TRAINING REGULATIONS

RAC SERVICING (DomRAC) NC II

(Domestic Refrigeration and Air-Conditioning)

HEATING, VENTILATION, AIR CONDITIONING AND REFRIGERATION

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
East Service Road, South Superhighway, Taguig City, Metro Manila

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REFRIGERATION AND AIR-CONDITIONING (RAC) SERVICING NC II
[Domestic Refrigeration and Air-Conditioning]

SECTION 1 RAC SERVICING (DomRAC) NC II QUALIFICATION

The **RAC SERVICING (DomRAC) NC II** Qualification consists of competencies that a person must achieve to enable him/her to install, service, maintain, troubleshoot and repair domestic air-conditioning and refrigeration units.

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
HVC311202	Interpret technical drawings
HVC311201	Observe procedures, specifications and manuals of instructions
HVC311203	Perform mensurations and calculations
HVC713202	Perform basic benchworks
HVC724201	Perform basic electrical works
HVC311204	Maintain tools and equipment
HVC315201	Perform housekeeping and safety practices
HVC311205	Document work accomplished

CODE NO.	CORE COMPETENCIES
HVC723337	Install domestic refrigeration and air-conditioning (DomRAC) units
HVC723338	Service and maintain domestic refrigeration and air-conditioning (DomRAC) units
HVC723339	Troubleshoot and repair domestic refrigeration and air-conditioning (DomRAC) systems

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

- Domestic Refrigeration and Air-conditioning Technician

SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in **RAC SERVICING *(*DomRAC*)* 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 ***Bold & Italicized*** fonts 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 ***Bold & Italicized*** fonts 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. Required 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. Required 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 ***Bold & Italicized*** fonts 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. Required Knowledge and Attitude	2.1. Communication process 2.2. Team structure 2.3. Team roles 2.4. Group planning and decision making
3. Required 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 ***Bold & Italicized*** fonts 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. Required Knowledge and Attitude	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. Required 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 ***Bold & Italicized*** fonts 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 ***Bold & Italicized*** fonts 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. Required 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. Required Skills	3.1 Practice of personal hygiene 3.2 Hazards/risks identification and control skills 3.3 Interpersonal skills 3.4 Communication skills
3. 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
4. Methods of Assessment	Competency may be assessed through: 5.1 Portfolio Assessment 5.2 Interview 5.3 Case Study/Situation
5. 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 ***Bold & Italicized*** fonts 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. Required Knowledge and Attitude	2.1 Types and uses of HVAC/R materials and tools 2.2 Different forms 2.3 Requisition procedures
3. Required 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 ***Bold & Italicized*** fonts 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. Required Knowledge and Attitude	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. Required 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 required 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 ***Bold & Italicized*** fonts 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. Required Knowledge and Attitude	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. Required 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 required 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 ***Bold & Italicized*** fonts 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. Required Knowledge and Attitude	2.1 **TRADE MATHEMATICS/MENSURATION** • Four fundamental operation • Linear measurement • Dimensions • Unit conversion • Ratio and proportion • Trigonometric functions • Algebraic equations
3. Required 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 required 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 required 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 BENCHWORKS

UNIT CODE : HVC713202

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

ELEMENT	PERFORMANCE CRITERIA ***Bold & Italicized*** fonts 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 ***Bold & Italicized*** fonts are elaborated in the Range of Variables
3. Perform required basic metal works	3.1 ***Work instructions are followed*** to ensure work safety 3.2 ***Basic metal works*** are performed applying knowledge on safety procedures and according to job requirements 3.3 Workpieces are clamped in ***workholding device*** to avoid damage and accidents 3.4 Work pieces are cut, chipped or filed according to required measurements, tolerance specified in the blueprint and free from burrs and sharp edges 3.5 Drilling is performed according to recommended sequence 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. Basic metal works	9.1 Sheet metal 9.2 Cutting 9.3 Filing 9.4 Drilling 9.5 Arc welding 9.6 Gas welding
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. Required Knowledge and Attitude	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. Required 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 required 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 ***Bold & Italicized*** fonts 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	9.7 Job requirements 9.8 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. Required Knowledge and Attitude	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. Required 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 required 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 ***Bold & Italicized*** fonts 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
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. Required 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. Required 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 required 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 COMPETENCY : PERFORM HOUSEKEEPING AND SAFETY PRACTICES FOR RAC SERVICING

UNIT CODE : HVC7315201

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

ELEMENT	PERFORMANCE CRITERIA ***Bold & Italicized*** fonts 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. Required Knowledge and Attitude	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. Required 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 required knowledge Assessment of required 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 ***Bold & Italicized*** fonts 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. Required 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. Required 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 required 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 DOMESTIC REFRIGERATION AND AIR-CONDITIONING (DomRAC) UNITS

UNIT CODE : HVC723337

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to safely install and test domestic refrigeration and air-conditioning (DomRAC) units. It includes conducting survey for installation, installing DomRAC unit and its electrical circuit as well as conducting performance testing.

ELEMENT	PERFORMANCE CRITERIA ***Bold & Italicized*** fonts are elaborated in the Range of Variables
1. Conduct survey	1.1. ***Site conditions*** and ***installation requirements*** are assessed according to manufacturer's specification and prevailing codes and ordinances. 1.2. ***Tools, equipment*** and ***materials*** needed for installation are determined according to site conditions and site installation requirements. 1.3. Survey result is reported in accordance with enterprise policies and procedures
2. Install DomRAC electrical circuit	2.1. Roughing-in activities are performed in accordance with the applicable Philippine Electrical Code (PEC) provisions 2.2. Electrical cabling and ***wiring devices*** of correct load carrying capacity are selected and safely installed in line with manufacturer's instructions 2.3. Power wiring is installed in accordance with applicable PEC provisions 2.4. Electrical circuit is tested in accordance with applicable PEC provisions
3. Install DomRAC unit	3.1. ***Unit*** and equipment/components are prepared based on work procedures 3.2. Bracket, hangers and frames are installed in accordance with manufacturer's recommendation and/or RAC Code of Practice 3.3. Unit is positioned and leveled in line with manufacturer's instructions and/or RAC Code of Practice 3.4. ***Sealing materials*** are installed to ensure an air tight seal around the unit in line with manufacturer's instructions and/or RAC Code of Practice 3.5. ***Condensate drain*** is installed in accordance with manufacturer's recommendation and/or RAC Code of Practice 3.6. Safe manual handling techniques are employed in line with enterprise ***OH&S procedures*** 3.7. 5's is exercised in line with enterprise policy

ELEMENT	PERFORMANCE CRITERIA ***Bold & Italicized*** fonts are elaborated in the Range of Variables
4. Conduct performance test	4.1. Voltage and current are measured according to unit power requirements. 4.2. Air temperature and velocity are measured based on unit specifications. 4.3. Sounds and vibration are checked based on unit specifications 4.4. ***Service report*** is accomplished in line with enterprise policies and procedures.

RANGE OF VARIABLES

VARIABLE	RANGE
1. site conditions	Site conditions may include: 1.1. assessment of structural and architectural installation provisions 1.2. assessment of availability of power source and unit's electrical provisions 1.3. assessment of wall finishing provisions 1.4. assessment of drainage provisions 1.5. assessment of air circulation/ ventilation provision
2. installation requirements	Installation requirements may include: 2.1. installation location requirements 2.2. wall finishing requirements 2.3. Electrical requirements • A/C plug and outlet • Wire size • Protection devices • Grounding
3. Tools and equipment	Tools and equipment may include: 3.1. Measuring tools 3.2. Spirit level 3.3. Plumb bob 3.4. Clear/Transparent water hose 3.5. Screw driver, flat and philip 3.6. Chisel 3.7. Hammer (claw and ballpeen) 3.8. Hacksaw 3.9. Electric drill 3.10. Drill bits 3.11. Cross cut/Rip saw 3.12. Welding equipment 3.13. Masonry tools (e.g. trowel, spade, level, etc.)
4. Materials	Materials includes: 4.1. Expansion bolt 4.2. Welding electrode (rod) 4.3. Sealant 4.4. Electrical cable/conduction 4.5. Convenience outlet 4.6. Electrical railways 4.7. Circuit breaker/switch 4.8. Masonry materials (e.g. cement, sand, etc.)

5. Wiring devices	May include: 5.1. Service grounding 5.2. Service outlet 5.3. Service plug
6. Unit	Unit includes: 6.1. Window type air-conditioner 6.2. Domestic Refrigeration unit (e.g. refrigerator, water cooler, household freezer, etc.)
7. Sealing materials	May include: 7.1. Rubber gasket 7.2. Foam 7.3. Plastic 7.4. Silicone
8. Condensate drain	May include: 8.1. PVC pipe/clamp 8.2. Plastic tubing/clamp 8.3. G.I. or metal tubing/clamp
9. OH&S procedures	May include: • Wearing of PPE • Lifting procedures • Ladder safety • Housekeeping
10. Service report	May include: • Installation report • Testing report • Commissioning report

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1. Assessed site conditions for DomRAC installation 1.2. Installed electrical circuit 1.3. Installed unit 1.4. Tested unit 1.5. Performed housekeeping	
2. Required Knowledge and Attitude	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 • Ratio and proportion • Unit conversion 2.3 **BLUEPRINT READING AND PLAN SPECIFICATION** • Electrical plans, symbols and abbreviations	2.4 **MATERIALS, TOOLS: USES AND SPECIFICATIONS** • Types of sealant • Types of insulation • Types of wires, conduits and fittings • Types of wiring device 2.5 **TRADE THEORY** • Basic refrigeration cycle • Basic electricity • Basic masonry • Basic carpentry • Basic plumbing • Basic arc welding 2.6 **MAINTENANCE** • Preventive Maintenance 2.7 **LEGISLATION** • RAC Code of Practice • Philippine Electrical Code
3. Required Skills	3.1 Interpreting plans and details 3.2 Preparing materials 3.3 Proper handling of tools and equipment 3.4 Working safely 3.5 Installing window-type air-conditioning and domestic refrigeration unit 3.6 Testing power supply 3.7 Connecting power circuit 3.8 Operating window-type air-conditioning unit and domestic refrigeration unit 3.9 Communicating effectively	
4. Resource Implications	The following resources must be provided: 4.1 Access to work place location/installation area 4.2 Tools and equipment appropriate to installation 4.3 Materials relevant to the proposed activity/task 4.4 Drawings and specifications relevant to the task	
5. Methods of Assessment	Competency must be assessed through: 5.1 Demonstration/Direct observation with oral questioning 5.2 Portfolio 5.3 Third party report	
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 DOMESTIC REFRIGERATION AND AIR-CONDITIONING (DomRAC) UNITS

UNIT CODE : HVC723338

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in servicing and maintaining domestic refrigeration and air-conditioning units. Specifically it includes cleaning and replacing air filters, servicing evaporator/ condenser, maintaining fan motor assembly, servicing electrical power and control circuits as well as accomplishing service and maintenance report.

ELEMENT	PERFORMANCE CRITERIA ***Bold & Italicized*** fonts are elaborated in the Range of Variables
1. Clean and replace air filter	1.1 ***Air filter*** is identified and removed following standard procedures 1.2 Filter is checked for damage and replaced if required in line with SOPs 1.3 Air filter is cleaned using the correct tools and cleaning procedures 1.4 Filter is replaced in accordance with filter specifications
2. Service evaporator/ condenser	2.1 Tools are selected in dismantling the evaporator/ condensing unit as per standard operating procedures (SOPs) 2.2 High pressure washer is used in cleaning evaporator/ condensing coil based on established procedures 2.3 Evaporator/condenser coil fins are straightened in accordance with service procedure 2.4 ***Cleaning agent*** or non-corrosive chemical is used in cleaning and maintaining evaporator/ condensing coil, fins and other ***body accessories*** as per standard operating procedures (SOPs)
3. Maintain fan motor assembly	3.1 Fan motor is maintained in line with manufacturer's instructions. 3.2 Fan blades and blower are serviced and maintained in line with manufacturer's instructions. 3.3 Fan motor terminals are checked and serviced in line with manufacturer's instructions. 3.4 Fan motor mounting is checked and serviced in line with manufacturer's instructions.

ELEMENT	PERFORMANCE CRITERIA ***Bold & Italicized*** fonts are elaborated in the Range of Variables
4. Service electrical power and control circuits	4.1 ***Proper instrument*** is used in checking power supply and diagnosing electrical control 4.2 Loose connections/wirings are repaired and reported in line with SOP 4.3 Plugs and outlets are checked in line with SOP 4.4 Grounding is checked in line with SOP
5. Accomplish service and maintenance report	5.1 All defects and problems encountered are reported in line with enterprise policies and procedures. 5.2 Observation and recommendation are properly reported in line with enterprise policies and procedures.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Air filter	1.1. Disposable 1.2. Reusable
2. Cleaning agent	2.1. Soap powder 2.2. Liquid soap
3. Other body accessories	3.1. base pan 3.2. drip tray 3.3. shroud 3.4. face cover 3.5. housing 3.6. propeller blade 3.7. centrifugal fan (blower)
4. proper instrument	May include: • clamp meter • VOM multi-tester

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1. Cleaned and/or replaced air filter parts/components 1.2. Cleaned evaporator/condensing coil 1.3. Maintained fan motor assembly 1.4. Serviced electrical power and control circuits 1.5. Accomplished service report.	
2. Required Knowledge	2.1 **SAFETY PRACTICES** • Protective personal equipment/safety gears • Handling of tools, equipment and accessories • Safety signs and symbols • Good housekeeping 2.2 **MATERIALS AND TOOLS: USES AND SPECIFICATIONS** • Types of lubricants • Parts of refrigerant circuit • Cleaning agents **2.3 EQUIPMENT** • Pressure washer • Clamp meter • VOM multi-tester	**2.4 TRADE THEORY** • Electrical/electric controls • Basic electricity/electronics • Fundamentals of refrigeration cycle • Fan motors • Motor compressor • Refrigeration system **2.5 PROCESSES** • Cleaning procedures • Servicing and maintenance procedures **2.6 LEGISLATION** • RAC Code of Practice • PEC
3. Required Skills	3.1 Interpreting diagrams 3.2 Preparing materials 3.3 Proper handling of tools and equipment 3.4 Testing electrical system 3.5 assembling and disassembling 3.6 inter-personal skills	
4. Resource Implications	The following resources must be provided: 4.1 Access to work place location 4.2 Tools and equipment 4.3 Materials relevant to the proposed activity 4.4 service manual	
5. Methods of Assessment	Competency must be assessed through: 5.1 Direct observation/demonstration with oral questioning 5.2 Portfolio 5.3 Third party results	
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 AND REPAIR DOMESTIC REFRIGERATION AND AIR-CONDITIONING (DomRAC) SYSTEMS

UNIT CODE : HVC723339

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to identify and analyze faults and troubles found in DomRAC systems. It also covers identifying and repairing faults/troubles, performing refrigerant recovery/ recycling and retrofitting on domestic refrigeration and air-conditioning unit as well as performing test-run on repaired DomRAC units. .

ELEMENT	PERFORMANCE CRITERIA ***Bold & Italicized*** fonts are elaborated in the Range of Variables
1. Plan and prepare for troubleshooting and repair	1.1 Appropriate wiring diagrams, charts and manuals are interpreted in line with the job requirements 1.2 Appropriate materials, tools and equipment are selected based on job requirements 1.3 Power supply is checked to ensure compliance with nameplate rating and/or manufacturer's specifications
2. Identify and repair faults/troubles	2.1. Appropriate ***PPE*** are selected and used in line with job requirements 2.2. ***Components*** are ***tested*** following manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy 2.3. Faults/problems with components are diagnosed in line with manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy 2.4. Remedial action is taken to overcome faults/problems in line manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy 2.5. Work is completed safely in line with workplace safety guidelines 2.6. Report on testing procedure, including faults and minor repair, is completed in line with manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy

ELEMENT	PERFORMANCE CRITERIA ***Bold & Italicized*** fonts are elaborated in the Range of Variables
3. Perform refrigerant recovery/recycling and retrofitting/ conversion on domestic refrigeration and air-conditioning unit	3.1 Safe working practices are observed throughout the task as per enterprise procedure 3.2 Suitable tools and equipment are selected and used based on job requirement 3.3 Optimum recovery of refrigerant is performed in line with RAC Code of Practice 3.4 Refrigerants recovery/recycling is performed according to manufacturer's recommendations and RAC Code of Practice 3.5 Retrofitting is performed based on RAC Code of Practice 3.6 Conversion is performed based on UN Conversion Manual.
4. Test-run repaired unit	2.7. Unit is tested in line with troubleshooting procedures 2.8. Report on repair and testing of unit is prepared in line with enterprise procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Components	May include but not limited to: 1.1. Electrical controls - Thermostat - Defrost timer - Relay - Thermo disc/Defrost thermostat - Switches - Overload protector 1.2. Compressor motor 1.3. Fan motors 1.4. Refrigerator defrost heater 1.5. Capacitor
2. PPE	Includes but not limited to: 2.1. Mask 2.2. Safety shoes 2.3. Safety goggles 2.4. Apron 2.5. Gloves
3. Test	May include: 3.1. Insulation 3.2. Resistance 3.3. Mechanical 3.4. Continuity 3.5. Timing Sequence 3.6. Leak

EVIDENCE GUIDE

<table>
<tr><td>1. Critical aspects of competency</td><td colspan="2">Assessment requires evidence that the candidate:

1.1 Diagnosed DomRAC faults/problems
1.2 Recover/Recycle refrigerants
1.3 Repaired and Retrofitted DomRAC
1.4 Tested Unit
1.5 Accomplished Service Report</td></tr>
<tr><td>2. Required Knowledge</td><td>2.1 SAFETY PRACTICES
• Protective personal equipment/safety gears
• Handling of tools, equipment and accessories
• Safety signs and symbols
• Good housekeeping
2.2 BLUEPRINT READING AND PLAN SPECIFICATION
• Schematic diagrams
2.3 MATERIALS AND TOOLS: USES AND SPECIFICATIONS
• Piercing valve
• Refrigerants
• Refrigeration oil
• Refrigeration accessories

Equipment
• Recovery machine
• Gauge manifold
• Vacuum pump
• Refractometer
• Weighing Scale
• Vacuumeter
• Refrigerant identifier
• Thermometer
• Leak detector
• Clamp meter</td><td>2.4 TRADE THEORY
• Basic Electricity
• Basic electronics
• Refrigeration principles
• Instrumentation

2.5 PROCESSES/ PROCEDURES
• Recovery/Recycling
• Retrofitting
• Conversion
• Motor insulation testing procedure
• Wiring resistance testing procedure
• Mechanical testing procedure
• Compressor construction
• Electrical system analysis
• Mechanical system analysis
2.6 LEGISLATION
• Environmental Protection Agency (EPA) Section 608
• DENR-EMB DAO No. 2004-08
• 19th MOP decision XIX/6 of the Montreal Protocol on Substances that Depletes the Ozone Layer
• Kyoto Protocol
• RAC Code of Practice
• UN Climate Change Framework
• Republic Act 9729 sec 3.k,3.l,3.m,3.n,3.0
• UN Conversion Manual</td></tr>
</table>

3. Required Skills	3.1 Interpreting 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 Tube processing 3.7 Proper handling of refrigerant and refrigeration oil 3.8 Recovery/recycling refrigerants 3.9 Retrofitting 3.10 System reprocess
4. Resource Implications	The following resources must be provided: 4.1 access to work place location and mockup unit 4.2 Tools and equipment appropriate to troubleshooting and repair 4.3 Materials relevant to the proposed activity 4.4 Drawings and specifications relevant to the task
5. Methods of Assessment	Competency must be assessed through: 5.1 Demonstration/Direct observation with oral questioning 5.2 Portfolio 5.3 Third party report
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 RAC Servicing NC II [Domestic Refrigeration and Air-Conditioning (DomRAC)].

3.1 CURRICULUM DESIGN

Course Title: **RAC SERVICING (DomRAC)** NC Level: **NC II**

Nominal Training Duration: 18 Hours (Basic)
42 Hours (Common)
420 Hours (Core)
180 Hours - in-school +
240 Hours - supervised-industry training (SIT)
---------- In actual work environment
480 Hour - Total training duration

Course Description:

This course is designed to equip individual with operational skills in RAC Servicing which installs, services and maintains, troubleshoots and repairs Domestic Refrigeration and Air-conditioning (Dom/RAC) units. It covers the basic, common and core competencies.

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

BASIC COMPETENCIES
18 Hours

Unit of Competency	Learning Outcomes	Training Methodology	Institutional 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	Training Methodology	Institutional 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

42 Hours

Unit of Competency	Learning Outcomes	Training Methodology	Institutional 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. Interpret technical drawings	2.1. Analyze symbols and data 2.2. Interpret work plans	Discussion Lecture Modular	Written Practical / Performance Test
3. 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

Unit of Competency	Learning Outcomes	Training Methodology	Institutional Assessment Approach
4. Perform mensuration and calculation	4.1 Select measuring instruments 4.2 Carry-out measurements and calculations	Self-paced/ Modular Demonstration Small Group Discussion Distance Education	Written/Oral Examination Practical Demonstration
5. Perform basic bench work	5.1 Prepare materials, tools and equipment for layout 5.2 Layout features in workplace 5.3 Cut sheets, plates and bars 5.4 Smooth sheets plates and bars 5.5 Drill holes in sheets, plates and bars 5.6 Bore holes in sheet plates and bars 5.7 Bend sheets, plates and bars 5.8 Join sheets, plates and bars	Modular Film Showing Demonstration On-the-job training	Interview Demonstration Direct Observation
6. Perform basic electrical works	6.1 Measure and analyze circuit and load resistance in electrical system 6.2 Measure and analyze voltage in electrical system 6.3 Measure and analyze current in electrical system 6.4 Test simple electrical components and connections 6.5 Repair minor electrical system troubles	Modular Computer-based training (Simulation) Demonstration On- the-job training	Interview Computer-based assessment (Simulation) Demonstration Direct Observation

Unit of Competency	Learning Outcomes	Training Methodology	Institutional Assessment Approach
7. Maintain tools and equipment	7.1 Check the conditions of tools and equipment; 7.2 Perform basic preventive maintenance 7.3 Store tools and equipment	Small Group Discussion Demonstration of Practical Skills Modular	Observation and Oral questioning Demonstration and Oral questioning Written test
8. Perform housekeeping and safety practices	8.1 Sort materials, tools and equipment 8.2 Clean workplace area, materials, tools and equipment 8.3 Systematize dispensing and retrieval of materials, tools and equipment 8.4 Identify and minimize/ eliminate hazards 8.5 Respond and record accidents 8.6 Follow basic securities	Small Group Discussion Demonstration of Practical Skills Modular	Observation and Oral questioning Demonstration and Oral questioning Written test
9. Document work accomplished	9.1 Identify forms and data 9.2 Prepare reports	Small Group Discussion Demonstration of Practical Skills Modular	Demonstration and Oral questioning Written Test

CORE COMPETENCIES

420 Hours (180 Hours in-school + 240 Hours SFT) *

Unit of Competency	Learning Outcome	Training Methodology	Institutional Assessment Approach
1. Install domestic refrigeration and air-conditioning (DomRAC) units	1.1 Conduct survey 1.2 Install DomRAC electrical circuit 1.3 Install DomRAC unit 1.4 Conduct performance test	Lecture Demonstration Trainee Hands-on SFT	Direct Observation Question Demonstration
2. Service and maintain domestic refrigeration and air-conditioning (DomRAC) units	2.1 Clean and replace air filter 2.2 Service evaporator/ condenser 2.3 Maintain fan motor assembly 2.4 Service electrical power and control circuits 2.5 Accomplish service and maintenance report	Lecture Demonstration Trainee Hands-on SFT	Direct Observation Questioning Demonstration
3. Trouble shoot domestic refrigeration and air-conditioning (DomRAC) units	3.1. Plan and prepare for troubleshooting and repair 3.2. Identify and repair faults/troubles 3.3. Perform refrigerant recovery/ recycling and retrofitting/ conversion on domestic refrigeration and air-conditioning unit 3.4. Test-run repaired unit	Lecture Demonstration Trainee Hands-on SFT	Direct Observation Questioning Demonstration

*Note: SFT – supervised-field training/exposure in actual work environment is included in the nominal training duration

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

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

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

TOOLS		EQUIPMENT		MATERIALS	
QTY.	**Description**	**QTY**	**Description**	**Qty.**	**Description**
10 pcs	Flaring tool	3 units	Vacuum pump motor, high stage, 1/2 HP , 220 volts	1 roll	Copper tube1/4 “, 3/8”, 5/16”, ½,1/8, 3/16, “OD, 50 ft. per roll
10 pcs.	Swaging tool	2 units	Recovery/ Recycling unit , portable type, 220 volts	1 roll	Aluminum tube, 3/8 “OD, 100 ft. per roll
5 pcs	Tube cutter	2 units	Oxy- Acetylene welding machine w/ complete outfit	1 roll	Capillary tube 1/16, OD, 100 ft. per roll
5 pcs	Tube bender	3 units	Reusable Service Cylinder 13.5kg	50 pcs.	Silver rod
4 pcs.	Sevice cylinder 2.5 kg.,10 kg. Capacity	1 unit	Refrigerator , single door 5 cu. Ft. 220 volts	50 pcs.	Aluminum rod
10 pcs	Electrical pliers	1 unit	Refrigerator, two door top mount freezer, 6 cu. Ft. 220 volts	10 pcs.	Silver flux

TOOLS		EQUIPMENT		MATERIALS	
QTY.	**Description**	**QTY**	**Description**	**Qty.**	**Description**
10 pcs.	Pliers, long nose	1 unit	Refrigerator , two door no frost, 6 cu. Ft. 220 volts	15 pcs.	Filter drier , ¼ "OD flared connection
10 pcs.	Screw driver, flat	1 unit	Freezer chest type, 10 cu Ft. 220 volts	15 pcs.	Filter drier , ¼ " OD solder connection
10 pcs.	Screw driver Philips	1 unit	Freezer, upright 6 cu. Ft. 220 volts	25 pcs.	Flare cap , ¼ " OD
10 pcs.	Files	1 unit	Water dispenser 220 volts	25 pcs.	Flare union, ¼ " OD
5 sets.	Allen wrench	3 units	Analog Clampmeter	25 pcs.	Flare plug, ¼ OD
5 pcs.	Adjustable wrench 8", 10"	3 units	Digital Clampmeter	13.6 kg.	Refrigerant 134a
5 sets	Open wrench	2 units	Window type aircon 2 hp 220 volts	13.6 kg.	Refrigerant 22
5 sets	Box wrench	1 unit	Air compressor, complete w/ accessories 220 volts	13.6 kgs	R 290
5 pcs.	Pipe wrench	5 units	Compressor motor 100 w , 220 volts	1 cyl.	Nitrogen gas
5 pcs.	Vise grip , 6 , "8 "	2 units	Electric drill portable, 3/8 ½ , Chuck, 220 volts	2 cyl.	Oxygen
5 pcs.	Thinners snip, 8''12"	1 set	Pedestal grinding machine, 6" grinding wheel ¾ " hp. 220 volts	2 cyl.	Acetylene gas
10 pcs.	Bullpen hammer, 12 oz	1 unit	Arc welding machine, Ac max. 250 amps. 220 V, 60 hz. Heavy duty	10 pcs.	Dual capacitor 25, 30, 35 mfd 370 vac
5 pcs.	Rubber mallet ,oz	10 sets	Gauge manifold w/ hoses	10 pcs.	Fan capacitor ,3, 4, 5, 6, 7, mfd 220 vac
10 pcs.	Hack saw	5 sets	Digital Volt ohm mili-ammeter	10 pcs.	Starting capacitor 60, 80, 100-105 mfd 220 volts
5 pcs.	Spray gun	5 sets	Analog VOM	10 pcs.	Potential relay 1, 1.5 2 hp 220 volts
10 pcs.	Steel rule , metric & english	1 set	Electronic leak detector (Fluorine based)	10 pcs.	Overload protector 1/6 ,1/8, 1/10 , 1/5, 1.5 2hp 220 volts
10 pcs.	Push rule	1 set	Electronic leak detector (Hydrocarbon based)	10 pcs.	Current relay 1/5, 1/6, 1/8 , 1/10, hp 220 volts
5 pcs.	Tri- square	5 sets	Thermometer, dial type	10 pcs.	Evaporator coil

TOOLS		EQUIPMENT		MATERIALS	
QTY.	**Description**	**QTY**	**Description**	**Qty.**	**Description**
8 pcs.	Pinch off tool	5 sets	Digital Thermometer	10 pcs.	Condenser
5 pcs.	Soldering iron, 100w , 220 volts	1 set	Nitrogen regulator	5 pcs,	Soldering lead
		2 units	Refractometer	5 pcs.	Soldering paste
		2 units	Vacuumeter	**Tools/equipment for Conversion**	
		1 unit	Refrigerant identifier	1 set	Insulated terminal connectors/rings
		2 units	Weighing scale	5 pcs	Sealed terminal box
		Personal Protective Equipment		5 sets	Screwed cable glands (various sizes)
		15 pairs	Safety gloves	2 rolls	Flexible electric cable (# 12 & # 14)
		15 pairs	Safety shoes	2 sets	Cable strap for wiring harness
		15 pcs	Safety goggles/spectacles	5 rolls	Rubber electrical tape
		15 pcs	Face mask	1 booklet	Label and warning sign sticker

3.5 TRAINING FACILITIES
RAC SERVICING NC II

Based on a class intake of 25 students/trainees.

SPACE REQUIREMENTS	Space (m)	Area in Sq. Meters	Total Area in Sq. Meters
A. LECTURE AREA*	4.00 x 8.00	32.00	32.00
B. LEARNING RESOURCE AREA	4.00 x 6.00	24.00	24.00
C. WORKSHOP	6x10	60.00	60.00
D. TOOL/STORAGE AREA*	4.00 x 4.00	16.00	16.00
E. WASH, TOILET AND LOCKER ROOM*	3.00 x 4.00	12.00	12.00
TOTAL			144
F. FACILITIES/EQUIPMENT/ CIRCULATION			44
TOTAL AREA			**188**

*Common facilities for all HVAC/R Courses

3.6 TRAINER'S QUALIFICATION FOR HVAC/R SECTOR

RAC SERVICING NC II

- Holder of National TVET Trainers Certificate Level I
- He must be a holder of RAC Servicing, NC II
- Good moral character
- Must be physically and mentally fit
- Must be computer literate
- *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

3.2 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.

As a matter of policy, graduates of programs registered with TESDA under these training regulations are required to undergo mandatory national competency assessment upon completion of the program.

SECTION 4 NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

4.1 To attain the National Qualification of **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 **RAC Servicing NC II** may be attained through:

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

4.2.2 For individuals, who are holders of National Certificate of RAC Servicing NC I shall be converted to RAC Servicing NC II. Holders of Certificate of Competency (COC) along RAC Servicing NC I will be required to undertake the required competencies through training or assessment for RAC Servicing NC II.

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:

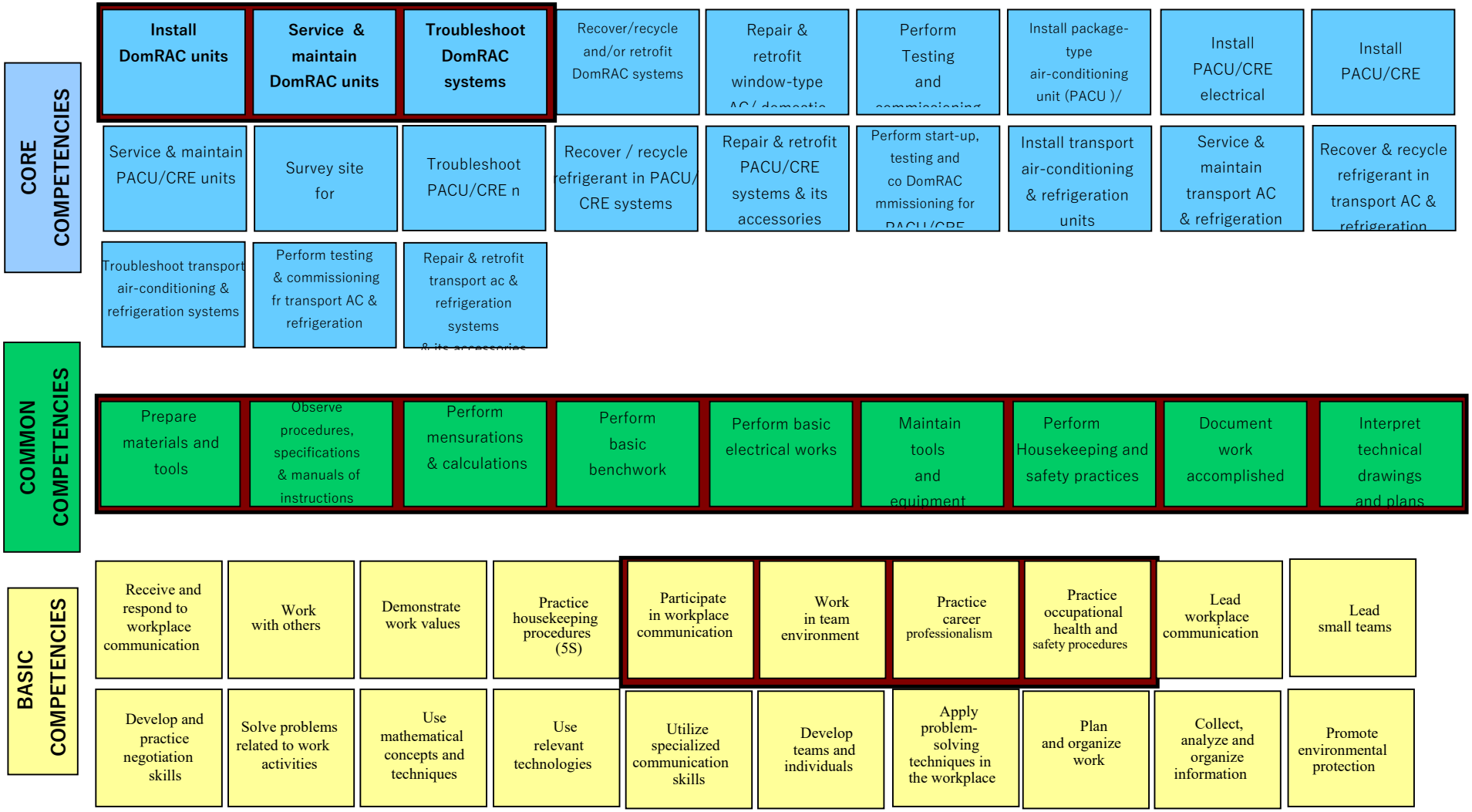
4.4.1 Graduates of formal, non-formal and informal including enterprise-based training programs

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
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) **Conversion –** Is a process of applying a flammable, non-ozone depleting substance and low global warming potential refrigerant to a system that ordinarily uses non-flammable, ozone depleting substance and high global warming potential refrigerant. It not only deals with refrigerant replacement but taking into consideration how to mitigate the flammability risk of the process.

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

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

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

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

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

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

14) **Filter Drier** – the component part used in air-conditioning or refrigeration

system to filter and dehydrates refrigerant in the system

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

16) **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) **SPLIT-TYPE Airconditioning unit** – an air-conditioning unit that contains the compressor, air or water-cooled condenser, metering device in one casing as outdoor unit and evaporator in another casing as indoor unit.

30) **Supervised Industry Training** – similar to on-the-job training – an approach in training designed to enhance the knowledge and skills of the trainee through actual experience in the workplace to acquire specific competencies prescribed in the training regulations.

31) **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

32) **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.

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

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

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

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

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

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