Lecture • Brainstorming • Demonstration • 5 Role-playing	• Demonstration or simulation with oral questioning • Case problems involving workplace diversity issues	1 hour
	4.3. Boost self-confidence and develop self-regulation	• Describe the components of self-regulation based on Self-Regulation Theory (SRT) • Explain personality development concepts • Cite self-help concepts (e. g., 7 Habits by Stephen Covey, transactional analysis, psycho-spiritual concepts) • Perform effective communication skills – reading, writing, conversing skills • Show affective skills – flexibility, adaptability, etc. • Determine strengths and weaknesses	• Small Group Discussion • Interactive Lecture • Brainstorming • Demonstration • Role-playing	• Demonstration or simulation with oral questioning • Case problems involving workplace diversity issues	1 hour
5. Contribute to workplace innovation	5.1. Identify opportunities to do things better	• Identify different roles of individuals in contributing to doing things better in the workplace • Appreciate positive impacts and challenges in innovation • Show mastery of the different types of changes and levels of participation in the workplace • Discuss 7-habits of highly effective people	• Interactive Lecture • Appreciative Inquiry • Demonstration • Group work	• Psychological and behavioral Interviews • Performance Evaluation • Life Narrative Inquiry • Review of portfolios of evidence and third-party workplace reports	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
				of on-the-job performance. • Standardized assessment of character strengths and virtues applied	
	5.2. Discuss and develop ideas with others	• Identify different roles of individuals in contributing to doing things better in the workplace • Appreciate positive impacts and challenges in innovation • Show mastery of the different types of changes and levels of participation in the workplace • Discuss 7-habits of highly effective people • Communicate ideas through small group discussions and meetings	• Interactive Lecture • Appreciative Inquiry • Demonstration • Group work	• Psychological and behavioral Interviews • Performance Evaluation • Life Narrative Inquiry • Review of portfolios of evidence and third-party workplace reports of on-the-job performance. • Standardized assessment of character strengths and virtues applied	1 hour
	5.3. Integrate ideas for change in the workplace	• Identify different roles of individuals in contributing to doing things better in the workplace • Appreciate positive impacts and challenges in innovation • Show mastery of the different types of changes and levels of participation in the workplace • Discuss 7-habits of highly effective people • Communicate ideas through small group discussions and meetings	• Interactive Lecture • Appreciative Inquiry • Demonstration • Group work	• Psychological and behavioral Interviews • Performance Evaluation • Life Narrative Inquiry • Review of portfolios of evidence and third-party	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		• Demonstrate basic skills in data analysis		workplace reports of on-the-job performance. • Standardized assessment of character strengths and virtues applied	
6. Present relevant information	6.1. Gather data/ information	• Lecture and discussion on: ○ Organizational protocols ○ Confidentiality and accuracy ○ Business mathematics and statistics ○ Legislation, policy and procedures relating to the conduct of evaluations • Reviewing data/ information	• Group discussion • Lecture • Demonstration • Role Play	• Oral evaluation • Written Test • Observation • Presentation	2 Hours
	6.2. Assess gathered data/ information	• Lecture and discussion on: ○ Data analysis techniques/ procedures ○ Organizational values, ethics and codes of conduct ○ Trends and anomalies • Computing business mathematics and statistics • Application of data analysis techniques	• Group discussion • Lecture • Demonstration • Role Play • Practical exercises	• Oral evaluation • Written Test • Observation • Presentation	3 Hours
	6.3. Record and present information	• Lecture and discussion on: ○ Reporting requirements to a range of audiences ○ Recommendations for possible improvements • Analysis and comparison of interim and final reports' outcomes • Reporting of data findings	• Group discussion • Lecture • Demonstration • Role Play • Practical exercises	• Oral evaluation • Written Test • Observation • Presentation	3 Hours
7. Practice Occupational Safety And Health Policies And Procedures	7.1. Identify OSH compliance requirements	• Discussion regarding: ○ Hierarchy of Controls ○ Hazard Prevention and Controls ○ Work Standards and Procedures ○ Personal Protective Equipment	• Lecture • Group Discussion	• Written Exam • Demonstration • Observation • Interviews / • Questioning	1 Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	7.2. Prepare OSH requirements for compliance	• Identification of required safety materials, tools and equipment • Handling of safety control resources	• Lecture • Group Discussion	• Written Exam • Demonstration • Observation • Interviews / • Questioning	1 Hour
	7.3. Perform tasks in accordance with relevant OSH policies and procedures	• Discussion of General OSH Standards and Principles • Performing industry related work activities in accordance with OSH Standards	• Lecture • Group Discussion	• Written Exam • Demonstration • Observation • Interviews / • Questioning	2 Hours
8. Exercise Efficient and Effective Sustainable Practices in the Workplace	8.1. Identify the efficiency and effectiveness of resource utilization	• Discussion on the process how Environmental Policies coherence is achieved • Discussion on Necessary Skills in response to changing environmental policies needs ○ Waste Skills ○ Energy Skills ○ Water Skills ○ Building Skills ○ Transport Skills ○ Material Skills	• Lecture • Group Discussion • Simulation • Demonstration	• Written Exam • Demonstration • Observation • Interviews / • Questioning	1 Hour
	8.2. Determine causes of inefficiency of resource utilization	• Discussion of Environmental Protection and Resource Efficiency Targets • Analysis on the Relevant Work Procedure	• Lecture • Group Discussion • Demonstration	• Written Exam • Demonstration • Observation • Interviews / • Questioning	1 Hour
	8.3. Convey inefficient and ineffective environmental practices	• Identification of (re)training needs and usage of environment friendly methods and technologies • Identification of environmental corrective actions • Practicing Environment Awareness	• Lecture • Group Discussion • Role Play • Demonstration	• Written Exam • Demonstration • Observation • Interviews / • Questioning	1 Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
9. Practice Entrepreneurial Skills in the Workplace	9.1. Apply entrepreneurial workplace best practices	• Case studies on Best entrepreneurial practices • Discussion on Quality procedures and practices • Case studies on Cost consciousness in resource utilization	• Case Study • Lecture/Discussion	• Case Study • Written Test • Interview	1 Hour
	9.2. Communicate entrepreneurial workplace best practices	• Discussion on communicating entrepreneurial workplace best practices	• Lecture/Discussion	• Written Test • Interview	1 Hour
	9.3. Implement cost-effective operations	• Case studies on Preservation, optimization and judicious use of workplace resources	• Case Study • Lecture/Discussion	• Case Study • Written Test • Interview	2 Hours

COMMON COMPETENCIES
35 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
1. Prepare materials and tools	1.1 Identify materials and tools	• Read and familiarize ○ Different work specifications ○ Types, uses and description of HVAC/R materials and accessories ○ Types, uses and description of HVAC/R tools ○ List of materials as per company standards • Identify and prepare tools according to the job requirements • Identify and prepare materials and accessories according to the job requirements	• Lecture-demonstration • Group discussion • PowerPoint presentation	• Written • Practical / Performance Test	1 hour
	1.2 Request materials and tools	• Read and familiarize ○ Work requirements ○ Types and uses of HVAC/R materials & tools ○ Material take-off ○ Requisition procedures • Prepare material take-off • Request materials and tools	• Simulation/ Demonstration • Discussion	• Written • Practical / Performance Test	1 hour
	1.3 Receive and inspect materials and tools	• Read and familiarize ○ Policy on receiving material deliveries ○ Material and tools quality and defects ○ Material handling • Check and inspect materials and tools • Store/stack tools and materials	• Lecture/ discussion • Demonstration	• Written / Oral Test • Demonstration • Practical Exercise	1 hour
2. Interpret technical drawings and plans	2.1. Analyze signs, symbols and data	2.1.1. Read and familiarize ○ Blueprint reading and plan specifications - Electrical plan, symbols & abbreviations ○ Written communication ○ Signs and symbols	• Discussion • Lecture • Modular	• Written • Practical / Performance Test	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		- Electrical and Mechanical ○ Parts and specification 2.1.2. Identify signs and symbols 2.1.3. Interpret different type of plans			
	2.2. Interpret technical drawings and plans	2.2.1. Read and familiarize ○ Alphabet of lines ○ Orthographic drawings ○ Perspective view ○ Trade mathematics/ Mensuration ○ Types technical plans ○ Notes and specifications 2.2.2. Perform drawing exercises 2.2.3. Perform technical plan interpretation 2.2.4. Follow measuring procedures •	• Discussion • Lecture • Modular	• Written • Practical / Performance Test	2 hour
	2.3. Apply freehand sketching	2.3.1. Read and familiarize ○ Drawing conventions ○ Dimensioning Conventions ○ Trade mathematics 2.3.2. Trace electrical/electronic/RAC schematics and drawings 2.3.3. Perform measurement 2.3.4. Sketch drawings and plans 2.3.5. Sketch pictures 2.3.6. Compute formulas 2.3.7. Use drawing instruments	• Discussion • Lecture • Modular	• Written • Practical / Performance Test	2 hour
3. Observe procedures, specifications and manuals of instructions	3.1 Identify and access specifications and manuals	• Read and familiarize ○ Types of manuals used in HVAC/R ○ Identification of symbols used in the manuals • Identify manuals and specifications • Access information and data	• Discussion • Lecture	• Oral questioning • Written Test	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
	3.2 Interpret manuals	• Read and familiarize o Types of manuals used in HVAC/R o Types of symbols used in manuals o System of measurements o Unit conversion • Interpret symbols and specifications • Access information and data • Compute/Determine conversion of units of measurements	• Discussion • Lecture • Modular	• Written • Practical / Performance Test	1 hour
	3.3 Apply information in manuals	• Read and familiarize o Types of manuals used in HVAC/R o Types and application of symbols in manuals o Unit conversion • Apply information from manuals	• Discussion • Lecture • Demonstration • Group discussion	• Demonstration (able to impart knowledge and skills) • Practical and oral exam	1 hour
	3.4 Store Manual	• Read and familiarize o types of manuals used in HVAC/R o Manual storing and maintenance procedures • Store and maintain manuals	• Demonstration • Group discussion	• Demonstration • Practical and oral exam	1 hour
4. Perform mensuration and calculation	4.1 Select measuring instruments;	• Identify category and types of measuring tools and its uses • Select measuring instruments as per category • Interpret shapes and dimensions of objects/components	• Lecture • Group discussion	• Written examination • Oral evaluation	1 hour
	4.2 Carry-out measurements and calculations	• Read o Measurements - Linear measurement - Geometrical measurement o Trade Mathematics - Unit conversion - Ratio and proportion - Area	• Lecture • Group discussion • Problem analysis	• Written examination • Oral evaluation • Problem solving	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		• Interpret formulas for volume, areas, perimeters of plane and geometric figures • Perform measurement • Compute measurement formulas			
	4.3 Maintain measuring instruments	• Identify and practice safe handling procedures in using measuring instruments • Describe procedures on maintenance of measuring instruments • Demonstrate proper cleaning and storage of measuring instruments	• Lecture • Demonstration • Group discussion • Simulation	• Written examination • Oral evaluation	1 hour
5. Perform basic bench work	5.1 Prepare materials, tools and equipment	• Read and familiarize o Communication methods o Work plan interpretation o Materials, tools and equipment; uses and specifications • Interpret work plan • List and prepare materials, tools and equipment needed	• Self-paced instruction • Film viewing • Direct laboratory experience • Group discussion	• Written test/ examination • Demonstration • Direct Observation	1 hour
	5.2 Lay-out and mark dimensions/ features on workplace	• Read and familiarize o Measuring tools; functions and use o Communication principles o Trade mathematics o Mensuration o Calculation o Conversion o Plan specifications • Plan drawing/lay-outing activity • Perform measuring activity • Perform marking and labeling activity	• Self-paced instruction • Film viewing • Direct laboratory experience • Group discussion • Industry Immersion	• Interview • Demonstration • Direct Observation	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration

	5.3 Perform required basic metal works	• Read and familiarize
		  ○ Tools and equipment: use and specifications
		  ○ Grinding, cutting, drilling, filing techniques
		  ○ Basic welding principles and application
		  ○ Applied occupational health and safety (OH&S)
		• Perform measuring activity
		• Perform grinding activity
		• Perform cutting activity
		• Perform drilling activity
		• Perform filing activity
		• Perform welding activity
			• Self -paced Instruction
			• Film viewing
			• Direct laboratory experience
			• Group discussion
				• Interview
				• Written test/ examination
				• Observation with questioning
				• Demonstration with questioning
					2 hours

6. Perform basic electrical works	6.1 Prepare electrical tools and test instruments	• Read and familiarize
		  ○ Uses of tools and testing instruments
		  ○ Calibration of testing instruments
		  ○ Safe handling and proper care of tools and testing instruments
		  ○ Communication (oral and written)
		• Calibrate and testing of instruments
		• Interpret work plans
		• Identify and prepare electrical tools and test instruments
			• Self -paced Instruction
			• Film viewing
			• Direct laboratory experience
			• Group discussion
			• Industry immersion
				• Interview
				• Written test/ examination
				• Observation with questioning
				• Demonstration with questioning
					1 hour

	6.2 Test power supply and electrical components	• Read and familiarize
		  ○ Functions and uses of testing instruments
		  ○ Basic electricity
		  ○ Electrical safety and hazards
		  ○ Testing procedures
		• Perform resistance reading
		• Perform voltage reading
		• Perform continuity testing
		• Perform current reading
		• Perform ground testing
			• Self -paced Instruction
			• Film viewing
			• Group discussion
				• Interview
				• Written test/ examination
				• Observation with questioning
				• Demonstration with questioning
					1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration

	6.3 Perform basic electrical repair	• Read and familiarize
		  ○ Types of electrical fixtures
		  ○ Electrical joints and splices
		  ○ Electrical safety and hazards
		  ○ Applied occupational health & safety (OH&S)
		• Repair minor electrical system troubles
		• Test simple electrical components and connections
			• Self-paced instruction
			• Film viewing
			• Direct laboratory experience
			• Industry Immersion
			• E-learning
				• Interview
				• Written test/ examination
				• Observation with questioning
				• Demonstration with questioning
					2 hours

7. Maintain tools and equipment	7.1 Check the conditions of tools and equipment	• Read and familiarize safety practices
		  ○ handling of tools and equipment
		  ○ good housekeeping
		  ○ materials, tools and equipment
		  ▪ types and uses of cleaning materials
		  ▪ types and uses of HVAC/R tools
		  ▪ types and uses of HVAC/R equipment
		  ○ operational conditions of HVAC/R tools and equipment
		  ○ HVAC/R tools and equipment defects
		  ○ Maintaining tools and equipment
		• Observe proper handling of tools and equipment
		• Identify tools and equipment defects
			• Small Group Discussion
			• Demonstration of Practical Skills
				• Observation and Oral questioning
				• Demonstration and Oral questioning
				• Written test
					1 hour

	7.2 Perform basic preventive maintenance	• Read and familiarize safety practices
		  ○ use of PPE
		  ○ good housekeeping
		  ○ usage of materials, tools and equipment
		  ▪ types and uses of lubricants
		  ▪ types and uses of cleaning materials
		  ▪ types and uses of HVAC/R equipment
		  ○ Preventive maintenance on tools and equipment
		  ▪ Methods and techniques
		  ▪ Procedures
			• Simulation
			• Group discussion
			• Practical Lab
			• Demonstration
				• Observation and Oral questioning
				• Demonstration and Oral questioning
				• Written test
					2 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		• Practice proper handling of tools and equipment • Perform preventive maintenance on tools and equipment			

	7.3 Store tools and equipment	• Read and familiarize safety practices
		  ○ Handling of tools and equipment
		  ○ good housekeeping
		  ○ Storing procedures and techniques
		  ○ Storage conditions/ locations
		• Store tools and equipment
			• Demonstration
			• Group discussion
			• Practical Lab
				• Practical exam
				• Direct observation
				• Written test
					1 hour

8. Perform housekeeping and safety practices	8.1 Sort materials, tools and equipment	• Read and familiarize
		  ○ Classification of tools, equipment and materials
		  ▪ Consideration in the selection of appropriate areas for storing materials, tools and equipment
		  ▪ Sorting procedures and considerations
		  ▪ Identify tools, equipment and materials
		  ▪ Perform sorting activities
			• Self-paced instruction
			• Film viewing
			• Direct laboratory experience
			• Group discussion Industry Immersion
				• Interview
				• Written test/ examination
				• Observation with questioning
				• Demonstration with questioning
					1 hour

	8.2 Clean workplace area, materials, tools and equipment	• Read and familiarize
		  ○ Cleaning materials, types and applications.
		  ○ Procedures in cleaning workplace area, tools and equipment.
		  ○ Consideration of a safe workplace area, tools and equipment
		  ○ Identification of cleaning materials and its applications
		• Apply procedures in cleaning workplace area, tools and equipment
			• Self-paced instruction
			• Film viewing
			• Direct laboratory experience
			• Group discussion
			• Immersion
				• Interview
				• Written test/ examination
				• Observation with questioning
				• Demonstration with questioning
					1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration

	8.3 Systematize dispensing and retrieval of materials, tools and equipment	• Read and familiarize
		  ○ Procedures in dispensing and retrieval of materials; tools, and equipment
		  ○ Things to be considered in returning the borrowed tools and equipment.
		• Apply procedures in dispensing and retrieval of materials; tools, and equipment
			• Self-paced instruction
			• Film viewing
			• Direct laboratory experience
			• Group discussion
			• Immersion
				• Interview
				• Written test/ examination
				• Observation with questioning
				• Demonstration with questioning
					1 hour

	8.4 Identify and minimize/ eliminate hazards	• Read and familiarize
		  ○ Composition of safety committee
		  ○ Policies and procedures in controlling risk
		  ○ Basic first aid procedure
		  ○ Safety signs and hazards warning preparation
		  ○ Equipment and safety devices
		  ○ Safe handling technique in using equipment and safe devices.
		  ○ roles of safety committee
		• Identify safety signs and workplace hazards
		• Demonstrate the first aid procedure
		• Demonstrate safe handling of equipment and safety devices
			• Self-paced instruction
			• Film viewing
			• Direct laboratory experience
			• Group discussion
			• Industrial/Plant visit
				• Interview
				• Written test/ examination
				• Observation with questioning
				• Demonstration with questioning
					1 hour

	8.5 Respond and record accidents	• Read and familiarize
		  ○ Types of accidents
		  ○ Procedures in applying first aid /treatment
		  ○ First aid supplies
		  ○ Steps in responding to and recording accidents
		• Demonstrate first aid/ treatment procedures
		• Prepare incident/ accident report
			• Self-paced instruction
			• Film viewing
			• Direct laboratory experience
			• Group discussion
				• Interview
				• Written test/ examination
				• Observation with questioning
				• Demonstration with questioning
					1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration

	8.6 Follow basic securities	• Read and familiarize
		  ○ Basic security procedures
		  ○ Security signs and symbols
		  ○ Loss control management
		  ▪ Hazards
		  ▪ Safety signs
		• Apply basic security procedures
		• Prepare incident/ accident report
			• Small Group Discussion
			• Demonstration of Practical Skills
			• Modular
			• Self-paced instruction
			• Film viewing
			• Demonstration Group discussion
				• Actual demonstration
				• Written test/exam
				• Observation
				• Oral questioning
					1 hour

9. Document work accomplished	9.1 Identify forms and data	• Read and familiarize
		  ○ Selecting and interpreting forms
		  ○ Interpreting work accomplished
		  ○ Data gathering techniques
		• Identify and interpret forms and data
			• Lecture
			• Discussion
			• Group work
				• Interview
				• Written
				• demonstration with questioning
					1 hour

	9.2 Prepare reports	• Read and familiarize
		  ○ Details of work completion
		  ○ Kinds of reports
		  ○ Preparation of reports
		• Prepare completion/ accomplishment reports
			• Lecture
			• Discussion
			• Group work
				• demonstration with questioning	1 hour

CORE COMPETENCIES

640 Hours (240 Hours in-school + 400 Hours SIL)

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration

1. Service and maintain mobile air-conditioning units
 	
(136 hrs)
	1.1. Clean and replace air filter	• Lecture and discussion on:
		  ○ Protective personal equipment/safety gears
		  ○ Safety signs and symbols
		  ○ Types of air filters
		  ○ Cleaning agents
		  ○ Servicing and maintenance procedures
		  ○ Cleaning air filter procedures
		  ○ RA 11058 provisions
		• Identify and pull out/dismantle air filter as per SOP
		• Check for damage and replace if needed according to filter specifications
		• Clean air filter with appropriate cleaning tools and procedures
			• Lecture
			• Demonstration
			• Trainee Hands-on
			• SIL
				• Interview
				• Written test/ examination
				• Direct Observation with questioning
				• Demonstration with questioning
					8 hours

	1.2. Recover and recycle refrigerants	• Lecture and discussion on:
		  ○ Fundamentals of refrigeration
		  ○ Types of refrigerants
		  ○ Refrigerant identifier
		  ○ System analyzer/Gauge manifold
		  ○ Operation of recovery/recycling machine
		  ○ Recovery and recycling process
		  ○ Proper storage of refrigerants
		  ○ RAC Code of Practice - recovery/recycling of refrigerants
		• Assess transport air-conditioning unit for recovery/recycling of refrigerants
		• Set-up equipment for recovery/recycling as per manufacturer's instruction
		• Perform recovery/recycling of refrigerants
			• Lecture
			• Demonstration
			• Trainee Hands-on
			• SIL
				• Interview
				• Written test/ examination
				• Direct Observation with questioning
				• Demonstration with questioning
					24 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration

	1.3. Service evaporator/ condenser assembly	• Lecture and discussion on:
		  ○ Types of cleaning solutions
		  ○ Types of evaporator/ condenser assembly
		  ○ Nitrogen and nitrogen regulator
		  ○ Electrical/electric controls
		  ○ Basic electricity/ electronics
		  ○ Cleaning evaporator/ condenser assembly procedures
		  ○ Tools for dismantling the evaporator/ condenser
		  ○ High pressure washer proper usage and settings
		• Disassemble the evaporator/ condenser
		• Clean evaporator/condensing coil using high pressure washer as per established procedures
		• Use appropriate cleaning agent or non-corrosive chemical in cleaning evaporator/condenser parts, components and accessories
		• Flush evaporator/condenser assembly using environment friendly flushing solution and oxygen-free nitrogen (OFN)
		• Assemble evaporator/condenser based on manufacturer's service manual
			• Lecture
			• Demonstration
			• Trainee Hands-on
			• SIL
				• Interview
				• Written test/ examination
				• Direct Observation with questioning
				• Demonstration with questioning
					24 hours

	1.4. Perform leak testing, evacuation and charging	• Lecture and discussion on :
		  ○ Vacuum pump set-up and operation
		  ○ Usage of vacuummeter
		  ○ Leak testing procedure
		  ○ Evacuation procedure
		  ○ Charging procedure
		• Perform leak testing as per manufacturer's service manual
		• Perform evacuation
			• Lecture
			• Demonstration
			• Trainee Hands-on
			• SIL
				• Interview
				• Written test/ examination
				• Direct Observation with questioning
				• Demonstration with questioning
					24 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		• Perform charging • Check operating parameters			
	1.5. Service compressor assembly, pulley and belt	• Lecture and discussion on: ○ Types of compressor ○ Types of belts ○ Belt tensioner and Belt tension gauge ○ Compressor assembly ○ Compressor parameters ○ Belts and pulleys • Service magnetic clutch based on manufacturer's instruction • Maintain belt tension and alignment of compressor and pulley • Check compressor parameters as per manufacturer's service manual • Check belt for damage and replace if needed • Service loose tube and hose fittings	• Lecture • Demonstration • Trainee Hands-on • SIL	• Interview • Written test/ examination • Direct Observation with questioning • Demonstration with questioning	24 hours
	1.6. Service electrical power and control circuits	• Lecture and discussion on: ○ Types of electrical controls ○ Fuses and terminal sockets ○ Electrical/electronic controls ○ Electrical troubleshooting techniques • Use appropriate instrument in checking power supply and diagnosing electrical control system • Check and repair loose connections/wirings • Service electrical controls • Check grounding in line with SOP	• Lecture • Demonstration • Trainee Hands-on • SIL	• Interview • Written test/ examination • Direct Observation with questioning • Demonstration with questioning	24 hours
	1.7. Accomplish service and maintenance report	• Lecture and discussion on: ○ Service report forms ○ Mensuration ○ Enterprise policies and procedures • Prepare report on all defects and	• Lecture • Demonstration • Trainee Hands-on	• Interview • Written test/ examination • Direct Observation	8 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		problems encountered • Prepare observation report and recommendation for service and maintenance	• SIL	with questioning • Demonstration with questioning	
		• **Supervised Industry Learning (SIL)**			**240** hours
2. Troubleshoot and repair mobile air-conditioning systems (72 hrs)	2.1. Plan and prepare for troubleshooting and repair on MAC systems	• Lecture and discussion on: ○ Electrical plans, symbols and abbreviations ○ Installation drawings and component instructions ○ schematic and pictorial diagrams of mobile air-conditioning systems ▪ Electrical ▪ Mechanical ○ Manufacturer's manual for mobile air-conditioning systems ○ Appropriate materials, tools and equipment for troubleshooting and repair ○ Troubleshooting and repair procedures • Interpret schematic diagram • Prepare materials, tools and equipment • Prepare troubleshooting and repair work on mobile air-conditioning system	• Lecture • Demonstration • Trainee Hands-on • SIL	• Interview • Written test/ examination • Direct Observation with questioning • Demonstration with questioning	16 hours
	2.2. Identify and repair faults/ troubles on MAC systems	• Lecture and discussion on: ○ safety procedures in troubleshooting and repairing ○ functions and testing procedures of mobile air-conditioning parts and accessories ○ processes in fault finding	• Lecture • Demonstration • Trainee Hands-on • SIL	• Interview • Written test/ examination • Direct Observation with questioning • Demonstration	24 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		○ service manuals ○ RAC Code of Practice ○ service manuals and service report forms • Apply safety procedure in troubleshooting and repair • Use appropriate testing instrument • Select components and replacement • Repair defective/faulty components • Prepare testing and repair work report on mobile air-conditioning system		with questioning	
	2.3. Perform refrigerant recovery/ recycling on MAC unit	• Lecture and discussion on: ○ Procedures in identifying refrigerants ○ Effects of refrigerants in the ozone layer and climate ○ Types of recovery machine ○ Methods of recovery/ recycling of refrigerants ○ Evacuation procedures ○ RAC Code of Practice • Apply safe handling of refrigerants • Perform recovery/recycling of refrigerants • Perform evacuation procedure	• Lecture • Demonstration • Trainee Hands-on • SIL	• Interview • Written test/ examination • Direct Observation with questioning • Demonstration with questioning	16 hours
	2.4. Test-run repaired MAC unit	• Lecture and discussion on: ○ Enterprise testing procedure ○ Point of location for parameter reading ○ Service report form • Test repaired unit as per troubleshooting procedures • Check and monitor operating parameters • Prepare service reports forms	• Lecture • Demonstration • Trainee Hands-on • SIL	• Interview • Written test/ examination • Direct Observation with questioning • Demonstration with questioning	16 hours
		• **Supervised Industry Learning (SIL)**			**120** hours
3. Perform start-up, test and commissioning	3.1. Prepare for start-up, test and commissioning	• Lecture and discussion on: ○ Schematic diagrams and symbols ○ Service report forms	• Lecture • Demonstration • Trainee Hands-	• Interview • Written test/ examination	8 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
for mobile air-conditioning unit (32 hrs)	of MAC unit	○ Testing instruments ○ PPE • Interpret schematic diagram • Interpret service report form data • Prepare testing instruments	on • SIL	• Direct Observation with questioning • Demonstration with questioning	
	3.2. Conduct start-up, test and commissioning of MAC unit	• Lecture and discussion on: ○ Testing points & procedures (electrical/mechanical) ○ Interlocking control sequence ○ operation sequence ○ Commissioning forms • Perform: ○ compressor test procedures ○ power supply test procedures ○ evaporator assembly test procedures ○ condenser assembly test procedures ○ thermostatic expansion valve test procedures ○ electrical control test procedures ○ leak testing procedure ○ pressure testing procedure • Fill up commissioning report forms	• Lecture • Demonstration • Trainee Hands-on • SIL	• Interview • Written test/ examination • Direct Observation with questioning • Demonstration with questioning	24 hours
		• **Supervised Industry Learning (SIL)**			**40** hours

*Note: SIL – supervised-industry learning/exposure in actual work environment is included in the nominal training duration. SIL of trainees may be conducted in different companies or service areas, e.g. car and van aircon service, buses, trucks service company and train company.

3.2 TRAINING DELIVERY

1. The delivery of training shall adhere to the design of the curriculum. Delivery shall be guided by the principles of competency-based TVET.

    a. Course design is based on competency standards set by the industry or recognized industry sector; (Learning system is driven by competencies written to industry standards)

    b. Training delivery is learner-centered and should accommodate individualized and self-paced learning strategies;

    c. Training can be done on an actual workplace setting, simulation of a workplace and/or through adoption of modern technology.

    d. Assessment is based in the collection of evidence of the performance of work to the industry required standards;

    e. Assessment of competency takes the trainee's knowledge and attitude into account but requires evidence of actual performance of the competency as the primary source of evidence.

    f. Training program allows for recognition of prior learning (RPL) or current competencies;

    g. Training completion is based on satisfactory performance of all specified competencies.

2. The competency-based TVET system recognizes various types of delivery modes, both on-and off-the-job as long as the learning is driven by the competency standards specified by the industry. The following training modalities and their variations/components may be adopted singly or in combination with other modalities when designing and delivering training programs:

    2.1. Institution- Based:

    - **Dual Training System (DTS)/Dualized Training Program (DTP)** which contain both in-school and in-industry training or fieldwork components. Details can be referred to the Implementing Rules and Regulations of the DTS Law and the TESDA Guidelines on the DTP;

    - **Distance learning** is a formal education process in which majority of the instruction occurs when the students and instructor are not in the same place. Distance learning may employ correspondence study, audio, video, computer technologies or other modern technology that can be used to facilitate learning and formal and non-formal training. Specific guidelines on this mode shall be issued by the TESDA Secretariat.

    - The **traditional classroom-based or in-center instruction** may be enhanced through use of learner-centered methods as well as laboratory or fieldwork components.

2.2. Enterprise-Based:

- **Formal Apprenticeship** – Training within employment involving a contract between an apprentice and an enterprise on an approved apprenticeable occupation.

- **Informal Apprenticeship** - is based on a training (and working) agreement between an apprentice and a master craftsperson wherein the agreement may be written or oral and the master craftsperson commits to training the apprentice in all the skills relevant to his or her trade over a significant period of time, usually between one and four years, while the apprentice commits to contributing productively to the work of the business. Training is integrated into the production process and apprentices learn by working alongside the experienced craftsperson.

- **Enterprise-based Training-** where training is implemented within the company in accordance with the requirements of the specific company. Specific guidelines on this mode shall be issued by the TESDA Secretariat.

2.3. Community-Based:

- **Community-Based Training** – short term programs conducted by non-government organizations (NGOs), LGUs, training centers and other TVET providers which are intended to address the specific needs of a community. Such programs can be conducted in informal settings such as barangay hall, basketball courts, etc. These programs can also be mobile training program (MTP).

3.3 TRAINEE ENTRY REQUIREMENTS

Trainees or students wishing to enroll in this program must possess the following requirements.

- Must have completed at least 10 yrs. basic education or an ALS certificate of achievement with grade 10 equivalent holder
- Can communicate both oral and written
- Can perform basic mathematical computation

This list does not include specific institutional requirements such as educational attainment, appropriate work experience, and others that may be required of the trainees by the school or training center delivering the TVET program.

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS LAND-BASED TRANSPORT MAC SERVICING NC II

Recommended list of tools, equipment and materials for the training of 25 trainees for Land-based Transport MAC Servicing NC II.

Up-to-date tools, materials, and equipment of equivalent functions can be used as alternatives. This also applies in consideration of community practices and their availability in the local market.

TOOLS		
Quantity	**Unit**	**Description / Specification**
6	sets	System Analyzer
6	pcs	Adjustable wrench, 12”
6	pcs	Adjustable wrench, 8”
3	sets	Open end wrench
3	sets	Box wrench
3	sets	Allen wrench
5	sets	Hacksaw
5	pcs	Rubber mallet
5	pcs	Ballpein hammer
10	pcs	Files, assorted
3	sets	Socket wrench
3	sets	Screw drivers
5.	pcs	Long nose plier
5	pcs	Side Cutter
5	pcs	Crimping tools
5	pcs	Vise grip
2	pcs	Bearing puller
1	set	Hole saw
2	sets	Oil pump
5	sets	Flaring tools
5	sets	Swaging tools
5	pcs	Tube cutter
5	pcs	Tube bender, lever type, ¼”, 5/16, 3/8, ½
5	pcs	Tube bender, spring type, ¼”, 5/16, 3/8, ½
5	pcs	Refrigeration ratchet
6	sets	Quick coupler connector for R134a, high and low
2	sets	Valve core remover
5	pcs	Push pull rule
5	pcs	Steel rule
5	sets	Soldering iron
2	units	Portable drill
1	unit	Portable grinder
1	set	Puncher, center
5	sets	Multitester
5	sets	Thermometer, digital
10	pcs	Service cylinder, 2.5 kg
3	units	Vacuum gauge

EQUIPMENT		
Quantity	**Unit**	**Description / Specification**
2	units	Recovery/recycling machine
3	units	Vacuum pump
1	unit	Pressure washer
1	unit	Refrigerant identifier
2	sets	Oxyacetylene unit
2	sets	Nitrogen cylinder w/ regulator
2	sets	Charging cylinder , R134a
2	units	Digital weighing scale
1	unit	Portable welding machine
1	unit	Air compressor
5	units	Auxiliary fan
5	units	Evaporator assembly
5	units	Condenser assembly
5	units	Compressor assembly
2	units	Mobile air conditioning trainer

MATERIALS		
Quantity	**Unit**	**Description / Specification**
1	pc	Refrigerant tank/cylinder R 134a / *407C – for train
5	pcs	Expansion valve
1	gal	Synthetic oil
1	roll	Copper tube, 3/8”
1	roll	Copper tube, ¼”
1	pc	Flexible pipe, discharge line
1	pc	Flexible pipe, suction line
10	sets	Fittings, discharge line
10	sets	Fittings, suction line
1	roll	Automotive wire #12
1	roll	Automotive wire #14
5	rolls	Electrical tape
100	pcs	Assorted types of clamps
10	liter	Universal flushing agent
100	pcs	Assorted types of flare nuts
100	pcs	Assorted types of nuts and bolts, Metric
100	pcs	Terminal clips
100	pcs	Assorted types of O-ring
50	pcs	Silver rod
50	pcs	Aluminum rod
5	can	Aluminum flux
5	can	Silver flux
3	pcs	Thermostat, auto aircon
3	pcs	Thermostat, electronic w/ thermistor
2	cylinders	Nitrogen gas
5	pcs	ignition lighter
5	boxes	Rags
5	boxes	Soap
10	pcs	Sand paper
5	pcs	Sealant

MATERIALS		
Quantity	**Unit**	**Description / Specification**
5	pcs	Pressure switch
5	pcs	Control resistor
5	pcs	Ambient sensor

Note: Subject to conformity of the health and safety protocols

3.5 TRAINING FACILITIES
LAND-BASED TRANSPORT MAC SERVICING NC II

Based on a class intake of 25 students/trainees.

SPACE REQUIREMENTS	Space (m)	Area in Sq. Meters	Qty	Total Area in Sq. Meters
A. LECTURE AREA*	6 x 8	48	1	48
B. WORKSHOP AREA	6 x10	60	1	60
C. LEARNING RESOURCE AREA	4 x 4	16	1	16
D. TOOL/STORAGE AREA*	3 x 4	12	1	12
E. WASH, TOILET AND LOCKER ROOM*	3 x 4	12	1	12
TOTAL				148
F. FACILITIES/EQUIPMENT/ CIRCULATION				45
TOTAL AREA				**193**

*Common facilities for all HVAC/R Courses

NOTES: Access to and use of equipment /facilities can be provided through cooperative arrangements or MOA with other partner-companies

Subject to conformity of the health and safety protocols

3.6 TRAINER'S QUALIFICATION FOR HVAC/R SECTOR
LAND-BASED TRANSPORT MAC SERVICING NC II

- Holder of National TVET Trainers Certificate (NTTC) Level I in Land-Based Transport Mobile Air-Conditioning (MAC) Servicing NC II or Automotive Servicing NC III or
  Graduate of BSIE/BTTE/BTVTEd - Major in RAC and with Land-Based Transport Mobile Air-Conditioning (MAC) Servicing NC II or Automotive Servicing NC III certificate
- Must be computer literate
- Must have at least two (2) years related industry experience within the past 5 years

3.7 INSTITUTIONAL ASSESSMENT

Institutional Assessment is gathering of evidences to determine the achievements of the requirements of the qualification to enable the trainer make judgement whether the trainee is competent or not competent.

SECTION 4. ASSESSMENT AND CERTIFICATION ARRANGEMENT

Competency Assessment is the process of collecting evidence and making judgments whether competency has been achieved. The purpose of assessment is to confirm that an individual can perform to the standards expected at the workplace as expressed in relevant competency standards.

The assessment process is based on evidence or information gathered to prove achievement of competencies. The process may be applied to an employable unit(s) of competency in partial fulfillment of the requirements of the national qualification.

4.1 NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

4.1.1 To attain the National Qualification of **Land-Based Transport Mobile Air-Conditioning (MAC) Servicing NC II**, the candidate must demonstrate competence in all the units listed in Section 1. Successful candidates shall be awarded a National Certificate signed by the TESDA Director General.

4.1.2 The qualification of **Land-Based Transport Mobile Air-Conditioning (MAC) Servicing NC II** may be attained through demonstration of competence through project-type assessment covering all required units of the qualification.

4.1.3 Assessment shall focus on the core units of competency. The basic and common units shall be integrated or assessed concurrently with the core units.

4.1.4 The following are qualified to apply for assessment and certification:

4.1.4.1 Graduates of formal, non-formal and informal including enterprise-based training programs

4.1.4.2 Experienced Workers in MAC and RAC servicing for at least 2 years (wage employed or self-employed)

4.1.5 **Recognition of Prior Learning (RPL).** Candidates who have gained competencies through previous work or life experiences, education, and informal training related to all the core competencies may apply for recognition in the qualification through Portfolio Assessment in accordance with the provision of **TESDA Circular No. 59, Series of 2020.**

4.1.6 The existing National Certificate (NC) and Certificate of Competency (COC) of individuals in Transport RAC Servicing NC II will still be in effect until the said NC and COC will have expired. Individuals are advised to take the assessment for this amended/updated TR on or before the expiration of such certificates.

4.1.7 The guidelines on assessment and certification are discussed in detail in the "Operating Procedures on Assessment and Certification" and "Guidelines on the Implementation of the Philippine TVET Competency Assessment and Certification System (PTCACS)".

4.2 COMPETENCY ASSESSMENT REQUISITE

4.2.1 *Self-Assessment Guide*. The self-assessment guide (SAG) is accomplished by the candidate prior to actual competency assessment. SAG is a pre-assessment tool to help the candidate and the assessor determine what evidence is available, where gaps exist, including readiness for assessment.

This document can:

a. Identify the candidate's skills and knowledge
b. Highlight gaps in candidate's skills and knowledge
c. Provide critical guidance to the assessor and candidate on the evidence that need to be presented
d. Assist the candidate to identify key areas in which practice is needed or additional information or skills that should be gained prior to assessment.

4.2.2 *Accredited Assessment Center*. Only Assessment Center accredited by TESDA is authorized to manage the assessment activities of candidates for national certification.

4.2.3 *Accredited Competency Assessor*. Only competency assessor accredited by TESDA is authorized to assess the competencies of candidates for national certification.

ANNEX A

COMPETENCY MAP - HVAC/R Sector

Land-based Transport Mobile Air-Conditioning (MAC) Servicing NC II

CORE COMPETENCIES

Install window- type AC/ domestic refrigeration units	Service & maintain window-type AC/ domestic refrigeration units	Troubleshoot window-type AC/domestic refrigeration systems	Recover & recycle refrigerant in window-type AC/domestic refrigeration systems	Repair & retrofit window-type AC/ domestic refrigeration systems
Perform Testing and commissioning for window-type AC/domestic refrigeration	Install package-type air-conditioning unit (PACU) / commercial refrigeration equipment (CRE)	Install PACU/CRE electrical systems	Install PACU/CRE piping systems	Service & maintain PACU/CRE units
Survey site for installation	Troubleshoot PACU/CRE n systems	Recover / recycle refrigerant in PACU/ CRE systems	Repair & retrofit PACU/CRE systems & its accessories	Perform start-up, testing and commissioning for PACU/CRE
Install transport air-conditioning & refrigeration units	Service & maintain transport AC & refrigeration units	Recover & recycle refrigerant in transport AC & refrigeration systems	Troubleshoot transport air-conditioning & refrigeration systems	Perform testing & commissioning for transport AC & refrigeration
Install package-type air-conditioning unit (PACU)	Service & maintain PACU	Troubleshoot and repair PACU	Perform start-up, test and commissioning for PACU	**Service & maintain mobile air-conditioning (MAC) units**
Install commercial refrigeration equipment (CRE)	Service & maintain CRE	Troubleshoot and repair CRE	Perform start-up, test and commissioning for CRE	**Troubleshoot & repair mobile air-conditioning systems**
Install commercial air-conditioning unit (CACU)	Service & maintain CACU	Troubleshoot and repair CACU	Perform start-up, testing and commissioning for CACU	**Perform start-up, test and commissioning for mobile air-conditioning systems**
Repair & retrofit transport ac & refrigeration systems & its accessories	Install domestic refrigeration and air-conditioning units	Service & maintain domestic refrigeration and air-conditioning units	Troubleshoot & repair domestic refrigeration and air-conditioning units	

COMMON COMPETENCIES

Prepare materials and tools	**Observe procedures, specifications & manuals of instructions**	**Perform mensurations & calculations**	**Perform basic benchwork**	**Perform basic electrical works**
Maintain tools and equipment	**Perform housekeeping and safety practices**	**Document work accomplished**	**Interpret technical drawings and plans**	

BASIC COMPETENCIES

Receive and respond to workplace communication	Participate in workplace communication	Lead workplace communication	Utilize specialized communication skill	Manage and sustain effective communication strategies
Work with others	Work in team environment	Lead small teams	Develop and lead teams	Manage and sustain high performing teams
Solve/address routine problems	Solve/address general workplace problems	Apply critical thinking and problem solving techniques in the workplace	Perform higher order thinking processes and apply techniques in the workplace	Evaluate higher order thinking skills and adjust problem solving techniques
Enhance self-management skills	Develop career and life decisions	Work in a diverse environment	Contribute to the practice of social justice in the workplace	Advocate strategic thinking for global citizenship
Support Innovation	Contribute to workplace innovation	Propose methods of applying learning and innovation in the organization	Manage innovative work instructions	Incorporate innovation into work procedures
Access and maintain information	Present relevant information	Use information systematically	Manage and evaluate usage of information	Develop systems in managing, and maintaining information
Follow occupational safety and health policies and procedures	Practice occupational safety and health policies and procedures	Evaluate occupational safety and health work practices	Lead in improvement of Occupational Safety and Health Program, Policies and Procedures	Manage implementation of occupational safety and health programs in the workplace
Apply environmental work standards	Exercise efficient and effective sustainable practices in the workplace	Evaluate environmental work practices	Lead towards improvement of environmental work programs, policies and procedures	Manage implementation of environmental programs in the workplace
Adopt entrepreneurial mindset in the workplace	Practice entrepreneurial skills in the workplace	Facilitate entrepreneurial skills for micro-small-medium enterprises (MSMEs)	Sustain entrepreneurial skills	Develop and sustain a high-performing enterprise

GLOSSARY OF TERMS

1) **Accumulator** – is used on systems that accommodate an orifice tube to meter refrigerants into the evaporator. It is connected directly to the evaporator outlet and stores excess liquid refrigerant. The chief role of the accumulator is to isolate the compressor from any damaging liquid refrigerant. Accumulators, like receiver-driers, also remove debris and moisture from a system.

2) **Air-conditioning** - is the cooling, heating, dehumidification, and filtration of the air located within the passenger compartment of a vehicle.

3) **Air-cooled Condenser** – an equipment that condenses refrigerant vapor using air as the condensing medium

4) **Air Distribution** – the process of distributing conditioned air into a confined space

5) **Charge** - A specific amount of refrigerant or compressor oil by weight. The vehicle manufacturer for individual A/C system applications specifies this.

6) **Charging -** The process of placing a specified amount of refrigerant and compressor oil into an A/C system.

7) **Check** – to verify, inspect, or test an HVAC/R component for satisfactory condition with the use of an instrument or a device

8) **Compressor** - commonly referred to as the heart of the system, the compressor is a belt driven pump that is fastened to the engine. It is responsible for compressing and transferring refrigerant gas.

9) **Condenser** - is the area in which heat dissipation occurs. The condenser is designed to radiate heat. As hot compressed gasses are introduced into the top of the condenser, they are cooled off. As the gas cools, it condenses and exits the bottom of the condenser as a high-pressure liquid.

10) **Dehydration** – the process of removing moisture from a refrigeration system

11) **Electric Heat Defrost** – use of electric resistance heating coils to melt ice or frost from evaporators

12) **Evacuation** – removal of air/any gas and moisture from a refrigeration system

13) **Evaporator** – is located in the interior of the vehicle. Its primary function is to transfer heat contained in the passenger compartment air, into the refrigerant, which is circulated by the compressor, through the evaporator coil. During this process, the air is also filtered and dehumidified.

14) **Fan** – a mechanical device for **moving** air

15) **Fan Coil Unit (FCU)** – an air-conditioning component that consists of a fan motor and an evaporator coil

16) **Filter Drier** – the component part used in air-conditioning or refrigeration system to filter and dehydrates refrigerant in the system

17) **Idler Pulley** – a pulley used to maintain proper belt tension

18) **Inspect** – determine the actual condition of HVAC/R component without the use of instrument

19) **Interlocking** – it is the action of interconnecting electric control wires to achieve a sequential action

20) **Leak Test** – the procedure of determining/pin pointing leaks in a pressurized system

21) **Liquid Line Solenoid Valve** – electrically operated valve that shuts-off the flow of the refrigerant to the evaporator.

22) **Manifold Gauge Set** – provides access to and monitors pressures within the system. Manifold gauge sets are available in different configurations and styles. 3-way or 4-way, liquid filled gauges, with or without a sight glass, 3 hoses or 4 hoses, 1/4 inch or 3/8 inch manifold connections, etc.

23) **Metering Device** – it is one of the major components in a refrigeration system used to regulate the flow of refrigerant into the evaporator

24) **Mobile Air-conditioning (MAC) unit** – see Transport Air-conditioning unit.

25) **Pull-out** – to remove from a place of installation

26) **Pressure Switches --** the systems use high- and low-pressure switches wired in series to control the power circuit of the compressor clutch relay. If either pressure switch opens, interrupting the circuit to the clutch relay, the operation of the compressor will stop. When conditions return to normal, the switch will automatically reset and the compressor will resume operating. The switches are non--adjustable.

27) **Pressure Test** – a procedure whereby pressure is applied to the piping system, the purpose of which is to determine its soundness and stability

28) **Pump down** – a process of using the compressor to pump and contain all the refrigerant charge into the condenser and/or receiver

29) **Recovery/Recycle Machine (R134a) -** Recovers and recycles R134a refrigerant that is present within the air conditioning system.

30) **Refrigerant --** is a material that is used to move heat from the passenger compartment to the outside air. It is a substance that gives up heat by condensing at high temperature and pressures and absorbs heat by evaporating at low temperatures and pressures. The heat transfer properties exhibited when refrigerant changes state is the foundation of the refrigerant cycle. Most Transport MAC systems use R134a.

31) **Refrigerant Charging** – the process of introducing into the system the proper amount of refrigerant

32) **Refrigerant Cylinder** -- Storage tank for R134a.

33) **Refrigerant Scale** -- Accurately weighs the transfer of refrigerant into the air--conditioning system.

34) **Service Mechanic** – worker who possess basic skills related to HVAC/R system

35) **Sight Glass/Liquid Line Moisture Indicator** – indicates refrigerant quality and charge

36) **Split-Type Air-conditioning unit** – an air-conditioning unit that contains the compressor, air or water-cooled condenser, metering device in one casing as outdoor unit and evaporator in another casing as indoor unit.

37) **Supervised Industry Learning** – similar to on-the-job training – an approach in training designed to enhance the knowledge and skills of the trainee through actual experience in the workplace to acquire specific competencies prescribed in the training regulations. Likewise, the term Supervised Industry Learning or SIL in replacement of the term Supervised Industry Training (SIT) or On-the-Job Training (OJT) to provide more focus on the process of absorbing and retaining learner's enhanced competencies in a workplace and thus enable the learner to practice those competencies in a variety of workplace situation.

38) **Thermostat Expansion Valve (TXV**) – a refrigerant control valve connected before an evaporator that regulates flow of refrigerant. Operated by temperature and pressure, and reacts to the degree of gas superheat at the evaporator outlet through a feeler bulb

39) **Transport Air-conditioning Unit –** refers to an air-conditioning unit driven directly from the turning axle of the vehicle when they are in motion, or by the vehicle engine itself, or by a separate gasoline/diesel engine and/or electric motor mounted on the same vehicle. It covers the land and marine/sea transports.

40) **Troubleshoot** – the process of analyzing system defect or malfunction

41) **Vacuum** – pressure lower than atmospheric pressure measured in inches of mercury. Complete vacuum is 29.92 in. mercury or at least 500 microns

42) **Vacuum Pump –** Removes moisture and air from the air conditioning system in order to obtain required micron level.

43) **Water Treatment** – the use of chemicals in water to prevent corrosion, formation of scales, algae growth and formation of slime

44) **Workmanlike-manner** – quality of work within the accepted industry standard

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