TRAINING REGULATIONS

TRANSPORT

RAC SERVICING NC II

HEATING, VENTILATING, AIR-CONDITIONING AND REFRIGERATING (HVAC/R) SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
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TABLE OF CONTENTS

HVAC/R SECTOR
TRANSPORT REFRIGERATION AND AIR-CONDITIONING (RAC) SERVICING NC II

		Page No.
SECTION 1	TRANSPORT RAC SERVICING NC II QUALIFICATION	1 - 2
SECTION 2	COMPETENCY STANDARDS	
	• Basic Competencies	3 - 17
	• Common Competencies	18 - 51
	• Core Competencies	52 - 87
SECTION 3	TRAINING STANDARDS	
	3.1 Curriculum Design	88 - 93
	3.2 Training Delivery	94 - 95
	3.3 Trainee Entry Requirements	95
	3.4 List of Tools, Equipment and Materials	96 - 97
	3.5 Training Facilities	98
	3.6 Trainers' Qualifications	98
	3.7 Institutional Assessment	98
SECTION 4	NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS	99 - 100
COMPETENCY MAP		101
DEFINITION OF TERMS		102 - 104
ACKNOWLEDGEMENTS		105

TRAINING REGULATIONS FOR

TRANSPORT REFRIGERATION AND AIR-CONDITIONING (RAC) SERVICING NC II

SECTION 1 TRANSPORT RAC SERVICING NC II QUALIFICATION

The **TRANSPORT RAC SERVICING NC II** Qualification consists of competencies that a person must achieve that will enable him/her to install, service, maintain, troubleshoot and repair air-conditioning and refrigeration units in transport sector.

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

The Units of Competency comprising this Qualification include the following:

CODE NO.	BASIC COMPETENCIES
500311105	Participate in workplace communication
500311106	Work in team environment
500311107	Practice career professionalism
500311108	Practice occupational health and safety procedures

CODE NO.	COMMON COMPETENCIES
HVC713201	Prepare materials and tools
HVC311201	Observe procedures, specifications and manuals of instruction
HVC311203	Perform mensurations and calculations
HVC713202	Perform basic benchwork
HVC724201	Perform basic electrical works
HVC311204	Maintain tools and equipment
HVC315201	Perform housekeeping and safety practices
HVC311205	Document work accomplished

CODE NO.	CORE COMPETENCIES
HVC723316	Install transport air-conditioning and refrigeration units
HVC723317	Service and maintain transport air-conditioning and refrigeration units
HVC723318	Troubleshoot transport air-conditioning and refrigeration systems
HVC723319	Recover and recycle refrigerant in transport air-conditioning and refrigeration systems
HVC723320	Repair and retrofit transport air-conditioning and refrigeration and its accessories
HVC723321	Perform testing and commissioning for transport air-conditioning and refrigeration

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

- Transport Air-conditioning and Refrigeration Technician

SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in **TRANSPORT RAC SERVICING NC II**.

BASIC COMPETENCIES

UNIT OF COMPETENCY : PARTICIPATE IN WORKPLACE COMMUNICATION

UNIT CODE : 500311105

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
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

2. Participate in workplace meetings and discussions	2.1 Team meetings are attended on time 2.2 Own opinions are clearly expressed and those of others are listened to without interruption 2.3 Meeting inputs are consistent with the meeting purpose and established ***protocols*** 2.4 ***Workplace interactions*** are conducted in a courteous manner 2.5 Questions about simple routine workplace procedures and maters concerning working conditions of employment are asked and responded to 2.6 Meetings outcomes are interpreted and implemented

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
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 Basic mathematical processes are used for routine calculations 3.4 Errors in recording information on forms/ documents are identified and properly acted upon 3.5 Reporting requirements to supervisor are completed according to organizational guidelines

RANGE OF VARIABLES

VARIABLE	RANGE
1. Appropriate sources	1.1. Team members 1.2. Suppliers 1.3. Trade personnel 1.4. Local government 1.5. Industry bodies
2. Medium	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	3.1. Manual filing system 3.2. Computer-based filing system
4. Forms	4.1. Personnel forms, telephone message forms, safety reports
5. Workplace interactions	5.1. Face to face 5.2. Telephone 5.3. Electronic and two way radio 5.4. Written including electronic, memos, instruction and forms, non-verbal including gestures, signals, signs and diagrams
6. Protocols	6.1. Observing meeting 6.2. Compliance with meeting decisions 6.3. Obeying meeting instructions

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 communication equipment 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. Underpinning Knowledge and Attitudes	2.1. Effective communication 2.2. Different modes of communication 2.3. Written communication 2.4. Organizational policies 2.5. Communication procedures and systems 2.6. Technology relevant to the enterprise and the individual's work responsibilities
3. Underpinning Skills	3.1. Follow simple spoken language 3.2. Perform routine workplace duties following simple written notices 3.3. Participate in workplace meetings and discussions 3.4. Complete work related documents 3.5. Estimate, calculate and record routine workplace measures 3.6. Basic mathematical processes of addition, subtraction, division and multiplication 3.7. Ability to relate to people of social range in the workplace 3.8. Gather and provide information in response to workplace Requirements
4. Resource Implications	4.1. Fax machine 4.2. Telephone 4.3. Writing materials 4.4. Internet
5. Methods of Assessment	5.1. Direct Observation 5.2. Oral interview and written test
6. Context for Assessment	6.1. Competency may be assessed individually in the actual workplace or through accredited institution

UNIT OF COMPETENCY: WORK IN TEAM ENVIRONMENT

UNIT CODE : 500311106

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes to identify role and responsibility as a member of a team.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
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
2. Identify own role and responsibility within team	2.1. Individual role and responsibilities within the team environment are identified
	2.2. Roles and responsibility of other team members are identified and recognized
	2.3. Reporting relationships within team and external to team are identified
3. Work as a team member	3.1. Effective and appropriate forms of communications used and interactions undertaken with team members who contribute to known team activities and objectives
	3.2. Effective and appropriate contributions made to complement team activities and objectives, based on individual skills and competencies and ***workplace context***
	3.3. Observed protocols in reporting using standard operating procedures
	3.4. Contribute to the development of team work plans based on an understanding of team's role and objectives and individual competencies of the members.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Role and objective of team	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	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	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. Operated 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 1.6. Reported outcomes
2. Underpinning Knowledge and Attitude	2.1. Communication process 2.2. Team structure 2.3. Team roles 2.4. Group planning and decision making
3. Underpinning Skills	3.1. Communicate appropriately, consistent with the culture of the workplace
4. Resource Implications	The following resources MUST be provided: 4.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 4.2. Materials relevant to the proposed activity or tasks
5. Methods of Assessment	Competency may be assessed through: 5.1. Observation of the individual member in relation to the work activities of the group 5.2. Observation of simulation and or role play involving the participation of individual member to the attainment of organizational goal 5.3. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork
6. Context for Assessment	6.1. Competency may be assessed in workplace or in a simulated workplace setting 6.2. Assessment shall be observed while task are being undertaken whether individually or in group

UNIT OF COMPETENCY: PRACTICE CAREER PROFESSIONALISM

UNIT CODE : 500311107

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in promoting career growth and advancement.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Integrate personal objectives with organizational goals	1.1 Personal growth and work plans are pursued towards improving the qualifications set for the profession 1.2 Intra- and interpersonal relationships ~~is~~ are maintained in the course of managing oneself based on performance ***evaluation*** 1.3 Commitment to the organization and its goal is demonstrated in the performance of duties
1. Set and meet work priorities	2.1 Competing demands are prioritized to achieve personal, team and organizational goals and objectives. 2.2 ***Resources*** are utilized efficiently and effectively to manage work priorities and commitments 2.3 Practices along economic use and maintenance of equipment and facilities are followed as per established procedures
2. Maintain professional growth and development	3.1 ***Trainings and career opportunities*** are identified and availed of based on job requirements 3.2 ***Recognitions*** are sought/received and demonstrated as proof of career advancement 3.3 ***Licenses and/or certifications*** relevant to job and career are obtained and renewed

RANGE OF VARIABLES

VARIABLE	RANGE
1. Evaluation	1.1 Performance Appraisal 1.2 Psychological Profile 1.3 Aptitude Tests
2. Resources	2.1 Human 2.2 Financial 2.3 Technology 2.3.1 Hardware 2.3.2 Software
3. Trainings and career opportunities	3.1 Participation in training programs 3.1.1 Technical 3.1.2 Supervisory 3.1.3 Managerial 3.1.4 Continuing Education 3.2 Serving as Resource Persons in conferences and workshops
4. Recognitions	4.1 Recommendations 4.2 Citations 4.3 Certificate of Appreciations 4.4 Commendations 4.5 Awards 4.6 Tangible and Intangible Rewards
5. Licenses and/or certifications	5.1 National Certificates 5.2 Certificate of Competency 5.3 Support Level Licenses 5.4 Professional Licenses

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Attained job targets within key result areas (KRAs) 1.2 Maintained intra - and interpersonal relationship in the course of managing oneself based on performance evaluation 1.3 Completed trainings and career opportunities which are based on the requirements of the industries 1.4 Acquired and maintained licenses and/or certifications according to the requirement of the qualification
2. Underpinning Knowledge	2.1 Work values and ethics (Code of Conduct, Code of Ethics, etc.) 2.2 Company policies 2.3 Company-operations, procedures and standards 2.4 Fundamental rights at work including gender sensitivity 2.5 Personal hygiene practices
3. Underpinning Skills	3.1 Appropriate practice of personal hygiene 3.2 Intra and Interpersonal skills 3.3 Communication skills
4. Resource Implications	The following resources **MUST** be provided: 4.1 Workplace or assessment location 4.2 Case studies/scenarios
5. Methods of Assessment	Competency may be assessed through: 5.1 Portfolio Assessment 5.2 Interview 5.3 Simulation/Role-plays 5.4 Observation 5.5 Third Party Reports 5.6 Exams and Tests
6. Context of Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

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

UNIT CODE : **500311108**

UNIT DESCRIPTOR : This unit covers the outcomes required to comply with regulatory and organizational requirements for occupational health and safety.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Identify hazards and risks	1.1 ***Safety regulations*** and workplace safety and hazard control practices and procedures are clarified and explained based on organization procedures 1.2 ***Hazards/risks*** in the workplace and their corresponding indicators are identified to minimize or eliminate risk to co-workers, workplace and environment in accordance with organization procedures 1.3 ***Contingency measures*** during workplace accidents, fire and other emergencies are recognized and established in accordance with organization procedures
2. Evaluate hazards and risks	2.1 Terms of maximum tolerable limits which when exceeded will result in harm or damage are identified based on threshold limit values (TLV) 2.2 Effects of the hazards are determined 2.3 OHS issues and/or concerns and identified safety hazards are reported to designated personnel in accordance with workplace requirements and relevant workplace OHS legislation

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
3. Control hazards and risks	3.1 Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace are consistently followed 3.2 Procedures for dealing with workplace accidents, fire and emergencies are followed in accordance with organization OHS policies 3.3 ***Personal protective equipment (PPE)*** is correctly used in accordance with organization OHS procedures and practices 3.4 Appropriate assistance is provided in the event of a workplace emergency in accordance with established organization protocol
4. Maintain OHS awareness	4.1 ***Emergency-related drills and trainings*** are participated in as per established organization guidelines and procedures 4.2 ***OHS personal records*** are completed and updated in accordance with workplace requirements

RANGE OF VARIABLES

VARIABLE	RANGE
1. Safety regulations	May include but are not limited to: 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 Philippine Occupational Safety and Health Standards 1.6 DOLE regulations on safety legal requirements 1.7 ECC regulations
2. Hazards/Risks	May include but are not limited to: 2.1 Physical hazards – impact, illumination, pressure, noise, vibration, temperature, radiation 2.2 Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects 2.3 Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors 2.4 Ergonomics • Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles • Physiological factors – monotony, personal relationship, work out cycle
3. Contingency measures	May include but are not limited to: 3.1 Evacuation 3.2 Isolation 3.3 Decontamination 3.4 (Calling designed) emergency personnel

4. PPE	May include but are not limited to: 4.1 Mask 4.2 Gloves 4.3 Goggles 4.4 Hair Net/cap/bonnet 4.5 Face mask/shield 4.6 Ear muffs 4.7 Apron/Gown/coverall/jump suit 4.8 Anti-static suits

VARIABLE	RANGE
5. Emergency-related drills and training	5.1 Fire drill 5.2 Earthquake drill 5.3 Basic life support/CPR 5.4 First aid 5.5 Spillage control 5.6 Decontamination of chemical and toxic 5.7 Disaster preparedness/management
6. OHS personal records	6.1 Medical/Health records 6.2 Incident reports 6.3 Accident reports 6.4 OHS-related training completed

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Explained clearly established workplace safety and hazard control practices and procedures 1.2 Identified hazards/risks in the workplace and its corresponding indicators in accordance with company procedures 1.3 Recognized contingency measures during workplace accidents, fire and other emergencies 1.4 Identified terms of maximum tolerable limits based on threshold limit value- TLV. 1.5 Followed Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace 1.6 Used Personal Protective Equipment (PPE) in accordance with company OHS procedures and practices 1.7 Completed and updated OHS personal records in accordance with workplace requirements
2. Underpinning Knowledge and Attitude	2.1 OHS procedures and practices and regulations 2.2 PPE types and uses 2.3 Personal hygiene practices 2.4 Hazards/risks identification and control 2.5 Threshold Limit Value -TLV 2.6 OHS indicators 2.7 Organization safety and health protocol 2.8 Safety consciousness 2.9 Health consciousness
3. Underpinning Skills	3.1 Practice of personal hygiene 3.2 Hazards/risks identification and control skills 3.3 Interpersonal skills 3.4 Communication skills
4. Resource Implications	The following resources must be provided: 4.1 Workplace or assessment location 4.2 OHS personal records 4.3 PPE 4.4 Health records
5. Methods of Assessment	Competency may be assessed through: 5.1 Portfolio Assessment 5.2 Interview Case Study/Situation

6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

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*** terms are elaborated in the Range of Variables
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
2. Requisition materials	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
3. Receive and inspect materials	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

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. Underpinning Knowledge	2.1 Types and uses of HVAC/R materials and tools 2.2 Different forms 2.3 Requisition procedures
3. Underpinning Skills	3.1 Preparing materials and tools 3.2 Proper handling of tools and equipment 3.3 Following Instructions
4. Resource Implications	The following resources should be provided: 4.1 Workplace location 4.2 Materials relevant to the unit of competency 4.3 Technical plans, drawings and specifications relevant to the activities
5. Methods of Assessment	Competency in this unit must be assessed through: 5.1 Direct observation and oral questioning
6. Context for Assessment	6.1 Competency may be assessed in the workplace or in a simulated workplace 6.2 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*** terms are elaborated in the Range of Variables
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***
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

3. Apply freehand sketching	3.1 Where applicable, correct freehand sketching is produced in accordance with the job requirements

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. Work plan	2.1 Job requirements 2.2 Installation instructions 2.3 Components instruction
3. Classification	Including but not limited to: 3.1 Electrical 3.2 Mechanical
4. Drawing	4.1 Drawing symbols 4.2 Alphabet of lines 4.3 Orthographic views - Front view - Right side view/left side view - Top view - Pictorial 4.4 Schematic diagram 4.5 Electrical drawings 4.6 Structural drawings 4.7 Welding symbols

5. Tools and materials	Including but not limited to: 5.1 Compass 5.2 Divider 5.3 Rulers 5.4 Triangles 5.5 Drawing tables 5.6 Computer

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 workplan following specifications 1.5 Demonstrated ability to determine job specifications based on working/technical drawing
2. Underpinning Knowledge	2.1 **TRADE MATHEMATICS** • Linear measurement • Dimension • Unit conversion 2.2 **BLUEPRINT READING AND PLAN SPECIFICATION** • Electrical, mechanical plan, symbols and abbreviations • Drawing standard symbols 2.3 **TRADE THEORY** • Basic Technical Drawing • Types Technical Plans • Various Types of Drawings • Notes and Specifications
3. Underpinning skills	3.1 Interpreting drawing/orthographic drawing 3.2 Interpreting technical plans 3.3 Matching specification details with existing resources 3.4 Following instructions 3.5 Handling of drawing instruments

4. Resource implications	The following resources should be provided: 4.1 Workplace 4.2 Drawings and specification relevant to task 4.3 Materials and instrument relevant to proposed activity
5. Methods of assessment	Competency should be assessed through: 5.1 Direct Observation 5.2 Questions/Interview 5.3 Written test related to underpinning knowledge
6. Context of assessment	6.1 Competency assessment may occur in workplace or any appropriate simulated environment 6.2 Assessment shall be observed while task are being undertaken whether individually or in group 6.3 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*** terms are elaborated in the Range of Variables
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
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

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
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

RANGE OF VARIABLES

VARIABLE	RANGE
1. Procedures, specifications and manuals of instructions	Kinds of Manuals: 1.1 Manufacturer's Specification Manual 1.2 Repair Manual 1.3 Maintenance Procedure Manual 1.4 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. Underpinning Knowledge	2.1 Types of manuals used in HVAC/R sector 2.2 Identification of symbols used in the manuals 2.3 Identification of units of measurements 2.4 Unit conversion
3. Underpinning Skills	3.1 Reading and comprehension skills required to identify and interpret construction manuals and specifications 3.2 Accessing information and data
4. Resource Implications	The following resources should be provided: 4.1 All manuals/catalogues relative to HVAC/R sector

5. Methods of Assessment	Competency should be assessed through: 5.1 Direct Observation 5.2 Questions/Interview Assessment of underpinning knowledge and practical skills may be combined
6. Context for Assessment	6.1 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines 6.2 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** terms* are elaborated in the Range of Variables

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
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 Workpieces are measured according to job requirements

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-ohmeter 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

VARIABLE	RANGE
	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. Underpinning Knowledge	2.1 **TRADE MATHEMATICS/MENSURATION** • Four fundamental operation • Linear measurement • Dimensions • Unit conversion • Ratio and proportion • Trigonometric functions • Algebraic equations
3. Underpinning Skills	3.1 Performing calculation by addition, subtraction, multiplication and division: trigonometric functions and algebraic equations 3.2 Visualizing objects and shapes 3.3 Interpreting formulas for volume, areas, perimeters of plane and geometric figures 3.4 Proper handling of measuring instruments
4. Resource Implications	The following resources should be provided: 4.1 Workplace location 4.2 Problems to solve 4.3 Measuring instrument appropriate to carry out tasks 4.4 Instructional materials relevant to the propose activity Assessment of underpinning knowledge and practical skills may be combined
5. Methods of Assessment	Competency should be assessed through: 5.1 Actual demonstration 5.2 Direct observation 5.3 Written test/questioning related to underpinning knowledge
6. Context for Assessment	6.1 Competency assessment may occur in workplace or any appropriate simulated environment 6.2 Assessment shall be observed while task are being undertaken whether individually or in group 6.3 Competency assessment must be undertaken in accordance with the TESDA assessment guidelines

UNIT OF COMPETENCY: PERFORM BASIC BENCHWORK

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*** terms are elaborated in the Range of Variables
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)
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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
3. Perform required benchworks	3.1 ***Work instructions are followed*** to ensure work safety 3.2 ***Benchworks*** 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 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 Ballpen 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
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

VARIABLE	RANGE
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 Goggles
9. Benchworks	9.1 Cutting 9.2 Filing 9.3 Drilling
10. Workholding device	10.1 Machine vise 10.2 Pliers 10.3 Vise grip
11. Manual	11.1 Procedures 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. Underpinning knowledge	2.1 **TRADE MATHEMATICS** • Linear measurements • Dimensions • Unit conversion 2.2 **TRADE THEORY** • Basic Benchwork 2.3 **SAFETY PRACTICES** • PPE • Handling of tools, supplies and equipment • Good housekeeping
3. Underpinning skills	3.1 Performing basic benchwork 3.2 Communicating effectively 3.3 Work safety 3.4 Preparing materials, tools and equipment 3.5 Proper handling of tools and equipment
4. Resource implications	The following resources should be provided: 4.1 Workplace 4.2 Work plan 4.3 Materials, tools and equipment relevant to the proposed activity/task
5. Methods of assessment	Competency should be assessed through: 5.1 Actual demonstration 5.2 Direct observation 5.3 Written/questioning related to underpinning knowledge

6. Context of assessment	6.1 Competency assessment may occur in workplace or any appropriate simulated environment 6.2 Assessment shall be observed while task are being undertaken whether individually or in group 6.3 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*** terms are elaborated in the Range of Variables
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
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

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

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work plan	9.4 Job requirements 9.5 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. Underpinning knowledge	2.1 **TRADE MATHEMATICS** • Linear measurements • Dimensions • Unit conversion 2.2 **TRADE THEORY** • Basic electricity 2.3 **SAFETY PRACTICES** • PPE • Handling of tools and equipment • Good housekeeping
3. Underpinning skills	3.1 Installing and repairing electrical fixtures 3.2 Communicating effectively 3.3 Work safety 3.4 Proper handling of materials, tools and equipment 3.5 Preparing materials, tools and equipment 3.6 Wiring components 3.7 Testing power supply and electrical component
4. Resource Implications	The following resources should be provided: 4.1 Work place 4.2 Work plan 4.3 Materials, tools and equipment relevant to the proposed activity/task
5. Methods of Assessment	Competency should be assessed through: 5.1 Direct observation 5.2 Written test/questioning relevant to underpinning knowledge
6. Context of Assessment	6.1 Competency assessment may occur in workplace or any appropriate simulated environment 6.2 Assessment shall be observed while task are being undertaken whether individually or in group 6.3 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*** terms are elaborated in the Range of Variables

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
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

ELEMENT	**PERFORMANCE CRITERIA** ***Italicized*** terms are elaborated in the Range of Variables

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

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	4.4 Maintenance schedule forms 4.5 Requisition Slip 4.6 Inventory Form Slip 4.7 Inspection Form Slip 4.8 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
2. Underpinning Knowledge	2.1 **SAFETY PRACTICES** • Use of PPE • Handling of tools and equipment • Good housekeeping 2.2 **MATERIALS, TOOLS AND EQUIPMENT** • Types and Uses of lubricants • Types and Uses of cleaning materials • Types and Uses of measuring instruments and equipment 2.3 **PREVENTIVE MAINTENANCE** • Methods and techniques • Procedures
3. Underpinning Skills	3.1 Preparing maintenance materials, tools and equipment 3.2 Proper handling of tools and equipment 3.3 Performing preventive maintenance 3.4 Following instructions
4. Resource Implications	The following resources should be provided: 4.1 Work place 4.2 Maintenance Schedule 4.3 Maintenance materials, tools and equipment relevant to the proposed activity/task
5. Methods of Assessment	Competency should be assessed through: 5.1 Direct observation 5.2 Written test/questioning relevant to underpinning knowledge
6. Context for Assessment	6.1 Competency assessment may occur in workplace or any appropriate simulated environment 6.2 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

UNIT OF COMPETNCY : 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*** terms are elaborated in the Range of Variables
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
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
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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
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 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
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

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

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: 4.9 Fire 4.10 Explosion 4.11 Spills 4.12 Falls 4.13 Electrocution 4.14 Injuries caused by falling objects 4.15 Injuries caused by sharp objects 4.16 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 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

VARIABLE	RANGE
4. Personal Protective Equipment (PPE)	PPE may include but not limited to: 4.17 Goggles 4.18 Gas mask 4.19 Working gloves 4.20 Safety shoes 4.21 Face shield 4.22 Insulating mat 4.23 Over-all apron 4.24 Hard hat 4.25 Safety belt 4.26 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
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. Underpinning Knowledge	2.1 Kinds and Uses of PPE 2.2 Identification of Safety Signs and Symbols 2.3 5S of Good Housekeeping 2.4 General OH&S principles, responsibilities and legislations 2.5 OH&S requirements in relations to work safety 2.6 Environmental requirements relative to work safety 2.7 Hazard identification and avoidance in the workplace 2.8 First-aid treatment procedures 2.9 Kinds of emergency situations – causes and how to deal with different situations 2.10 Kinds of injuries and effects 2.11 Accident/hazard reporting 2.12 Basic security procedures 2.13 Uses of Manuals
3. Underpinning Skills	3.1 Wearing the appropriate PPE 3.2 Reading skills required to interpret work instruction 3.3 Identifying safety signs and symbols 3.4 Practice of CPR, Mouth to Mouth Resuscitation and other First-Aid Treatment 3.5 Problem solving in emergency situation 3.6 Handling injured worker 3.7 Coordination of work in times of emergency 3.8 Fire fighting procedures and techniques 3.9 Reporting/recording accidents and potential hazards

4. Resource Implications	The following resources should be provided: 4.1 Work place 4.2 Materials, tools and equipment relevant to the proposed activity/task 4.3 Safety signs 4.4 Safety devices 4.5 Accident reporting procedures 4.6 First-aid materials and guidelines
5. Methods of Assessment	Competency should be assessed through: 5.1 Direct observation while task is being undertaken 5.2 Written test/questioning relevant to underpinning knowledge Assessment of underpinning knowledge and practical skills may be combined
6. Context for Assessment	6.1 Competency assessment may occur in workplace or any appropriate simulated environment 6.2 Assessment shall be observed while task are being undertaken whether individually or in group in accordance with the approved industry OHSA regulations 6.3 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*** terms are elaborated in the Range of Variables
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
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

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. Underpinning Knowledge	2.1 **SOURCES OF INFORMATION** • Service manual • Parts catalogue • Service report • Price estimates/quotation • Warranty card • Types and Uses of Forms • Parts and Accessories
3. Underpinning Skills	3.1 Writing skills needed to complete prepared report forms 3.2 Reading skills used to read manuals and specifications
4. Resource Implications	Things necessary to conduct method of assessment: 4.1 Work place location 4.2 Materials relevant to the proposed activity
5. Methods of Assessment	Competency in this unit must be assessed through: 5.1 Direct observation 5.2 Questions related to underpinning knowledge
6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

CORE COMPETENCIES

UNIT OF COMPETENCY: INSTALL TRANSPORT AIR-CONDITIONING AND REFRIGERATION UNITS

UNIT CODE : HVC723316

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to safely install and test air-conditioning and refrigeration units in the land and marine transports.

ELEMENT	PERFORMANCE CRITERIA ***italicized*** terms are elaborated in the Range of Variables
1. Prepare for the installation of refrigeration and air-conditioning systems	1.1 ***Work instructions*** are read and interpreted to determine job requirements 1.2 Installation drawings and component instructions are verified with supervisor 1.3 Arrangements are made for the installation and with approval of appropriate authority 1.4 ***Tools and equipment*** are selected in line with job requirements 1.5 ***Unit*** and associated ***materials*** are selected in accordance with job requirements

2. Install refrigeration and air-conditioning system components	2.1 ***Components*** of transport air-conditioning and refrigeration systems are checked and identified as per procedures 2.2 Components are positioned/secured and installed in accordance with drawings, designs and specifications 2.3 Supports and bracketing to secure pipework are positioned and fixed in accordance with drawings, designs and specifications 2.4 Piping, tubing, ducting and insulation are positioned and secured in accordance with drawings and specifications 2.5 ***Safety precautions*** are observed are observed as per safety standards 2.6 Valves and controls are installed in accordance with designs, specifications and work instructions

ELEMENT	**PERFORMANCE CRITERIA** ***Italicized*** terms are elaborated in the Range of Variables
3. Charge the components of refrigeration and air-conditioning systems	3.1 Systems and components are checked for leaks in accordance with SOPs 3.2 Components and systems are charged with refrigerant and secondary heat transfer fluids in accordance with system instructions, specifications, industry codes and regulations 3.3 Identification labels are affixed to systems and components in accordance with industry codes and regulations 3.4 Systems are prepared for testing, and documentation is completed according to company policy

4. Test transport air-conditioning and refrigeration systems for operation	4.1 Safety precautions are observed as per safety regulations 4.2 Suitable tools and equipment are selected and used as per procedures 4.3 Test gauges are connected according to system manufacturer's instructions 4.4 Level of refrigerant charge is determined based on standard operating procedures 4.5 Blockages and other malfunctions are identified and located based on procedures 4.6 Efficiency of the system is determined as per procedures 4.7 Report on installation and testing of unit is prepared in line with enterprise procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work Instructions	1.1 Manufacturer's recommendations/ specifications 1.2 Installation drawings 1.3 Blueprints 1.4 Components instructions
2. Tools and equipment	2.1 Electric drill and bits 2.2 Box wrenches 2.3 Electric arc welding machine 2.4 Oxy-acetylene welding accessories/set

3. Unit	Transport air-conditioning and refrigeration units refer to: 3.1 Land transport (engine driven, e.g. cars, trucks, refrigerated vans, etc.) 3.2 Marine/sea transport (vessels)
4. Materials	4.1 Angle bar/flat bar/steel plate 4.2 Bolts, nuts and screw/lock washer 4.3 Insulation tape 4.4 Working plans, drawings, manual
5. Components	5.1 Compressor 5.2 Compressor bracket 5.3 Compressor assembly 5.4 Idler/Tension pulley 5.5 Evaporator assembly 5.6 Condensers 5.7 Condenser fan 5.8 Air ducts 5.9 Evaporators 5.10 Expansion device
6. Safety precautions	6.1 Personal safety 6.2 PPE 6.3 Safety of others

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Read and interpreted work instructions to determine job requirements 1.2 Selected tools, equipment and materials in line with job requirements 1.1 Installed unit, equipment/components are sequentially done and correctly positioned and leveled in line with drawings, designs, specifications and manufacturer's instructions 1.2 Charged components and systems in accordance with system instructions, specifications, industry codes and regulations 1.5 Employed safe manual handling techniques in line with enterprise procedures 1.6 Tested unit in line with the manufacturer's instructions 1.7 Demonstrated compliance with safety regulation applicable to worksite operations 1.8 Identified faults and problems and made necessary action to rectify 1.9 Cleaned worksite and kept in a safe state in accordance with enterprise procedures 1.10 Communicated interactively with others where applicable to ensure safety and effective work operations
2. Underpinning Knowledge	2.1 **SAFETY PRACTICES** • Protective personal equipment/safety gears • Handling of tools, equipment and accessories • Safety signs and symbols • Good housekeeping 2.2 **TRADE MATHEMATICS/ MENSURATION** • Linear measurements • Dimensions • Ratio and proportion • Unit conversion 2.3 **BLUEPRINT READING AND PLAN SPECIFICATIONS** • Electrical plans, symbols and abbreviations 2.4 **LEGISLATION** • Clean Air Act (RA 8749) • Montreal Protocol • Ozone Depleting Refrigerants (ODRs) 2.5 **MATERIALS, TOOLS: USES AND SPECIFICATIONS** • Bolts and nuts • Brackets • Rivets • Wrenches • Tubing tools • Cutting tools

	2.6 **TRADE THEORY** • Basic Electrical • Basic electronics • Basic automotive • Air-conditioning and refrigeration system - Compressor - Evaporator - Condenser - Expansion valve • Function of air-conditioning/refrigerant components • Basic welding • Principles of air-conditioning and refrigeration - Compression - Condensing - Expansion - Revaporizing • Installation procedures • Selection of unit and components • Heat transfer 2.7 **MAINTENANCE** • Preventive Maintenance
3. Underpinning Skills	3.1 Interpreting plan, drawings, specifications and manuals 3.2 Installing equipment, components and accessories 3.3 Fabricating brackets 3.4 Safe manual handling 3.5 Reading and interpreting manufacturer's manual 3.6 Performing mathematical computation
4. Resource Implications	Things necessary to conduct method of assessment: 4.1 Work place location 4.2 Tools and equipment appropriate to construction processes 4.3 Materials relevant to the proposed activity 4.4 Drawings and specifications relevant to the task 4.5 Air-conditioning and refrigeration equipment and components 4.6 Vehicle
5. Methods of Assessment	Competency in this unit must be assessed through: 5.1 Direct observation 5.2 Questions related to underpinning knowledge
6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: **SERVICE AND MAINTAIN TRANSPORT AIR-CONDITIONING AND REFRIGERATION UNITS**

UNIT CODE : **HVC723317**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in maintaining air-conditioning and refrigeration units in the land and marine transports.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Check and maintain components/parts of air-conditioning and refrigeration systems	1.1 Evaporator/condenser coil are cleaned in accordance with manufacturer's maintenance manual 1.2 Refrigerant piping are checked for condition, leak, insulation and tightness of support/brackets as per manual 1.3 ***Operating condition*** and electro-mechanical controls/setting is in accordance with manufacturer's operation/service manual 1.4 ***Air-conditioning and refrigeration accessories and components*** are checked and adjusted as per manufacturer's operation/service manual 1.5 Fittings and support of all systems and equipment must be checked for leakage 1.6 Correct maintenance procedures are applied according to standard operating procedures
2. Maintain lubrication system	2.1 Lubrication system and components are checked to meet operational specifications 2.2 Oil levels, properties and circulation balances are checked and adjusted to meet operational specifications 2.3 Oil leaks are detected and rectified based on procedures

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
3. Maintain refrigerant system	3.1 Pressure drops across strainer, filters and filter drier are checked and recorded based on procedures 3.2 Refrigerant leaks are detected and rectified based on procedures 3.3 Refrigerant system variables and contaminants are checked and adjusted based on procedures
4. Maintain secondary heat transfer	4.1 ***Liquid properties*** are adjusted based on standards 4.2 Follow-up action is arranged in accordance with workplace procedures
5. Maintain air distribution system	5.1 Air distribution system components are checked and air flows are balanced based on procedures 5.2 Outdoor air supply systems are checked and maintained based on operational and regulatory requirements 5.3 Humidifier equipment is checked, serviced, and sanitized based on operational and regulatory requirements
6. Maintain electrical system	6.1 Electrical wiring are checked for circuit troubles as per standard operating procedures 6.2 Electrical control and devices are checked for normal operation as per standard operating procedures 6.3 Termination and joints are checked for firmness and tightness as per standard operating procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Operating conditions	1.1 Pressures 1.2 Temperatures 1.3 Voltages 1.4 Current draws 1.5 RPM of compressor pulley
2. Air-conditioning and Refrigeration components	2.1 Evaporator 2.2 Condenser Coil 2.3 Oil Filters 2.4 Refrigerant Piping 2.5 Belts 2.6 Pulley alignment/tension 2.7 Mechanical controls and services 2.8 Compressor 2.9 Valves 2.10 Door Hinges 2.11 Cabinetry/Housing 2.12 Fans 2.13 Motors 2.14 Refrigerant flow control
3. Liquid properties	3.1 Refrigerant 3.2 Water (H_2O)

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Checked air-conditioning/refrigeration equipment components and devices in accordance with manufacturer's maintenance/operation manual 1.2 Checked operating conditions and electro-mechanical controls/settings in accordance with manufacturer's operation/service manual 1.3 Checked and adjusted lubrication and refrigerant system variables and components to meet operational specifications/efficiency 1.4 Checked and maintained air distribution system to meet operational and regulatory requirements 1.5 Conducted test as per standard procedures 1.6 Demonstrated compliance with safety regulations applicable to worksite operations 1.7 Selected types of electrical tools/instrument and wiring devices in accordance with specification and job requirements 1.8 Identified faults and problems and made necessary actions to rectify 1.9 Communicated interactively with others where applicable to ensure safe and effective work operations
2. Underpinning Knowledge	2.1 **SAFETY PRACTICES** • Protective personal equipment/safety gears • Handling of tools, equipment and accessories • Safety signs and symbols • Good housekeeping 2.2 **TRADE MATHEMATICS/MENSURATION** • Linear measurements • Dimensions • Ratio and proportion • Unit conversion 2.3 **BLUEPRINT READING** • Electrical plans, symbols and abbreviations • Mechanical plan, symbols and abbreviations

2. Underpinning Knowledge	2.4 **TRADE THEORY** • Basic electricity • Air-conditioning and refrigeration • Compressor • Condenser • Expansion valve • Lubricant • Principles of Refrigeration • Compression • Condensing • Expansion • Revaporizing • Basic electronics • Basic automotive • Electrical and mechanical system of A/C • Heat transfer 2.5 **MAINTENANCE** • Preventive Maintenance • Maintaining electrical system • Maintaining mechanical system 2.6 **LEGISLATION** • Clean Air Act (RA 8749) • Montreal Protocol • Ozone Depleting Refrigerants (ODRs)
3. Underpinning Skills	3.1 Interpreting plans and details 3.2 Preparing materials 3.3 Handling of electrical and mechanical tools and equipment 3.4 Troubleshooting technique 3.5 Calibrating of expansion valve 3.6 Maintaining transport air-conditioning and refrigeration systems 3.7 Adjusting superheat
4. Resource Implications	Things necessary to conduct method of assessment: 4.1 Work place location 4.2 Tools and equipment appropriate to servicing/maintaining transport air-conditioning and refrigeration processes 4.3 Materials relevant to the proposed activity 4.4 Drawings and specifications relevant to the task
5. Methods of Assessment	Competency in this unit must be assessed through: 5.1 Direct observation 5.2 Questions related to underpinning knowledge
6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: TROUBLESHOOT TRANSPORT AIR-CONDITIONING AND REFRIGERATION SYSTEMS

UNIT CODE : HVC723318

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to identify, analyze and find remedy faults pertaining to transport air-conditioning and refrigeration systems.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Plan and prepare for troubleshooting	1.1 Appropriate wiring diagrams, charts and manuals are selected in line with equipment tested 1.2 Appropriate materials, ***tools and equipment*** are selected for testing procedures 1.3 Power supply is checked in compliance with nameplate rating and/or manufacturer's standard
2. Troubleshoot air-conditioning and refrigeration systems	2.1 ***Components*** are correctly identified in line with job requirements 2.2 Faults are identified and diagnosed as per procedures 2.3 Faults are identified and diagnosed based on instructions 2.4 Operational function of each component is inspected and tested in accordance with the standard operating procedures 2.5 Components are repaired/replaced as per manufacturer's operation/repair manual 2.6 Components are reconditioned and overhauled in accordance with workplace procedures

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
3. Test unit	3.1 Unit is ***tested*** in line with manufacturer's instructions 3.2 Report on installation and testing of unit is prepared in line with enterprise procedures 3.3 Unit is tested for short and grounds in conformity with troubleshooting procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Components	1.1 Electrical controls - Thermostat - Timer - Relay Thermo disc 1.2 Compressor 1.3 Compressor motor and relays 1.4 Condenser 1.5 Fan motors 1.6 Refrigerant circuit 1.7 Refrigerator defrost heater 1.8 Evaporator fan and motor (no frost) 1.9 Refrigerator door strip heater 1.10 Liquid line strainer 1.11 Metering device 1.12 Pressure controls 1.13 Thermostat 1.14 Refrigerant piping 1.15 Defrost controls 1.16 Fan/fan motor 1.17 Pipe insulation 1.18 Door hinges 1.19 Latches 1.20 Cabinetry/Housing 1.21 Expansion valve
2. Tools and instrument	**Tools** 2.1 Pliers 2.2 Screwdriver 2.3 Wrenches 2.4 Wire stripper/crimper **Instrument** 2.5 Multi-tester 2.6 Clamp-ammeter 2.7 Capacitor tester 2.8 Electric leak detector 2.9 Megger

VARIABLE	RANGE
3. PPE	Includes but not limited to: 3.1 Mask 3.2 Safety shoes 3.3 Safety goggles 3.4 Apron 3.5 Gloves
4. Test	4.1 Insulation 4.2 Resistance 4.3 Mechanical 4.4 Continuity 4.5 Timing Sequence 4.6 Leak

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Supplied power in compliance with nameplate rating and/or manufacturer's standard 1.2 Selected appropriate wiring diagrams, charts and manuals in line with equipment tested 1.3 Tested transport air-conditioning and refrigerator electrical and mechanical controls and its components/accessories as per standard procedures 1.3 Performed leak test as per standard procedures 1.4 Reconditioned/overhauled transport air-conditioning and refrigeration and its components in accordance with workplace procedures 1.7 Selected and used appropriate processes, tools, materials and equipment to carry out tasks 1.8 Demonstrated compliance with safety regulations applicable to worksite operations 1.9 Identified faults and problems and made necessary action to rectify in line with SOP 1.10 Communicated effectively with others where applicable to ensure safe and effective work operations 1.11Completed troubleshooting as to specifications

2. Underpinning Knowledge	2.1 **SAFETY PRACTICES** • Personal protective equipment, clothing/safety gears • Electrical safety 2.2 **BLUEPRINT READING AND PLAN SPECIFICATION** • Electrical plans, symbols and abbreviations 2.3 **MATERIALS AND TOOLS: USES AND SPECIFICATIONS** • Electrical tools/equipment • Parts of refrigerant circuit	2.4 **TRADE THEORY** • Basic electricity • Basic electronics • Basic automotive • Refrigeration principles • Instrumentation 2.5 **PROCESSES/ PROCEDURES** • Motor insulation testing procedure • Wiring resistance testing procedure • Mechanical testing procedure • Compressor construction • Electrical system analysis • Mechanical system analysis 2.6 **LEGISLATION** • Clean Air Act (R.A. 8749) • Montreal Protocol • Ozone Depleting Refrigerants (ODRs)

3. Underpinning Skills	3.1 Interpreting plan and details (Schematic diagram) 3.2 Preparing materials 3.3 Proper handling of electrical tools/equipment 3.4 Testing electrical system 3.5 Testing mechanical system 3.6 Brazing
4. Resource Implications	Things necessary to conduct method of assessment: 4.1 Work place location 4.2 Tools and equipment appropriate to troubleshooting processes 4.3 Materials relevant to the proposed activity 4.4 Drawings and specifications relevant to the task
5. Methods of Assessment	Competency in this unit must be assessed through: 5.1 Direct observation 5.2 Questions related to underpinning knowledge (Written Test)
6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: RECOVER AND RECYCLE REFRIGERANT IN TRANSPORT REFRIGERATION SYSTEMS

UNIT CODE : HVC723319

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in the recovery and recycling of refrigerants in air-conditioning and refrigeration systems in the land and marine transports. This includes evaluation of unit for recovery/recycling, setting-up of equipment and performing recovery and recycling of refrigerant operations.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Assess unit for recovery/ recycling	1.1 Relevant data is gathered on unit to be recovered/recycled as per procedures 1.2 Appropriateness of ***unit*** for refrigerant recovery/recycling is determined according to Clean Air Act/Montreal Protocol requirements and manufacturer's specifications
2. Set-up equipment for recovery/ recycling	2.1. ***Equipment, instruments, tools and accessories*** are gathered based on job requirements 2.2. Equipment, instruments and tools are checked as per specifications 2.3 Equipment, instruments, tools and accessories are set-up according to manufacturer's recommendations
3. Perform refrigerant recovery/ recycling	3.1 ***Optimum recovery*** of refrigerant is determined in line with the Clean Air Act/ Montreal Protocol 3.2 Refrigerants recovery/recycling is performed according to ***manufacturer's recommendations*** and Clean Air Act/Montreal Protocol 3.3 Recovered refrigerant in the tank is identified and labeled as per recycling procedures 3.4 ***Contaminants*** are removed from the system based on procedures 3.5 Recovery/recycling machine is operated and maintained in accordance with manufacturer's recommendations 3.6 Safety measures in recovery/recycling of refrigerants are observed in accordance with industry requirements

RANGE OF VARIABLES

VARIABLE	RANGE
1. Unit	Transport air-conditioning and refrigeration units refer to: 1.1 Land transport (engine drive, e.g. cars, trucks, refrigerated vans, etc.) 1.2 Marine/sea transport (vessels)
2. Equipment	2.1 Recovery machine 2.2 Recycling machine
3. Instruments	3.1 Refrigerant identifier 3.2 Acid test kit
4. Tools	4.1 System analyzer 4.2 Spanner 4.3 Set of wrenches 4.4 Weighing scale 4.5 Marker 4.6 Masking tape
5. Optimum recovery	5.1 Pressure reading of 30 in Hg/ 760mm Hg.
6. Manufacturer's recommendations	Includes but not limited to: 6.1 Equipment operator's manual 6.2 Equipment service manual 6.3 Nameplate data
7. Contaminants	7.1 Acid 7.2 Moisture 7.3 Foreign particles e.g. chips, burr 7.4 Non-condensable gases

EVIDENCE GUIDE

1. Critical aspects of competency	Competency assessment requires evidence that the candidate: 1.1 Performed refrigerant recycling, complying with manufacturer's recommendations, environmental regulations, safety precautions and as specified in the Clean Air Act/Montreal Protocol 1.2 Achieved optimum refrigerant recovery following standard procedures/manufacturer's recommendations 1.3 Demonstrated compliance with safety regulations applicable to worksite operations 1.4 Selected and used appropriate to the processes, tools, materials and equipment to carry out tasks 1.5 Identified faults and problems and took necessary action to rectify 1.6 Communicated effectively with others where applicable to ensure safe and effective work operations

2. Underpinning Knowledge	2.1 Recovery/recycling principles, procedures and standards 2.2 Ozone-layer depletion and its effects 2.3 Montreal Protocol and Clean Air Act (RA 8749) 2.4 Recovery/recycling equipment specifications, parts and uses 2.5 Refrigerant types and specifications 2.6 Safety precautions in handling refrigerants 2.7 Refrigerant identifier instrument, specification, parts and uses 2.8 Trade Theory - Basic electrical - Air-conditioning and refrigeration - Compressor - Condenser - Expansion valve - Lubricant - Principles of Refrigeration - Compression - Condensing - Expansion - Revaporizing - Basic electronics - Basic automotive - Electrical and mechanical system of A/C - Heat transfer

3. Underpinning Skills	3.1 Installing and operating recovery and recycling machine 3.2 Interpreting manufacturer and equipment data 3.3 Estimating cost of recovery/recycling 3.4 Maintaining recovery/recycling machine 3.5 Use of refrigerant identifier
4. Resource Implications	Things necessary to conduct method of assessment: 4.1 Manufacturer's manual 4.2 Work place location 4.3 Materials, tools and equipment relevant to the proposed activity 4.4 Air-conditioning/refrigeration unit

5. Methods of Assessment	Competency in this unit must be assessed through: 5.1 Direct observation 5.2 Questions related to underpinning knowledge
6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: REPAIR AND RETROFIT TRANSPORT AIR-CONDITIONING AND REFRIGERATION SYSTEMS AND ITS ACCESSORIES

UNIT CODE : HVC723320

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in troubleshooting, repairing and retrofitting air-conditioning and refrigeration systems in the land and marine transports. It also includes evaluating the condition of the existing transport air-conditioning and

refrigeration system, preparing materials, repairing/replacing faulty transport air-conditioning and refrigeration system and its components, undertaking preventive maintenance and retrofitting of transport air-conditioning and refrigeration system from CFC to HCFC/HC refrigerants.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Evaluate condition of existing air conditioning system in PACU/CRE	1.1 Safe working practices are observed based on safety regulations 1.2 Visual inspection of all air conditioning components is performed and any signs of damage, lubricant leaks and corrosion are reported to the supervisor 1.3 Air conditioning system is operated to check that the system performs on R-12 as intended by the manufacturer, and any malfunction is reported to the supervisor 1.4 Leak test is performed immediately after the air conditioning system has been operating for 10 to 15 minutes using a compatible leak detector, and any leaks found are repaired according to manufacturer's specifications

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables

2. Prepare for servicing/repairing transport air-conditioning and refrigeration system	2.1 Work instructions are read and interpreted based on job requirements 2.2 ***Electrical materials*** are prepared as per job requirements and are checked for damage 2.3 Appropriate PPE is selected in line with the job requirements 2.4 Work safety is observed according to enterprise regulations
3. Prepare air conditioning system for retrofitting	3.1 Safe working practices are observed throughout the task 3.2 Suitable tools and equipment are selected and used according to manual 3.3 Faults identified from a visual inspection and an operational check are rectified according to manufacturer's specifications 3.4 Amount of oil in the compressor is optimized by running the R-12 air conditioning system with the blower on high speed 3.5 All R-12 refrigerant is recovered from the vehicle's air conditioning system using compatible refrigerant recovery and recycling equipment and in accordance with legislation and manufacturer's recommendations 3.6 Air conditioning system is ***evacuated*** to remove as much R-12 as possible from the residue mineral oil 3.7 ***Mineral oil is removed*** from the system following compressor and manufacturer's recommendations

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables

4. Convert air conditioning system for HCFC/HC	4.1 Safe working practices are observed throughout the task 4.2 Suitable tools and equipment are selected and used compatible components 4.3 ***Non-compatible components*** are replaced following compressor and vehicle manufacturer's recommendations 4.4 Quick connect service ports are installed per procedures 4.5 Air conditioning system is evacuated following the procedure outlined in the recovery equipment instructions 4.6 Specified amount of compatible oil (Polyalkylene Glycol [PAG oil] or ester oil) is installed following compressor and manufacturer's recommendations and instructions 4.7 Air conditioning system is charged following compressor and vehicle manufacturer's guidelines, and in accordance with legislation and codes of practice 4.8 ***Retrofit labels*** are installed as per procedure

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
5. Undertake preventive maintenance check/adjustment	5.1 Inspection and testing on transport air-conditioning and refrigeration components is carried out with appropriate test equipment in accordance with air-conditioning / refrigeration principles, procedures and safety requirements 5.2 Preventive maintenance is performed in accordance with the manufacturer's specifications
6. Test air conditioning system operation	6.1 Safe working practices are observed as per safety regulations 6.2 Suitable tools and HCFC/HC compatible equipment are selected and used as per procedures and vehicle manufacturer's specifications 6.3 Air-conditioning system is checked based on procedures 6.4 Any leaks located as a result of leak detection tests are sealed in compliance with compressor and manufacturer's instructions 6.5 Air-conditioning system is tested and operated within compressor and manufacturer's acceptable limits of temperatures and pressures
7. Return to service air-conditioning and refrigeration equipment and its accessories	7.1 Components are reassembled, tested and assessed for correct operation against specification 7.2 Assembly and testing procedures are followed based on manual 7.3 Maintenance records/service reports are recorded and completed in accordance with standard operating procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Electrical materials	1.1 Electrical tape 1.2 Wire connector 1.3 Wires and cables 1.4 Breaker 1.5 Terminal clips/plugs
2. Safety precautions	2.1 Personal safety 2.2 Safety of others, equipment
3. Leaks	3.1 Leaks on pipings and around compressor, evaporator and condenser
4. Evacuation	4.1 Minimum of 30minutes, steady vacuum of 29 in. Hg (mercury) unless otherwise specified by the compressor and manufacturer
5. Mineral oil removal	5.1 Removing and draining components, flushing using R-141
6. Components	6.1 Compressor 6.2 Condenser 6.3 Evaporator 6.4 Liquid Line Strainer 6.5 Metering Device 6.6 Pressure Controls 6.7 Thermostat 6.8 Refrigerant Piping 6.9 Defrost Controls 6.10 Fan/Fan Motor 6.11 Pipe Insulation 6.12 Door Hinges 6.13 Latches 6.14 Cabinetry/Housing 6.15 Expansion valve

VARIABLE	RANGE
7. Non-compatible components	7.1 Filter 7.2 Compressor 7.3 Desiccant 7.4 Receiver-drier (accumulator-drier) 7.5 Pressure switches and controls
8. Retrofit label	8.1 Name and address of company (or individual) performing retrofit service 8.2 Date service performed 8.3 Type and amount of refrigerant 8.4 Type and amount of lubricant 8.5 Warning to use only refrigerant and the specified oil
9. Retrofitting procedures	9.1 CFCs to HCFCs/HC

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Performed visual inspection of all air-conditioning components 1.2 Selected types of electrical tools/instrument and wiring devices, equipment and materials in accordance with specification and job requirement 1.3 Identified and diagnosed faults in accordance with the standard operating procedures 1.4 Reported and repaired any signs of damage, lubricant leaks and corrosion according to manufacturer's specifications 1.5 Repaired/replaced transport air-conditioning and refrigeration and its components as per manufacturer's operation/repair manual 1.6 Converted air-conditioning system with appropriate refrigerants following standard operating procedures 1.7 Air-conditioning system functioned within compressor and manufacturer's acceptable limits of temperatures and pressures 1.8 Tested air-conditioning system operation according to manufacturer's specifications and standard operating procedures 1.9 Performed preventive maintenance in accordance with manufacturer's specifications 1.10 Recorded and completed maintenance/service reports in accordance with standard operating procedures 1.11 Demonstrated compliance with safety regulations applicable to worksite operations 1.12 Communicated interactively with others where applicable to ensure safe and effective work operations

2. Underpinning Knowledge	2.1 **SAFETY PRACTICES** • Protective personal equipment/safety gear • Safe handling of tools and equipment • Proper handling of refrigerants/pressure testing and welding gases • Safety signs and symbols • Safety hazard • Good housekeeping 2.2 **BLUEPRINT READING AND PLAN SPECIFICATION** • Electrical wiring control diagram • Mechanical plan/symbols and abbreviations • Electrical plans, symbols and abbreviations	2.3 **TRADE THEORY** • Basic electricity • Basic electronics • Basic automotive • Basic refrigeration cycle • Fundamentals of control • Principle and operation of auxiliary parts of refrigeration system • Principle and operation of air-conditioning and refrigeration • Principle and operation of interlocking control • Fan characteristics • Electrical code • Air-conditioning and refrigeration system • Basic welding • Installation procedures • Selection of unit and components • Heat transfer

	2.4 **TOOLS/MATERIALS: USES AND SPECIFICATIONS** • Types of electrical controls • Types of expansion valves/metering devices • Types of compressor motor • Types of condenser • Types of evaporator • Types of refrigerant • Types of pressure control • Types of defrost timer • Types of fan motor • Types of fan • Types of pipe • Types of filter drier • Types of filter/strainer element • Types of thermostat • Types of circuit breaker • Types of magnetic contractor • Types of unloader • Types of compressor • Types of pump • Phase sequence tester 2.5 **TRADE MATHEMATICS/ MENSURATION** • Linear measurements • Dimensions • Ratio and proportion • Unit conversion 2.6 **LEGISLATION** • Clean Air Act (RA 8749) • Montreal Protocol • Ozone Depleting Refrigerants (ODRs) 2.7 **MAINTENANCE** • Preventive Maintenance	2.8 **PROCESSES/ PROCEDURES** • Electrical control calibration procedures • Repair/replace/assemble compressor procedure • Repair/replace defective condenser procedure • Replace liquid line strainer element procedure • Replace metering device procedure • Replace pressure controls procedure • Replace thermostat procedure • Repair/replace refrigerant piping procedure • Brazing procedure • Refrigerant recovery procedures • Follow the general procedure for checking-out transport air-conditioning and refrigeration control • Pump down procedures • Replace defrost controls procedure • Repair/replace fan/fan motor procedures re: evaporator condenser • Refrigerant charging procedures • Leak testing procedures • Mechanical testing • Latest update on refrigerant types and usage in relation to environmental issues

3. Underpinning Skills	3.1 Reading and interpreting schematic diagram, plans, drawings, specifications and manuals 3.2 Installing equipment, components and accessories 3.3 Fabricating brackets 3.4 Using electrical tools and materials properly 3.5 Handling manual safely 3.7 Testing electrical/mechanical 3.8 Troubleshooting technique 3.9 Replacing defective parts 3.10 Preparing reports 3.11 Reading and interpreting manufacturer's manual 3.12 Performing mathematical computation and calculations, including linear measurements, ratios and unit conversion
4. Resource Implications	Things necessary to conduct method of assessment: 4.1 Work place location 4.2 Air-conditioning and refrigeration system 4.3 Refrigerant 4.4 Materials, tools and equipment appropriate to repairing/retrofitting processes 4.5 Drawings and specifications relevant to the task
5. Methods of Assessment	Competency in this unit must be assessed through: 5.1 Direct observation 5.2 Questions related to underpinning knowledge
6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: PERFORM TESTING AND COMMISSIONING FOR TRANSPORT AIR-CONDITIONING AND REFRIGERATION

UNIT CODE : HVC723321

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in performing testing and commissioning air-conditioning and refrigeration systems in the land and marine transports.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Prepare for commissioning refrigeration and air-conditioning systems	1.1 Work instructions are read and interpreted as per job requirements 1.2 Tools and equipment are selected in accordance with job requirements 1.3 Pre-commissioning checks are completed and complied with procedures laid down in ***system documents*** 1.4 Commissioning method and program are produced and recording sheets are prepared in accordance with standard operating procedures 1.5 Flow rates are confirmed for the system to be commissioned 1.6 ***Commissioning instruments*** are procured and calibrated in accordance with system documents 1.7 PPE is selected in line with job requirements

2. Assess refrigeration and air-conditioning system operation	2.1 ***Systems*** are checked safely in accordance with standard operating procedures 2.2 Pressures and temperature are correctly determined and recorded in accordance with standard operating procedures 2.3 Faults are correctly isolated to component level and appropriate corrective action applied 2.4 Refrigeration and air-conditioning systems is checked for leaks and contamination safely in accordance with standard operating procedures

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
3. Recover refrigerant and air-conditioning system	3.1 Refrigerant system is evacuated using appropriate techniques, tools and equipment and in accordance with standard operating procedures, codes and regulations 3.2 Refrigerant evacuated from the refrigeration and air-conditioning systems is contained/ disposed of in accordance with standard operating procedures 3.3 Quantities of refrigerant reclaimed from refrigeration and air-conditioning systems and those that are released into the atmosphere are recorded/ reported in accordance with standard operating procedures
4. Charge the refrigeration and air-conditioning system	4.1 Systems are charged with the correct refrigerant to system specifications and in accordance with standard operating procedures and as per manufacturer's instruction manual 4.2 Appropriate lubricating oil is added to the refrigeration and air-conditioning systems in accordance with standard operating procedures 4.3 Refrigeration and air-conditioning systems is checked for leaks using appropriate tools, techniques and equipment in accordance with standard operating procedures
5. Perform pre-start checks	5.1 Electrical, pneumatic and other controls are tested and set to meet specified and safety performance requirements 5.2 Electrical systems are checked in compliance with performance and safety requirement 5.3 Motor, motor ratings and pump rotation directions are verified based on procedures 5.4 Fluid flows are tested and balanced as per procedures 5.5 Noise and vibration levels are confirmed within limits of specifications

RANGE OF VARIABLES

VARIABLE	RANGE
1. Unit	Land and marine transports may include but is not limited to: 1.1 Land transport (engine driven, e.g. cars, trucks, refrigerated vans, etc.) 1.2 Marine/sea transport (vessels)
2. System documents	2.1 Operating and maintenance procedures 2.2 Instructions for the system 2.3 Manufacturer's specifications 2.4 Company-prepared operating and maintenance manuals
3. Commissioning instruments	Including but is not limited to: 3.1 System analyzer 3.2 Manifold gauge 3.3 Clampmeter 3.4 Multi-tester 3.5 Psychrometer 3.6 Thermometer 3.7 Electronic leak detector

EVIDENCE GUIDE

1. Critical aspects of competency	Competency requires evidence that the candidate: 1.1 Checked refrigeration and air-conditioning system in accordance with standard operating procedures, relevant codes and refrigeration 1.2 Correctly isolated faults to component level applied appropriate corrective action 1.3 Checked refrigeration and air-conditioning for leaks and contamination safely using appropriate tools, techniques and equipment in accordance with standard operating procedures 1.4 Recorded/reported recovered refrigerant from refrigeration and air-conditioning systems are in accordance with standard operating procedures and relevant codes and refrigeration 1.5 Charged systems with the correct refrigerant to system specifications and in accordance with standard operating procedures and as per manufacturer's instruction manual 1.6 Tested and set electrical, pneumatic and other controls to meet specified and safety performance requirements 1.7 Identified faults and problems and made necessary action to rectify 1.8 Communicated interactively with others where applicable to ensure safe and effective work operations 1.9 Completed performing commissioning and start-up procedures in accordance with the standard procedures
2. Underpinning Knowledge	2.1 **SAFETY PRACTICES** • Protective personal equipment/safety gears • Safe handling of tools and equipment • Proper handling of refrigerants • Safety signs and symbols • Safety hazard • Good housekeeping 2.2 **BLUEPRINT READING AND PLAN SPECIFICATION** • Electrical wiring control diagram • Mechanical plan/symbols and abbreviation

	2.3 **TOOLS/MATERIALS: USES AND SPECIFICATIONS** • Types of electrical controls • Types of expansion valve • Types of compressor motor • Types of condenser • Types of evaporator • Types of refrigerant • Types of pressure control • Types of defrost timer • Types of fan motor • Types of fan • Types of pipe • Types of filter drier • Types of filter/strainer element • Types of thermostat • Types of circuit breaker	• Types of magnetic contactor • Types of unloader • Types of compressor • Types of pump 2.4 **MAINTENANCE** • Preventive maintenance 2.5 **TRADE THEORY** • Basic electricity • Basic electronics • Basic automotive • Basic refrigeration cycle • Fundamentals of refrigeration and control • Interlocking control sequence • Fundamentals of piping • Fan characteristics • Pump principles • Cooling tower principles
	2.6 **PROCESSES/ PROCEDURES** • Compressor test procedures • Power supply test procedures • Cooler/evaporator test procedures • Condensing unit test procedures • Pump test procedures • Cooling tower test procedures • Thermostatic expansion valve test procedures • Automatic expansion valve test procedures	• Electrical control test procedures • Leak testing procedure (for refrigeration circuit and water piping) • Pressure testing procedure • Vacuum testing procedure • Refrigerant charging procedure • Pumpdown procedure • Crank case heater test procedures • Unloading test procedures • Start-up procedure 2.7 **LEGISLATION** • Clean Air Act (RA 8749) • Montreal Protocol • Ozone Depleting Refrigerants (ODRs)

3. Underpinning Skills	3.1 Interpreting plan and details 3.2 Preparing materials 3.3 Performing work safety 3.4 Using electrical tools and testing equipment properly 3.5 Electrical testing 3.6 Mechanical testing 3.7 Communicating effectively
4. Resource Implications	Things necessary to conduct method of assessment: 4.1 Work place location 4.2 Tools and equipment appropriate to performing commissioning on the refrigeration and air-conditioning systems 4.3 Materials relevant to the proposed activity 4.4 Drawings and specifications relevant to the task
5. Methods of Assessment	Competency in this unit must be assessed through: 5.1 Direct observation 5.2 Questions related to underpinning knowledge
6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

SECTION 3 TRAINING STANDARDS

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 Transport RAC Service.

3.1 CURRICULUM DESIGN

Course Title: TRANSPORT RAC SERVICING NC Level: NC II

Nominal Training Duration: 18 Hours (Basic)
34 Hours (Common)
160 Hours (Core)

Course Description:

This course is designed to equip individual with operational skills in RAC Servicing which installs, services and maintains, troubleshoots and repairs transport air-conditioning and refrigeration units. It covers the basic, common and core competencies.

To obtain this, all units prescribed for this qualification must be achieved:

BASIC COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Participate in workplace communication	1.1 Obtain and convey workplace information 1.2 Complete relevant work related documents 1.3 Participate in workplace meeting and discussion	Group discussion Interaction	• Demonstration • Observation • Interviews/ questioning
2. Work in a team environment	2.1 Describe and identify team role and responsibility in a team 2.2 Describe work as a team member	Discussion Interaction	• Demonstration • Observation • Interviews/ questioning

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
3. Practice career professionalism	3.1 Integrate personal objectives with organizational goals 3.2 Set and meet work priorities 3.3 Maintain professional growth and development	Discussion Interaction	• Demonstration • Observation • Interviews/ questioning
4. Practice occupational health and safety	4.1 Evaluate hazard and risks 4.2 Control hazards and risks 4.3 Maintain occupational health and safety awareness	Discussion Plant tour Symposium	• Observation • Interview

COMMON COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Prepare materials and tools	1.1 Identify materials and tools 1.2 Request materials and tools 1.3 Receive and inspect materials and tools	Self-paced/ Modular Demonstration Small Group Discussion Distance Education	Written Practical / Performance Test
2. Observe procedures, specifications and manuals of instructions	2.1 Identify and access specifications and manuals 2.2 Interpret manuals 2.3 Apply information in manuals	Discussion Lecture Modular	Written Practical / Performance Test
3. Perform mensuration and calculation	3.1 Select measuring instruments 3.2 Carry-out measurements and calculations	Self-paced/ Modular Demonstration Small Group Discussion Distance Education	Written/Oral Examination Practical Demonstration

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
4. Perform basic bench work	4.1 Prepare materials, tools and equipment for layout 4.2 Layout features in workplace 4.3 Cut sheets, plates and bars 4.4 Smooth sheets plates and bars 4.5 Drill holes in sheets, plates and bars 4.6 Bore holes in sheet plates and bars 4.7 Bend sheets, plates and bars 4.8 Join sheets, plates and bars	Modular Film Showing Demonstration On-the-job training	Interview Demonstration Direct Observation
5. Perform basic electrical works	5.1 Measure and analyze circuit and load resistance in electrical system 5.2 Measure and analyze voltage in electrical system 5.3 Measure and analyze current in electrical system 5.4 Test simple electrical components and connections 5.5 Repair minor electrical system troubles	Modular Computer-based training (Simulation) Demonstration On- the-job training	Interview Computer-based assessment (Simulation) Demonstration Direct Observation

6. Maintain tools and equipment	6.1 Check the conditions of tools and equipment; 6.1 Perform basic preventive maintenance 6.3 Store tools and equipment	Small Group Discussion Demonstration of Practical Skills Modular	Observation and Oral questioning Demonstration and Oral questioning Written test

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
7. Perform housekeeping and safety practices	7.1 Sort materials, tools and equipment 7.2 Clean workplace area, materials, tools and equipment 7.3 Systematize dispensing and retrieval of materials, tools and equipment 7.4 Identify and minimize/ eliminate hazards 7.5 Respond and record accidents 7.6 Follow basic securities	Small Group Discussion Demonstration of Practical Skills Modular	Observation and Oral questioning Demonstration and Oral questioning Written test
8. Document work accomplished	8.1 Identify forms and data 8.2 Prepare reports	Small Group Discussion Demonstration of Practical Skills Modular	Demonstration and Oral questioning Written Test

CORE COMPETENCIES

Unit of Competency	Learning Outcome	Methodology	Assessment Approach

1. Install transport air-conditioning and refrigeration units	1.1 Prepare tools, materials Instrument and equipment for installation of transport refrigeration and air-conditioning system 1.2 Lay-out mechanical Components, accessories and piping of transport refrigeration and air-conditioning system 1.3 Install mechanical components, accessories and piping of transport refrigeration	Discussion Demonstration Trainee Hands-on	Direct Observation and Questioning Demonstration

Unit of Competency	Learning Outcome	Methodology	Assessment Approach
2. Service and maintain transport air-conditioning and refrigeration units.	2.1 Check and maintain components/parts of mobile air-conditioning and refrigeration system 2.2 Maintain electrical system 2.3 Maintain electrical system 2.4 Repair/Replace transport air-conditioning and refrigeration system parts and accessories	Discussion Demonstration Trainee Hands-on	Direct Observation and Questioning Demonstration.
3. Trouble shoot transport air-conditioning and refrigeration units	3.1 Check power supply 3.2 Test electrical component of air-conditioning equipment 3.3 Test electrical component of Domestic refrigeration units 3.4 Test air-conditioning and Domestic refrigeration circuits 3.5 Report and record finding of the tested unit	Discussion Demonstration Trainee Hands-on	Direct Observation and Questioning Demonstration
4. Recover and recycle refrigerant in transport air-conditioning and refrigeration system	4.1 Assess unit for recovery/recycling 4.2 Set-up equipment/ recycle machine 4.3 Perform refrigerant recovery/recycling	Discussion Demonstration Trainee Hands-on	Direct Observation and Questioning Demonstration

Unit of Competency	Learning Outcome	Methodology	Assessment Approach
5. Repair and retrofit transport air-conditioning and refrigeration systems	5.1 Evaluate, conditioning of existing transport air conditioning 5.2 Prepare for servicing/ repairing transport air-conditioning and refrigeration/system 5.3 Prepare air-conditioning system for retrofitting 5.4 Troubleshoot air conditioning and refrigeration components 5.5 Covert air conditioning system for HCFC/HC 5.6 Undertake preventive maintenance check/ adjustment 5.7 Test air-conditioning 5.8 Return to service air-conditioning and refrigeration equipment and its accessories	Lecturette Demonstration Trainee Hands-on	Direct Observation and Question Demonstration
6. Perform testing and commissioning for transport air-conditioning and refrigeration	6.1 Prepare for commissioning refrigeration and air conditioning system. 6.2 Assess refrigeration and air-conditioning system operation 6.3 Recover refrigerant in refrigeration and air-conditioning system 6.4 Charge the refrigeration and air-conditioning system 6.5 Perform pre-start checks	Discussion Demonstration Trainee Hands-on	Direct Observation and Questioning Demonstration

3.2 TRAINING DELIVERY

The delivery of training should adhere to the design of the curriculum. Delivery shall be guided by the 10 basic principles of competency-based TVET:

- The training is based on curriculum developed from the competency standards;
- Learning is modular in its structure;
- Training delivery is learner-centered and should accommodate individualized and self-paced learning strategies;
- Training is based on work that must be performed;
- Training materials are directly related to the competency standards and the curriculum modules;
- Assessment is based in the collection of evidence of the performance of work to the industry required standard;
- Training is based both on and off-the-job components;
- Training program allows for recognition of prior learning (RPL) or current competencies;
- Training allows for multiple entry and exit; and
- Training programs are registered with the UTPRAS.

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 may be adopted when designing training programs:

- The dualized mode of training delivery is preferred and recommended. Thus programs would contain both in-school and in-industry training or fieldwork components. Details can be referred to the Dual Training System (DTS) Implementing Rules and Regulations.

- Modular/self-paced is a competency-based training modality wherein the trainee is allowed to progress at his own pace. The trainer facilitates the training

delivery.

- Peer teaching/mentoring is a training modality wherein fast learners are given the opportunity to assist the slow learners.

- Supervised Industry Training or On-the-Job Training is 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.

- 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, or audio, video or computer technologies.

- Project-based instruction is an authentic instructional model or strategy in which students plan, implement and evaluate projects that have real world applications.

3.3 TRAINEE ENTRY REQUIREMENTS

This section specifies the qualifications of trainees and educational experience. Other requirements like health and physical requirements are also stated. Passing entry written examinations may also be indicated if necessary.

- Can perform basic mathematical computation
- Good moral character
- Ability to communicate either oral and written
- Physically and mentally fit

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS TRANSPORT RAC SERVICING NC II

Recommended list of tools, equipment and materials for the training of 25 trainees for TRANSPORT RAC Servicing NC II.

TOOLS		EQUIPMENT		MATERIALS	
Qty.	**Description**	**Qty.**	**Description**	**Qty.**	**Description**
6 sets	System Analyzer	2 units	Recovery/recycling machine	3 pcs	Liquid receiver/drier, R 12
6 pcs.	Adjustable wrench, 12”	3 units	Vacuum pump	2 pcs	Liquid receiver/drier, R 134a
6 pcs.	Adjustable wrench, 8”	1 unit	Pressure washer	1 pc	Refrigerant tank R 12
3 sets	Open end wrench	1 unit	Refrigerant identifier	1 pc	Refrigerant tank R 134a
3 sets	Box wrench	2 sets	Oxyacetylene unit	5 pcs	Expansion valve
3 sets	Allen wrench	2 sets	Nitrogen cylinder w/ regulator	1 gal	Mineral oil, 3 GS, 5 GS
5 sets	Hacksaw	2 sets	Charging cylinder , R134a and R12	1 gal	Synthetic oil
5 pcs	Rubber mallet	2 units	Digital weighing scale	1 roll	Copper tube. 3/8”
5 pcs.	Ballpen hammer	1 unit	Portable welding machine	1	Flexible pipe, discharge line
10 pcs.	Files, assorted	1 unit	Air compressor	1	Flexible pipe, suction line
3 sets	Socket wrench	5units	Auxillary fan	10	Fittings, discharge line
3 sets	Tinner’s snip	5 units	Evaporator, hang type	10	Fittings, suction line

3 sets	Screw drivers	5 units	Condenser coil	1 roll	Automotive wire # 12
5 pcs.	Long nose plier	5units	Compressor	1roll	Automotive wire #14
5 pcs	Side Cutter	2 units	Transport Refrigeration Trainer	5 rolls	Electrical tape
5 pcs.	Crimping tools	2 units	Transport air conditioning Trainer	100 pcs	Assorted types of clamps
5 pcs.	Vise grip				
1 set	Hole saw				

TOOLS		EQUIPMENT		MATERIALS	
Qty.	Description	Qty.	Description	Qty.	Description
2 sets	Oil pump			100 pcs	Assorted types of flare nuts
5 sets	Flaring tools			100 pcs	Assorted types of nuts and bolts
5 sets	Swaging tool			100 pcs	Terminal clips
5 pcs.	Tube cutter			100 pcs	Assorted types of O ring
5 pcs.	Tube bender, ¼"			50 pcs	Silver rod
5 pcs.	Tube bender			50 pcs	Aluminum rod
5 pcs.	Refrigeration ratchet			5jar	Aluminum flux
3 sets	Quick connector for R134a			3 pcs	Thermostat ,auto aircon
5 pcs.	Push pull rule			3 pcs	Thermostat ,electronic w/ thermistor
5 pcs.	Steel rule			2 cyls	Nitrogen gas
5 sets	Soldering iron			3 sets	Idling stabilizer
2 units	Portable drill			5 sets	Overhauling gasket ,abacus
1 unit	Portable grinder			5 sets	Overhauling gasket, Nippondenso
1 set	Puncher			5 pcs	ignition lighter
5 sets	Multitester			5 boxes	Rags
5 sets	Thermometer, digital			5 boxes	Soap
10 pcs.	Service cylinder, 2.5 kg			10 pcs	Sand paper
3 pcs.	Refractometer			5 pcs	Sealant
3 units	Vacuum gauge			5 pcs	Pressure switch
				5 pcs	Control resistor
				5 pcs	Ambient sensor

3.5 TRAINING FACILITIES
TRANSPORT RAC SERVICING NC II

Based on a class intake of 25 students/trainees.

Unit of Competency	Space (m)	Area in Sq. Meters	Total Area in Sq. Meters
A. LECTURE AREA*	4 x 8	32	32
B. LEARNING RESOURCE AREA	4 x 6	24	24
C. TOOL/STORAGE AREA*	4 x 4	16	16
D. WASH, TOILET AND LOCKER ROOM*	3 x 4	12	12
E. FACILITIES/ EQUIPMENT/ CIRCULATION			25
TOTAL AREA			**109**

3.6 TRAINER'S QUALIFICATION FOR HVAC/R SECTOR

TRANSPORT RAC SERVICING NC II

TRAINER QUALIFICATION II (TQ II)

(TM II)

- Must have undergone training on Training Methodology II
- He must be a holder of RAC Servicing, NC III
- Good moral character
- Must be physically and mentally fit
- Must be computer literate
- Must be a Civil Service eligible (for government position or appropriate professional license issued by the Professional Regulatory Board)
- *Must have at least two (2) years job/industry experience

*Optional: Only when required by the hiring institution
Reference: TESDA Board Resolution No. 2004-03

3.7 INSTITUTIONAL ASSESSMENT

Institutional assessment is undertaken by trainees to determine their achievement of units of competency. A certificate of achievement is issued for each unit of competency.

SECTION 4 NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

4.1 To attain the National Qualification of **Transport RAC 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.

4.2 The qualification of **Transport RAC Servicing NC II** may be attained through:

4.2.1 Accumulation of Certificates of Competency (COCs) in all the following areas:

4.2.1.1 Install transport air-conditioning and refrigeration units

4.2.1.1.1 Install transport air-conditioning and refrigeration units

4.2.1.1.2 Perform testing and commissioning for transport air-conditioning and refrigeration units

4.2.1.2 Service and maintain transport air-conditioning and refrigeration units

4.2.1.3 Troubleshoot transport air-conditioning and refrigeration systems

4.2.1.4 Recover and Recycle refrigerant in transport air-conditioning and refrigeration systems

4.2.1.5 Repair and retrofit transport air-conditioning and refrigeration systems and its accessories

4.2.1.5.1 Repair and retrofit transport air-conditioning and refrigeration systems and its accessories

4.2.1.5.2 Perform testing and commissioning for transport air-conditioning and

refrigeration

Successful candidates shall be awarded Certificates of Competency (COCs).

4.2.2 Demonstration of competence through project-type assessment covering all required units of the qualification.

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

One or two additional evidences in the form of Portfolio, Third Party Report, Written Test and Demonstration with Questioning may be required by the assessor in addition to those specified in the Methods of Assessment in the Competency Standards, depending on the need for supplementary evidences.

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

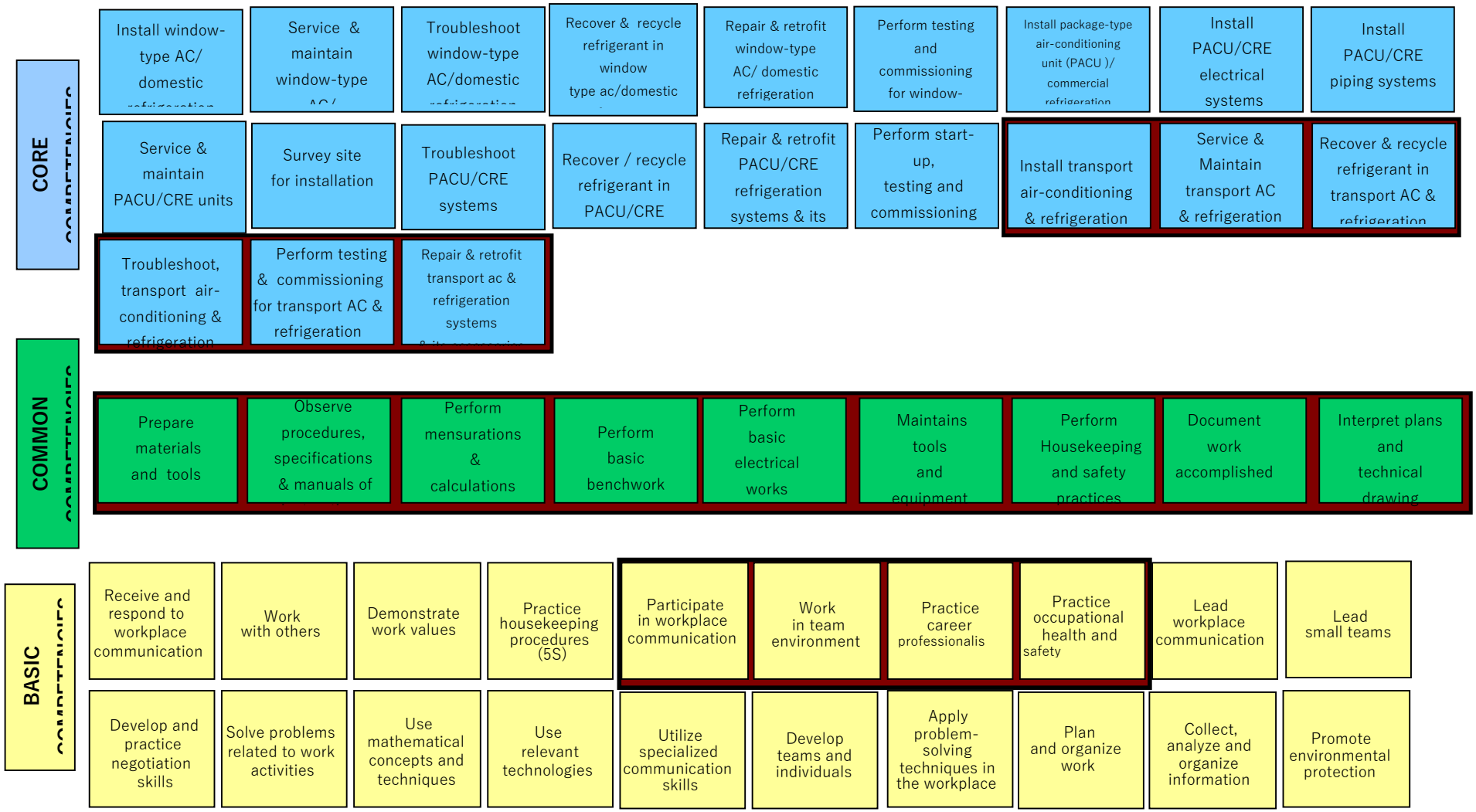
4.4.1 Graduates of formal, non-formal and informal including enterprise-based training programs

4.4.2 Experienced Workers (wage employed or self-employed)

4.5 The guidelines on assessment and certification are discussed in detail in the "Procedures Manual on Assessment and Certification" and "Guidelines on the Implementation of the Philippine TVET Qualification and Certification System (PTQCS) .

COMPETENCY MAP - HVAC/R Sector
TRANSPORT RAC SERVICING NC II

ANNEX A



DEFINITION OF TERMS

1) **Air Cooled Condensing Unit (ACCU)/OUTDOOR UNIT** – an equipment that condenses refrigerant vapor using air as the condensing medium. It consist of compressor, condenser coil and fan motor

2) **Air Cooled Condenser** – an equipment that condenses refrigerant vapor using air as the condensing medium

3) **Air Handling Unit (AHU)/INDOOR UNIT** – an air-conditioning component that consists of a fan motor and an evaporator coil. It is this equipment used in air-conditioning that absorbs heat from the space

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

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

6) **Commercial Refrigeration** - covers water coolers/ display coolers, vendo machine, beverage machine icedrop/ice cream/ice cube vending machines

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

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

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

10) **Evaporator** – the component in a refrigeration system where liquid refrigerant is
changed into a vapor by the absorption of heat

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

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

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

14) **Hot Gas Defrost** – component part used to remove frosting on the evaporator
coil using hot gas refrigerant from the compressor

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

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

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

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

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

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

21) **Package Air-conditioning Unit (PACU)/SPLIT-TYPE** – an air-conditioning unit that contains the compressor, water-cooled condenser, metering device and evaporator all of which is in one casing

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

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

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

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

26) **Retrofitting** – a process of upgrading existing equipment or system using ozone depleting substances to environmental friendly refrigerant

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

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

29) **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

30) **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.

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

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

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

34) **Window Type Air-conditioning Unit** – is a self-contained air-conditioning
unit house in a single casing mounted in a wall or window opening

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

ACKNOWLEDGEMENTS

The Technical Education and Skills Development Authority (TESDA) wishes to extend thanks and appreciation to the many representatives of business, industry, academe and government agencies who donated their time and expertise to the development and validation of these Training Regulations.

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