TRAINING REGULATIONS

COMMERCIAL REFRIGERATION INSTALLATION AND SERVICING NC III

HEATING, VENTILATING, AIR-CONDITIONING AND REFRIGERATION TECHNOLOGY SECTOR

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

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

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

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

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

Each TR has four sections:

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

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

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

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

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

COMMERCIAL REFRIGERATION INSTALLATION AND SERVICING NC III

TRAINING REGULATIONS FOR
COMMERCIAL REFRIGERATION INSTALLATION AND SERVICING NC III

SECTION 1 COMMERCIAL REFRIGERATION INSTALLATION AND SERVICING NC III QUALIFICATION DESCRIPTION

The **Commercial Refrigeration Installation and Servicing NC III** Qualification consists of competencies that a person must achieve to enable him/her to install, service, maintain, troubleshoot and repair including perform start-up, test and commissioning of commercial refrigeration equipment/systems with a nominal capacity of 3 tons of refrigeration (TR) and below.

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

The Units of Competency comprising this Qualification include the following:

CODE NO.	BASIC COMPETENCIES
400311319	Lead workplace communication
400311320	Lead small teams
400311321	Apply critical thinking and problem-solving techniques in the workplace
400311322	Work in a diverse environment
400311323	Propose methods of applying learning and innovation in the organization
400311324	Use information systematically
400311325	Evaluate occupational safety and health work practices
400311326	Evaluate environmental work practices
400311327	Facilitate entrepreneurial skills for micro-small-medium enterprises (MSMEs)

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

CODE NO.	CORE COMPETENCIES
HVC723341	Install commercial refrigeration equipment
HVC723343	Service and maintain commercial refrigeration equipment
HVC723345	Troubleshoot and repair commercial refrigeration equipment
HVC723347	Perform start-up, test and commissioning for commercial refrigeration equipment

A person who has achieved these competencies is Qualified to be a:

- Commercial Refrigeration Equipment Installer
- Commercial Refrigeration Equipment Maintenance Technician
- Commercial Refrigeration Technician (HVAC/R Technician)

SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in **Commercial Refrigeration Installation and Servicing NC III**.

BASIC COMPETENCIES

UNIT OF COMPETENCY : LEAD WORKPLACE COMMUNICATION

UNIT CODE : 400311319

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to lead in the dissemination and discussion of ideas, information and issues in the workplace.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Communicate information about workplace processes	1.1. Relevant ***communication method*** is selected based on workplace procedures 1.2. Multiple operations involving several topics/areas are communicated following enterprise requirements 1.3. Questioning is applied to gain extra information 1.4. Relevant sources of information are identified in accordance with workplace/ client requirements 1.5. Information is selected and organized following enterprise procedures 1.6. Verbal and written reporting is undertaken when required 1.7. Communication and negotiation skills are applied and maintained in all relevant situations	1.1. Organization requirements for written and electronic communication methods 1.2. Effective verbal communication methods 1.3. Business writing 1.4. Workplace etiquette	1.1. Organizing information 1.2. Conveying intended meaning 1.3. Participating in a variety of workplace discussions 1.4. Complying with organization requirements for the use of written and electronic communication methods 1.5. Effective business writing 1.6. Effective clarifying and probing skills 1.7. Effective questioning techniques (clarifying and probing)
2. Lead workplace discussions	2.1. Response to workplace issues are sought following enterprise procedures 2.2. Response to workplace issues are provided immediately 2.3. Constructive contributions are made to ***workplace discussions*** on such	2.1 Organization requirements for written and electronic communication methods 2.2 Effective verbal communication methods 2.3 Workplace	2.1 Organizing information 2.2 Conveying intended meaning 2.3 Participating in variety of workplace discussions 2.4 Complying with organization requirements for

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	issues as production, quality and safety 2.4. Goals/objectives and action plans undertaken in the workplace are communicated promptly	etiquette	the use of written and electronic communication methods 2.5 Effective clarifying and probing skills
3. Identify and communicate issues arising in the workplace	3.1. Issues and problems are identified as they arise 3.2. Information regarding problems and issues are organized coherently to ensure clear and effective communication 3.3. Dialogue is initiated with appropriate personnel 3.4. Communication problems and issues are raised as they arise 3.5. Identify barriers in communication to be addressed appropriately	3.1. Organization requirements for written and electronic communication methods 3.2. Effective verbal communication methods 3.3. Workplace etiquette 3.4. Communication problems and issues 3.5. Barriers in communication	3.1. Organizing information 3.2. Conveying intended meaning 3.3. Participating in a variety of workplace discussions 3.4. Complying with organization requirements for the use of written and electronic communication methods 3.5. Effective clarifying and probing skills 3.6. Identifying issues 3.7. Negotiation and communication skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Methods of communication	May include: 1.1. Non-verbal gestures 1.2. Verbal 1.3. Face-to-face 1.4. Two-way radio 1.5. Speaking to groups 1.6. Using telephone 1.7. Written 1.8. Internet
2. Workplace discussions	May include: 2.1. Coordination meetings 2.2. Toolbox discussion 2.3. Peer-to-peer discussion

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Dealt with a range of communication/information at one time 1.2. Demonstrated leadership skills in workplace communication 1.3. Made constructive contributions in workplace issues 1.4. Sought workplace issues effectively 1.5. Responded to workplace issues promptly 1.6. Presented information clearly and effectively written form 1.7. Used appropriate sources of information 1.8. Asked appropriate questions 1.9. Provided accurate information
2. Resource Implications	The following resources MUST be provided: 2.1. Variety of Information 2.2. Communication tools 2.3. Simulated workplace
3. Methods of Assessment	Competency in this unit must be assessed through 3.1. Case problem 3.2. Third-party report 3.3. Portfolio 3.4. Interview 3.5. Demonstration/Role-playing
4. Context for Assessment	4.1. Competency may be assessed in the workplace or in simulated workplace environment

UNIT OF COMPETENCY : LEAD SMALL TEAMS

UNIT CODE : 400311320

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to lead small teams including setting, maintaining and monitoring team and individual performance standards.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Provide team leadership	1.1. ***Work requirements*** are identified and presented to team members based on company policies and procedures 1.2. Reasons for instructions and requirements are communicated to team members based on company policies and procedures 1.3. ***Team members' queries and concerns*** are recognized, discussed and dealt with based on company practices	1.1. Facilitation of Team work 1.2. Company policies and procedures relating to work performance 1.3. Performance standards and expectations 1.4. Monitoring individual's and team's performance vis a vis client's and group's expectations	1.1. Communication skills required for leading teams 1.2. Group facilitation skills 1.3. Negotiating skills 1.4. Setting performance expectation
2. Assign responsibilities	2.1. Responsibilities are allocated having regard to the skills, knowledge and aptitude required to undertake the assigned task based on company policies. 2.2. Duties are allocated having regard to individual preference, domestic and personal considerations, whenever possible	2.1. Work plan and procedures 2.2. Work requirements and targets 2.3. Individual and group expectations and assignments 2.4. Ways to improve group leadership and membership	2.1. Communication skills 2.2. Management skills 2.3. Negotiating skills 2.4. Evaluation skills 2.5. Identifying team member's strengths and rooms for improvement
3. Set performance expectations for team members	3.1 Performance expectations are established based on client needs 3.2 Performance expectations are based on individual team members knowledge, skills and aptitude 3.3 Performance expectations are discussed and disseminated to individual team members	3.1 One's roles and responsibilities in the team 3.2 Feedback giving and receiving 3.3 Performance expectation	3.1 Communication skills 3.2 Accurate empathy 3.3 Congruence 3.4 Unconditional positive regard 3.5 Handling of Feedback
4. Supervised team performance	4.1 Performance is ***monitored*** based on defined performance criteria and/or assignment	4.1 Performance Coaching 4.2 Performance management	4.1 Communication skills required for leading teams 4.2 Coaching skill

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	instructions 4.2 Team members are provided with ***feedback***, positive support and advice on strategies to overcome any deficiencies based on company practices 4.3 ***Performance issues*** which cannot be rectified or addressed within the team are referenced to appropriate personnel according to employer policy 4.4 Team members are kept informed of any changes in the priority allocated to assignments or tasks which might impact on client/customer needs and satisfaction 4.5 Team operations are monitored to ensure that employer/client needs and requirements are met 4.6 Follow-up communication is provided on all issues affecting the team 4.7 All relevant documentation is completed in accordance with company procedures	4.3 Performance Issues	

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work requirements	May include: 1.1. Client Profile 1.2. Assignment instructions
2. Team member's concerns	May include: 2.1. Roster/shift details
3. Monitor performance	May include: 3.1. Formal process 3.2. Informal process
4. Feedback	May include: 4.1. Formal process 4.2. Informal process
5. Performance issues	May include: 5.1. Work output 5.2. Work quality 5.3. Team participation 5.4. Compliance with workplace protocols 5.5. Safety 5.6. Customer service

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Maintained or improved individuals and/or team performance given a variety of possible scenario 1.2. Assessed and monitored team and individual performance against set criteria 1.3. Represented concerns of a team and individual to next level of management or appropriate specialist and to negotiate on their behalf 1.4. Allocated duties and responsibilities, having regard to individual's knowledge, skills and aptitude and the needs of the tasks to be performed 1.5. Set and communicated performance expectations for a range of tasks and duties within the team and provided feedback to team members
2. Resource Implications	The following resources MUST be provided: 2.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2. Materials relevant to the proposed activity or task
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1. Written Examination 3.2. Oral Questioning 3.3. Portfolio
4. Context for Assessment	4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center

UNIT OF COMPETENCY: APPLY CRITICAL THINKING AND PROBLEM SOLVING TECHNIQUES IN THE WORKPLACE

UNIT CODE : 400311321

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to solve problems in the workplace including the application of problem solving techniques and to determine and resolve the root cause/s of specific problems in the workplace.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Examine specific workplace challenges	1.1. Variances are examined from normal operating **parameters;** and product quality. 1.2. Extent, cause and nature of the specific problem are defined through observation, investigation and ***analytical techniques***. 1.3. ***Problems*** are clearly stated and specified.	1.1. Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations. 1.2. Competence to include the ability to apply and explain, enough for the identification of fundamental causes of specific workplace challenges. 1.3. Relevant equipment and operational processes. 1.4. Enterprise goals, targets and measures. 1.5. Enterprise quality OHS and environmental requirement. 1.6. Enterprise information systems and data collation 1.7. Industry codes and standards.	1.1. Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace. 1.2. Identifying extent and causes of specific challenges in the workplace.
2. Analyze the causes of specific workplace challenges.	2.1. Possible causes of specific problems are identified based on experience and the use of problem-solving tools **/** analytical techniques. 2.2. Possible cause statements are developed based on findings. 2.3. Fundamental causes are identified per results of investigation conducted.	2.1 Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations. 2.2 Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause,	2.1 Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		determining the corrective action and provision of recommendations. 2.3 Relevant equipment and operational processes. 2.4 Enterprise goals, targets and measures. 2.5 Enterprise quality OSH and environmental requirement. 2.6 Enterprise information systems and data collation. 2.7 Industry codes and standards.	2.2 Identifying extent and causes of specific challenges in the workplace. 2.3 Providing clear-cut findings on the nature of each identified workplace challenges.
3. Formulate resolutions to specific workplace challenges	3.1. All possible options are considered for resolution of the problem. 3.2. Strengths and weaknesses of possible options are considered. 3.3. Corrective actions are determined to resolve the problem and possible future causes. 3.4. ***Action plans*** are developed identifying measurable objectives, resource needs and timelines in accordance with safety and operating procedures	3.1. Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations 3.2. Relevant equipment and operational processes 3.3. Enterprise goals, targets and measures 3.4. Enterprise quality OSH and environmental requirement 3.5. Principles of decision making strategies and techniques 3.6. Enterprise information systems and data collation 3.7. Industry codes and standards	3.1. Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace. 3.2. Identifying extent and causes of specific challenges in the workplace. 3.3. Providing clear-cut findings on the nature of each identified workplace challenges. 3.4. Devising, communicating, implementing and evaluating strategies and techniques in addressing specific workplace challenges.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
4. Implement action plans and communicate results	4.1. Action plans are implemented and evaluated. 4.2. Results of plan implementation and recommendations are prepared. 4.3. Recommendations are presented to appropriate personnel. 4.4. Recommendations are followed-up, if required.	4.1 Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations 4.2. Relevant equipment and operational processes 4.3 Enterprise goals, targets and measures 4.4 Enterprise quality, OSH and environmental requirement 4.5 Principles of decision making strategies and techniques 4.6 Enterprise information systems and data collation 4.7 Industry codes and standards	4.1 Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace. 4.2 Identifying extent and causes of specific challenges in the workplace. 4.3 Providing clear-cut findings on the nature of each identified workplace challenges. 4.4 Devising, communicating, implementing and evaluating strategies and techniques in addressing specific workplace challenges.

RANGE OF VARIABLES

VARIABLES	RANGE
1. Parameters	May include: 1.1 Processes 1.2 Procedures 1.3 Systems
2. Analytical techniques	May include: 2.1. Brainstorming 2.2. Intuitions/Logic 2.3. Cause and effect diagrams 2.4. Pareto analysis 2.5. SWOT analysis 2.6. Gant chart, Pert CPM and graphs 2.7. Scattergrams
3. Problem	May include: 3.1. Routine, non – routine and complex workplace and quality problems 3.2. Equipment selection, availability and failure 3.3. Teamwork and work allocation problem 3.4. Safety and emergency situations and incidents 3.5. Risk assessment and management
4. Action plans	May include: 4.1. Priority requirements 4.2. Measurable objectives 4.3. Resource requirements 4.4. Timelines 4.5. Co-ordination and feedback requirements 4.6. Safety requirements 4.7. Risk assessment 4.8. Environmental requirements

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Examined specific workplace challenges. 1.2. Analyzed the causes of specific workplace challenges. 1.3. Formulated resolutions to specific workplace challenges. 1.4. Implemented action plans and communicated results on specific workplace challenges.
2. Resource Implications	2.1. Assessment will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability over a range of situations. A bank of scenarios / case studies / what ifs will be required as well as bank of questions which will be used to probe the reason behind the observable action.
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1. Observation 3.2. Case Formulation 3.3. Life Narrative Inquiry 3.4. Standardized test The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components. These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.
4. Context for Assessment	4.1. In all workplace, it may be appropriate to assess this unit concurrently with relevant teamwork or operation units.

UNIT OF COMPETENCY : WORK IN A DIVERSE ENVIRONMENT

UNIT CODE : 400311322

UNIT DESCRIPTOR : This unit covers the outcomes required to work effectively in a workplace characterized by diversity in terms of religions, beliefs, races, ethnicities and other differences.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Develop an individual's cultural awareness and sensitivity	1.1. Individual differences with clients, customers and fellow workers are recognized and respected in accordance with enterprise policies and core values. 1.2. Differences are responded to in a sensitive and considerate manner 1.3. ***Diversity*** is accommodated using appropriate verbal and non-verbal communication.	1.1. Understanding cultural diversity in the workplace 1.2. Norms of behavior for interacting and dialogue with specific groups (e. g., Muslims and other non-Christians, non-Catholics, tribes/ethnic groups, foreigners) 1.3. Different methods of verbal and non-verbal communication in a multicultural setting	1.1. Applying cross-cultural communication skills (i.e. different business customs, beliefs, communication strategies) 1.2. Showing affective skills – establishing rapport and empathy, understanding, etc. 1.3. Demonstrating openness and flexibility in communication 1.4. Recognizing diverse groups in the workplace and community as defined by divergent culture, religion, traditions and practices
2. Work effectively in an environment that acknowledges and values cultural diversity	2.1 Knowledge, skills and experiences of others are recognized and documented in relation to team objectives. 2.2 Fellow workers are encouraged to utilize and share their specific qualities, skills or backgrounds with other team members and clients to enhance work outcomes. 2.3 Relations with customers and clients are maintained to show that diversity is valued by the	2.1 Value of diversity in the economy and society in terms of Workforce development 2.2 Importance of inclusiveness in a diverse environment 2.3 Shared vision and understanding of and commitment to team, departmental, and organizational goals and objectives 2.4 Strategies for customer service excellence	2.1 Demonstrating cross-cultural communication skills and active listening 2.2 Recognizing diverse groups in the workplace and community as defined by divergent culture, religion, traditions and practices 2.3 Demonstrating collaboration skills 2.4 Exhibiting customer service

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	business.		excellence
3. Identify common issues in a multicultural and diverse environment	3.1 ***Diversity-related conflicts*** within the workplace are effectively addressed and resolved. 3.2 Discriminatory behaviors towards customers/ stakeholders are minimized and addressed accordingly. 3.3 Change management policies are in place within the organization.	3.1 Value, and leverage of cultural diversity 3.2 Inclusivity and conflict resolution 3.3 Workplace harassment 3.4 Change management and ways to overcome resistance to change 3.5 Advanced strategies for customer service excellence	3.1 Addressing diversity-related conflicts in the workplace 3.2 Eliminating discriminatory behavior towards customers and co-workers 3.3 Utilizing change management policies in the workplace

RANGE OF VARIABLES

VARIABLE	RANGE
1. Diversity	This refers to diversity in both the workplace and the community and may include divergence in : 1.1 Religion 1.2 Ethnicity, race or nationality 1.3 Culture 1.4 Gender, age or personality 1.5 Educational background
2. Diversity-related conflicts	May include conflicts that result from: 2.1 Discriminatory behaviors 2.2 Differences of cultural practices 2.3 Differences of belief and value systems 2.4 Gender-based violence 2.5 Workplace bullying 2.6 Corporate jealousy 2.7 Language barriers 2.8 Individuals being differently-abled persons 2.9 Ageism (negative attitude and behavior towards old people)

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Adjusted language and behavior as required by interactions with diversity 1.2 Identified and respected individual differences in colleagues, clients and customers 1.3 Applied relevant regulations, standards and codes of practice
2. Resource Implications	The following resources should be provided: 2.1 Access to workplace and resources 2.2 Manuals and policies on Workplace Diversity
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Demonstration or simulation with oral questioning 3.2 Group discussions and interactive activities 3.3 Case studies/problems involving workplace diversity issues 3.4 Third-party report 3.5 Written examination 3.6 Role Plays
4. Context for Assessment	4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center

UNIT OF COMPETENCY: PROPOSE METHODS OF APPLYING LEARNING AND INNOVATION IN THE ORGANIZATION

UNIT CODE : 400311323

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to assess general obstacles in the application of learning and innovation in the organization and to propose practical methods of such in addressing organizational challenges.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Assess work procedures, processes and systems in terms of innovative practices	1.1. R***easons*** for innovation are incorporated to work procedures. 1.2. ***Models of innovation*** are researched. 1.3. G***aps or barriers*** to innovation in one's work area are analyzed. 1.4. Staff who can support and foster innovation in the work procedure are identified.	1.1 Seven habits of highly effective people. 1.2 Character strengths that foster innovation and learning (Christopher Peterson and Martin Seligman, 2004) 1.3 Five minds of the future concepts (Gardner, 2007). 1.4 Adaptation concepts in neuroscience (Merzenich, 2013). 1.5 Transtheoretical model of behavior change (Prochaska, DiClemente, & Norcross, 1992).	1.1 Demonstrating collaboration and networking skills. 1.2 Applying basic research and evaluation skills 1.3 Generating insights on how to improve organizational procedures, processes and systems through innovation.
2. Generate practical action plans for improving work procedures, processes	2.1 Ideas for innovative work procedure to foster innovation using individual and group techniques are conceptualized 2.2 Range of ideas with other team members and colleagues are evaluated and discussed 2.3 Work procedures and processes subject to change are selected based on ***workplace requirements*** (feasible and innovative). 2.4 Practical action plans are proposed to facilitate simple changes in the work procedures, processes and systems. 2.5 ***Critical inquiry*** is applied and used to facilitate discourse on adjustments in the simple work procedures, processes and systems.	2.1 Seven habits of highly effective people. 2.2 Character strengths that foster innovation and learning (Christopher Peterson and Martin Seligman, 2004) 2.3 Five minds of the future concepts (Gardner, 2007). 2.4 Adaptation concepts in neuroscience (Merzenich, 2013). 2.5 Transtheoretical model of behavior change (Prochaska, DiClemente, & Norcross, 1992).	2.1 Assessing readiness for change on simple work procedures, processes and systems. 2.2 Generating insights on how to improve organizational procedures, processes and systems through innovation. 2.3 Facilitating action plans on how to apply innovative procedures in the organization.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Evaluate the effectiveness of the proposed action plans	3.1 Work structure is analyzed to identify the impact of the new work procedures 3.2 Co-workers/key personnel is consulted to know who will be involved with or affected by the work procedure 3.3 Work instruction operational plan of the new work procedure is developed and evaluated. 3.4 Feedback and suggestion are recorded. 3.5 Operational plan is updated. 3.6 Results and impact on the developed work instructions are reviewed 3.7 Results of the new work procedure are evaluated 3.8 Adjustments are recommended based on results gathered	3.1 Five minds of the future concepts (Gardner, 2007). 3.2 Adaptation concepts in neuroscience (Merzenich, 2013). 3.3 Transtheoretical model of behavior change (Prochaska, DiClemente, & Norcross, 1992).	3.1 Generating insights on how to improve organizational procedures, processes and systems through innovation. 3.2 Facilitating action plans on how to apply innovative procedures in the organization. 3.3 Communicating results of the evaluation of the proposed and implemented changes in the workplace procedures and systems. 3.4 Developing action plans for continuous improvement on the basic systems, processes and procedures in the organization.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Reasons	May include: 1.1. Strengths and weaknesses of the current systems, processes and procedures. 1.2. Opportunities and threats of the current systems, processes and procedures.
2. Models of innovation	May include: 2.1. Seven habits of highly effective people. 2.2. Five minds of the future concepts (Gardner, 2007). 2.3. Neuroplasticity and adaptation strategies.
3. Workplace requirements	May include: 3.1. Feasible 3.2. Innovative
4. Gaps or barriers	May include: 4.1. Machine 4.2. Manpower 4.3. Methods 4.4. Money
5. Critical Inquiry	May include: 5.1. Preparation. 5.2. Discussion. 5.3. Clarification of goals. 5.4. Negotiate towards a Win-Win outcome. 5.5. Agreement. 5.6. Implementation of a course of action. 5.7. Effective verbal communication. See our pages: Verbal Communication and Effective Speaking. 5.8. Listening. 5.9. Reducing misunderstandings is a key part of effective negotiation. 5.10. Rapport Building. 5.11. Problem Solving. 5.12. Decision Making. 5.13. Assertiveness. 5.14. Dealing with Difficult Situations.

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Established the reasons why innovative systems are required 1.2 Established the goals of a new innovative system 1.3 Analyzed current organizational systems to identify gaps and barriers to innovation. 1.4 Assessed work procedures, processes and systems in terms of innovative practices. 1.5 Generated practical action plans for improving work procedures, and processes. 1.6 Reviewed the trial innovative work system and adjusted reflect evaluation feedback, knowledge management systems and future planning. 1.7 Evaluated the effectiveness of the proposed action plans.
2. Resource Implications	The following resources should be provided: 2.1 Pens, papers and writing implements. 2.2 Cartolina. 2.3 Manila papers.
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Psychological and behavioral Interviews. 3.2 Performance Evaluation. 3.3 Life Narrative Inquiry. 3.4 Review of portfolios of evidence and third-party workplace reports of on-the-job performance. 3.5 Sensitivity analysis. 3.6 Organizational analysis. 3.7 Standardized assessment of character strengths and virtues applied.
4. Context for Assessment	4.1 Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY: USE INFORMATION SYSTEMATICALLY

UNIT CODE : 400311324

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to use technical information systems, apply information technology (IT) systems and edit, format & check information.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Use technical information	1.1. ***Information*** are collated and organized into a suitable form for reference and use 1.2. Stored information are classified so that it can be quickly identified and retrieved when needed 1.3. Guidance are advised and offered to people who need to find and use information	1.1. Application in collating information 1.2. Procedures for inputting, maintaining and archiving information 1.3. Guidance to people who need to find and use information 1.4. Organize information 1.5. classify stored information for identification and retrieval 1.6. Operate the technical information system by using agreed procedures	1.1. Collating information 1.2. Operating appropriate and valid procedures for inputting, maintaining and archiving information 1.3. Advising and offering guidance to people who need to find and use information 1.4. Organizing information into a suitable form for reference and use 1.5. Classifying stored information for identification and retrieval 1.6. Operating the technical information system by using agreed procedures
2. Apply information technology (IT)	2.1. ***Technical information*** system is operated using agreed procedures 2.2. Appropriate and valid procedures are operated for inputting, maintaining and archiving information 2.3. ***Software*** required are utilized to execute the project activities 2.4. Information and data obtained are handled, edited, formatted and checked from a range of internal and external ***sources*** 2.5. Information are extracted, entered, and	2.1. Attributes and limitations of available software tools 2.2. Procedures and work instructions for the use of IT 2.3. Operational requirements for IT systems 2.4. Sources and flow paths of data 2.5. Security systems and measures that can be used 2.6. Extract data and format reports 2.7. Methods of entering and	2.1. Identifying attributes and limitations of available software tools 2.2. Using procedures and work instructions for the use of IT 2.3. Describing operational requirements for IT systems 2.4. Identifying sources and flow paths of data 2.5. Determining security systems and measures that can be used

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	processed to produce the outputs required by ***customers*** 2.6. Own skills and understanding are shared to help others 2.7. Specified ***security measures*** are implemented to protect the confidentiality and integrity of project data held in IT systems	processing information 2.8. WWW enabled applications	2.6. Extracting data and format reports 2.7. Describing methods of entering and processing information 2.8. Using WWW applications
3. Edit, format and check information	3.1 Basic editing techniques are used 3.2 Accuracy of documents are checked 3.3 Editing and formatting tools and techniques are used for more complex documents 3.4 Proof reading techniques is used to check that documents look professional	3.1 Basic file-handling techniques 3.2 Techniques in checking documents 3.3 Techniques in editing and formatting 3.4 Proof reading techniques	3.1 Using basic file-handling techniques is used for the software 3.2 Using different techniques in checking documents 3.3 Applying editing and formatting techniques 3.4 Applying proof reading techniques

RANGE OF VARIABLES

VARIABLE	RANGE
1. Information	May include: 1.1. Property 1.2. Organizational 1.3. Technical reference
2. Technical information	May include: 2.1. paper based 2.2. electronic
3. Software	May include: 3.1. spreadsheets 3.2. databases 3.3. word processing 3.4. presentation
4. Sources	May include: 4.1. other IT systems 4.2. manually created 4.3. within own organization 4.4. outside own organization 4.5. geographically remote
5. Customers	May include: 5.1. colleagues 5.2. company and project management 5.3. clients
6. Security measures	May include: 6.1. access rights to input; 6.2. passwords; 6.3. access rights to outputs; 6.4. data consistency and back-up; 6.5. recovery plans

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Used technical information systems and information technology 1.2. Applied information technology (IT) systems 1.3. Edited, formatted and checked information
2. Resource Implications	The following resources MUST be provided: 2.1. Computers 2.2. Software and IT system
3. Methods of Assessment	Competency in this unit MUST be assessed through: 3.1. Direct Observation 3.2. Oral interview and written test
4. Context for Assessment	4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center

UNIT OF COMPETENCY : EVALUATE OCCUPATIONAL SAFETY AND HEALTH WORK PRACTICES

UNIT CODE : 400311325

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to interpret-Occupational Safety and Health practices, set OSH work targets, and evaluate effectiveness of Occupational Safety and Health work instructions

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Interpret Occupational Safety and Health practices	1.1. ***OSH work practices issues*** are identified relevant to work requirements 1.2. OSH work standards and procedures are determined based on applicability to nature of work 1.3. Gaps in work practices are identified related to relevant OSH work standards	1.1. OSH work practices issues 1.2. OSH work standards 1.3. General OSH principles and legislations 1.4. Company/ workplace policies/ guidelines 1.5. Standards and safety requirements of work process and procedures	1.1. Communication skills 1.2. Interpersonal skills 1.3. Critical thinking skills 1.4. Observation skills
2. Set OSH work targets	2.1. Relevant work information are gathered necessary to determine OSH work targets 2.2. ***OSH Indicators*** based on gathered information are agreed upon to measure effectiveness of workplace OSH policies and procedures 2.3. Agreed OSH indicators are endorsed for approval from appropriate personnel 2.4. ***OSH work instructions*** are received in accordance with workplace policies and procedures*	2.1. OSH work targets 2.2. OSH Indicators 2.3. OSH work instructions 2.4. Safety and health requirements of tasks 2.5. Workplace guidelines on providing feedback on OSH and security concerns 2.6. OSH regulations Hazard control procedures 2.7. OSH trainings relevant to work	2.1. Communication skills 2.2. Collaborating skills 2.3. Critical thinking skills 2.4. Observation skills
3. Evaluate effectiveness of Occupational Safety and Health work instructions	3.1. OSH Practices are observed based on workplace standards 3.2. Observed OSH practices are measured against approved ***OSH metrics*** 3.3. Findings regarding effectiveness are assessed and gaps identified are implemented based on OSH work standards	3.1. OSH Practices 3.2. OSH metrics 3.3. OSH Evaluation Techniques 3.4. OSH work standards	3.1. Critical thinking skills 3.2. Evaluating skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. OSH Work Practices Issues	May include: 1.1 Workers' experience/observance on presence of work hazards 1.2 Unsafe/unhealthy administrative arrangements (prolonged work hours, no break-time, constant overtime, scheduling of tasks) 1.3 Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/ guidelines
2. OSH Indicators	May include: 2.1 Increased of incidents of accidents, injuries 2.2 Increased occurrence of sickness or health complaints/symptoms 2.3 Common complaints of workers' related to OSH 2.4 High absenteeism for work-related reasons
3. OSH Work Instructions	May include: 3.1 Preventive and control measures**,** and targets 3.2 Eliminate the hazard (i.e., get rid of the dangerous machine 3.3 Isolate the hazard (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off) 3.4 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) 3.5 Use administrative controls to reduce the risk (i.e. give trainings on how to use equipment safely; OSH-related topics, issue warning signages, rotation/shifting work schedule) 3.6 Use engineering controls to reduce the risk (i.e. use safety guards to machine) 3.7 Use personal protective equipment 3.8 Safety, Health and Work Environment Evaluation 3.9 Periodic and/or special medical examinations of workers
4. OSH metrics	May include: 4.1 Statistics on incidence of accidence and injuries 4.2 Morbidity (Type and Number of Sickness) 4.3 Mortality (Cause and Number of Deaths) 4.4 Accident Rate

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Identify OSH work practices issue relevant to work requirements 1.2. Identify gaps in work practices related to relevant OSH work standards 1.3. Agree upon OSH Indicators based on gathered information to measure effectiveness of workplace OSH policies and procedures 1.4. Receive OSH work instructions in accordance with workplace policies and procedures 1.5. Compare Observed OSH practices with against approved OSH work instructions 1.6. Assess findings regarding effectiveness based on OSH work standards
2. Resource Implications	The following resources should be provided: 2.1 Facilities, materials, tools and equipment necessary for the activity
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1 Observation/Demonstration with oral questioning 3.2 Third party report 3.3 Written exam
4. Context for Assessment	4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center

UNIT OF COMPETENCY : EVALUATE ENVIRONMENTAL WORK PRACTICES
UNIT CODE : 400311326
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitude to interpret environmental Issues, establish targets to evaluate environmental practices and evaluate effectiveness of environmental practices

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Interpret environmental practices, policies and procedures	1.1. ***Environmental work practices issues*** are identified relevant to work requirements 1.2. Environmental Standards and Procedures nature of work are determined based on Applicability to nature of work 1.3. Gaps in work practices related to Environmental Standards and Procedures are identified	1.1. Environmental Issues 1.2. Environmental Work Procedures 1.3. Environmental Laws 1.4. Environmental Hazardous and Non-Hazardous Materials 1.5. Environmental required license, registration or certification	1.1. Analyzing Environmental Issues and Concerns 1.2. Critical thinking 1.3. Problem Solving 1.4. Observation Skills
2. Establish targets to evaluate environmental practices	2.1. Relevant information are gathered necessary to determine environmental work targets 2.2. ***Environmental Indicators*** based on gathered information are set to measure environmental work targets 2.3. Indicators are verified with appropriate personnel	2.1. Environmental Indicators 2.2. Relevant Environment Personnel or expert 2.3. Relevant Environmental Trainings and Seminars	2.1. Investigative Skills 2.2. Critical thinking 2.3. Problem Solving 2.4. Observation Skills
3. Evaluate effectiveness of environmental practices	3.1. Work environmental practices are recorded based on workplace standards 3.2. Recorded work environmental practices are compared against planned indicators 3.3. Findings regarding effectiveness are assessed and gaps identified are implemented based on environment work standards and procedures 3.4. Results of environmental assessment are conveyed to appropriate personnel	3.1. Environmental Practices 3.2. Environmental Standards and Procedures	3.1. Documentation and Record Keeping Skills 3.2. Critical thinking 3.3. Problem Solving 3.4. Observation Skills

RANGE OF VARIABLES

VARIABLE	R A N G E
1. Environmental Work Practices Issues	May include: 1.1 Water Quality 1.2 National and Local Government Issues 1.3 Safety 1.4 Endangered Species 1.5 Noise 1.6 Air Quality 1.7 Historic 1.8 Waste 1.9 Cultural
2. Environmental Indicators	May include: 2.1 Noise level 2.2 Lighting (Lumens) 2.3 Air Quality - Toxicity 2.4 Thermal Comfort 2.5 Vibration 2.6 Radiation 2.7 Quantity of the Resources 2.8 Volume

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1. Identified environmental issues relevant to work requirements 1.2. Identified gaps in work practices related to Environmental Standards and Procedures 1.3. Gathered relevant information necessary to determine environmental work targets 1.4. Set environmental indicators based on gathered information to measure environmental work targets 1.5. Recorded work environmental practices are recorded based on workplace standards 1.6. Conveyed results of environmental assessment to appropriate personnel
2. Resource Implications	**The following resources should be provided:** 2.1 Workplace/Assessment location 2.2 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection 2.3 Case studies/scenarios relating to environmental protection
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1 Written/ Oral Examination 3.2 Interview/Third Party Reports 3.3 Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad) 3.4 Simulations and role-plays
4. Context for Assessment	4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center

UNIT OF COMPETENCY : **FACILITATE ENTREPRENEURIAL SKILLS FOR MICRO-SMALL-MEDIUM ENTERPRISES (MSMEs)**

UNIT CODE : **400311327**

UNIT DESCRIPTOR : This unit covers the outcomes required to build, operate and grow a micro/small-scale enterprise.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Develop and maintain micro-small-medium enterprise (MSMEs) skills in the organization	1.1 Appropriate ***business strategies*** are determined and set for the enterprise based on current and emerging business environment. 1.2 ***Business operations*** are monitored and controlled following established procedures. 1.3 Quality assurance measures are implemented consistently. 1.4 Good relations are maintained with staff/workers. 1.5 Policies and procedures on occupational safety and health and environmental concerns are constantly observed.	1.1 Business models and strategies 1.2 Types and categories of businesses 1.3 Business operation 1.4 Basic Bookkeeping 1.5 Business internal controls 1.6 Basic quality control and assurance concepts 1.7 Government and regulatory processes	1.1 Basic bookkeeping/ accounting skills 1.2 Communication skills 1.3 Building relations with customer and employees 1.4 Building competitive advantage of the enterprise
2. Establish and Maintain client-base/market	2.1 Good customer relations are maintained 2.2 New customers and markets are identified, explored and reached out to. 2.3 Promotions/Incentives are offered to loyal customers 2.4 Additional products and services are evaluated and tried where feasible. 2.5 ***Promotional/advertising initiatives*** are carried out where necessary and feasible.	2.1 Public relations concepts 2.2 Basic product promotion strategies 2.3 Basic market and feasibility studies 2.4 Basic business ethics	2.1 Building customer relations 2.2 Individual marketing skills 2.3 Using basic advertising (posters/ tarpaulins, flyers, social media, etc.)
3. Apply budgeting and financial management skills	3.1 Enterprise is built up and sustained through judicious control of cash flows. 3.2 Profitability of enterprise is ensured though appropriate ***internal controls***. 3.3 Unnecessary or lower-priority expenses and purchases are avoided.	3.1 Cash flow management 3.2 Basic financial management 3.3 Basic financial accounting 3.4 Business internal controls	3.1 Setting business priorities and strategies 3.2 Interpreting basic financial statements 3.3 Preparing business plans

RANGE OF VARIABLES

VARIABLE	RANGE
1. Business strategies	May include: 1.1. Developing/Maintaining niche market 1.2. Use of organic/healthy ingredients 1.3. Environment-friendly and sustainable practices 1.4. Offering both affordable and high-quality products and services 1.5. Promotion and marketing strategies (e. g., on-line marketing)
2. Business operations	May include: 2.1 Purchasing 2.2 Accounting/Administrative work 2.3 Production/Operations/Sales
3. Internal controls	May include: 3.1 Accounting systems 3.2 Financial statements/reports 3.3 Cash management
4. Promotional/ Advertising initiatives	May include: 4.1 Use of tarpaulins, brochures, and/or flyers 4.2 Sales, discounts and easy payment terms 4.3 Use of social media/Internet 4.4 "Service with a smile" 4.5 Extra attention to regular customers

EVIDENCE GUIDE

1. Critical aspects of competency	**Assessment requires evidence that the candidate :** 1.1. Demonstrated basic entrepreneurial skills 1.2. Demonstrated ability to conceptualize and plan a micro/small enterprise 1.3. Demonstrated ability to manage/operate a micro/small-scale business
2. Resource Implications	The following resources should be provided: 2.1. Simulated or actual workplace 2.2. Tools, materials and supplies needed to demonstrate the required tasks 2.3. References and manuals
3. Methods of Assessment	**Competency in this unit may be assessed through :** 3.1. Written examination 3.2. Demonstration/observation with oral questioning 3.3. Portfolio assessment with interview 3.4. Case problems
4. Context of Assessment	4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center

COMMON COMPETENCIES

UNIT OF COMPETENCY: PREPARE MATERIALS AND TOOLS

UNIT CODE : HVC713201

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

UNIT OF COMPETENCY: INTERPRET TECHNICAL DRAWINGS AND PLANS

UNIT CODE : HVC311202

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

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

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

UNIT CODE : HVC311201

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

UNIT OF COMPETENCY: PERFORM MENSURATIONS AND CALCULATIONS

UNIT CODE : HVC311203

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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Select measuring instruments	1.2 Object or component to be measured is identified, classified and interpreted to the appropriate regular ***geometric shape*** 1.3 Measuring tools are selected/ identified as per object to be measured or job requirements 1.4 Correct specifications are obtained from relevant sources 1.5 Appropriate ***measuring instruments*** are selected according to job requirements 1.6 Alternative measuring tools are used without sacrificing cost and quality of work	1.1. Category of measuring instruments 1.2. Types and uses of measuring instruments 1.3. Shapes and Dimensions 1.4. Formulas for volume, areas, perimeters of plane and geometric figures	1.1. Identifying and selecting measuring instruments 1.2. Visualizing objects and shapes
2. Carry out measurements and calculations	2.1 Accurate ***measurements and calculations*** are obtained to job requirements 2.2 Alternative measuring tools are used without sacrificing cost and quality of work 2.3 Calculation needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x) and division (/) including but not limited to: trigonometric functions, algebraic computations 2.4 Calculations involving fractions, percentages and mixed numbers are used to complete workplace tasks 2.5 Numerical computation is self-checked and corrected for accuracy 2.6 Instruments are read to the limit of accuracy of the tool 2.7 Systems of measurement identified and converted according to job requirements/ISO 2.8 Work pieces are measured according to job requirements	2.1. Calculation & measurement 2.2. Four fundamental operation 2.3. Linear measurement 2.4. Dimensions 2.5. Unit conversion 2.6. Ratio and proportion	2.1. Performing calculation by addition, subtraction, multiplication and division; 2.2. Interpreting formulas for volume, areas, perimeters of plane and geometric figures 2.3. Handling of measuring instruments

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Maintain measuring instruments	3.1. Measuring instruments are carefully handled to avoid damage 3.2. Measuring instruments are cleaned before and after using. 3.3. Proper storage of instruments undertaken according to manufacturer's specifications and standard operating procedures.	3.1. Types of measuring instruments and their uses 3.2. Safe handling procedures in using measuring instruments 3.3. Four fundamental operation of mathematics 3.4. Formula for volume, area, perimeter and other geometric figures	3.1. Handling and maintaining measuring instruments 3.2. Properly storing measuring instruments

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

UNIT OF COMPETENCY : PERFORM BASIC BENCHWORKS

UNIT CODE : HVC713202

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

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

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

RANGE OF VARIABLES

VARIABLE	RANGE	
1. Work plan	1.1 Job requirements 1.2 Schedule of work	
2. Materials	2.1 Steel brackets 2.2 Grinding disc 2.3 Drill bit 2.4 Flat/angle bars	2.5 Fastening screws 2.6 Masonry
3. Tools and equipment	3.1 Portable grinder 3.2 Hacksaw 3.3 File 3.4 Markers 3.5 Screw drivers 3.6 Ballpein hammer 3.7 L-square/steel square 3.8 Steel rule	3.9 Measuring tools 3.10 PPE 3.11 Portable electric drill 3.12 Bench wire 3.13 Tri-square 3.14 Flaring tool 3.15 Swaging tool 3.16 Reamer
4. Metallic materials	4.1 Mild steel plate 4.2 Flat bar 4.3 Square bar 4.4 Angle bar 4.5 Round bar	4.6 G.I. sheet 4.7 B.I. sheet 4.8 Beam
5. Non-metallic materials	5.1 PVC 5.2 Rubber 5.3 Wood 5.4 Fiber glass	5.5 Plastic 5.6 Ceramics
6. Dimensions	6.1 Measurements 6.2 Tolerances	
7. Work instructions	7.1 Work plan 7.2 Blueprint 7.3 Manufacturer's specifications	
8. Personal Protective Equipment (PPE)	8.1 Safety shoes 8.2 Gloves 8.3 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 9.7 Flaring 9.8 Swaging
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. Resource implications	The following resources should be provided: 2.1. Workplace 2.2. Work plan 2.3. Materials, tools and equipment relevant to the proposed activity/task
3. Methods of assessment	Competency should be assessed through: 3.1. Actual demonstration 3.2. Direct observation 3.3. Written/questioning related to required knowledge
4. Context of assessment	4.1. Competency assessment may occur in workplace or any appropriate simulated environment 4.2. Assessment shall be observed while task are being undertaken whether individually or in group 4.3. Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

UNIT OF COMPETENCY : PERFORM BASIC ELECTRICAL WORKS

UNIT CODE : HVC724201

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

UNIT OF COMPETENCY : MAINTAIN TOOLS, INSTRUMENTS 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, instruments and equipment based on the required performance standards.

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

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

UNIT CODE : HVC7315201

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

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

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

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hazards	Hazards that may be present in the workplace include but not limited to: 1.1. Flammable materials 1.2. Running machinery/equipment 1.3. Toxic substances 1.4. Debris 1.5. Open flames 1.6. Loose objects/fixtures 1.7. Chemicals 1.8. Electrical faults 1.9. Hot metals
2. Emergencies	Emergencies may include but not limited to: 2.1. Fire 2.2. Explosion 2.3. Spills 2.4. Falls 2.5. Electrocution 2.6. Injuries caused by falling objects 2.7. Injuries caused by sharp objects 2.8. Injuries caused by wrong usage of tools
3. Safety signs, symbols and hazard warnings	Safety signs and symbols include but not limited to: 3.1. 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 - Flammable Materials 3.2. Internationally recognized hazard warning signs and safety symbols
4. Personal Protective Equipment (PPE)	PPE may include but not limited to: 4.1. Goggles 4.2. Gas mask 4.3. Working gloves 4.4. Safety shoes 4.5. Face shield 4.6. Insulating mat 4.7. Over-all apron 4.8. Hard hat 4.9. Safety belt 4.10. Protective eyewear
5. First-aid Treatment	First-aid treatment includes but is not limited to: 5.1. CPR 5.2. Mouth to mouth resuscitation 5.3. Application of tourniquet 5.4. Application of pressure to bleeding wounds or cuts 5.5. First-aid treatment for burned victims

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

EVIDENCE GUIDE

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

UNIT OF COMPETENCY : DOCUMENT WORK ACCOMPLISHED

UNIT CODE : HVC311205

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

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

RANGE OF VARIABLES

VARIABLE	RANGE
1. Forms	1.1 Warranty Paper Request 1.2 Operating Log Sheet 1.3 Requisition Forms 1.4 Start up data sheet
2. Data	2.1 Current drawn 2.2 Operating data 2.3 Unit specifications 2.4 Records of work accomplished 2.5 Further work required 2.6 Spare parts used
3. Reports	3.1 Start-up commissioning Report 3.2 Warranty Paper Request 3.3 Turn-over Report 3.4 Operating Log Sheet 3.5 Service Report 3.6 Trouble Call Report 3.7 Requisition

EVIDENCE GUIDE

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

CORE COMPETENCIES

UNIT OF COMPETENCY: INSTALL COMMERCIAL REFRIGERATION EQUIPMENT

UNIT CODE : HVC723341

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to safely install the commercial refrigeration equipment (CRE) components as well as accessories based on manufacturer's recommendations. It also includes site survey, installation of electrical and piping systems.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Survey site for installation	1.1. Work instructions/ technical plans/drawings are interpreted as per job requirements 1.2. ***Installation requirements*** are verified in line with site conditions 1.3. Alteration/comments are prepared as per survey conducted 1.4. Result of survey is prepared in line with enterprise procedures.	1.1 Protective personal equipment/safety gears 1.2 Safety signs and symbols 1.3 Trade mathematics/ mensuration o Linear measurements o Ratio and proportion o Dimension 1.4 Mechanical plans, symbols and abbreviations 1.5 Electrical plans, symbols and abbreviations 1.6 Architectural/Structural plans 1.7 Plumbing plans, symbols and abbreviations 1.8 Equipment selection and application 1.9 Knowledge to understand the geographical location/site location 1.10 RA 11058 provisions	1.1 Interpreting plan and details 1.2 Preparing materials 1.3 Performing work safety practices 1.4 Work set-up and planning 1.5 Communication skills
2. Install commercial refrigeration equipment piping systems	2.1. ***Piping materials*** are prepared consistent with the approved designs and specifications 2.2. Brackets and supports are mounted in accordance with site conditions 2.3. Piping are installed, cleaned and tested in accordance with manufacturer's specifications, recommendations and RAC Code of Practice 2.4. Correct insulation and sealing/adhesive materials are used and installed in accordance with manufacturer's	2.1. Protective personal equipment/safety gears 2.2. Handling of tools, equipment and accessories 2.3. Safety signs and symbols 2.4. Good housekeeping 2.5. Trade mathematics/ mensuration o Linear measurements o Ratio and proportion o Dimension 2.6. Mechanical plans, symbols and abbreviations 2.7. Architectural/Structural plans 2.8. Plumbing plans, symbols and abbreviations 2.9. Fundamental of refrigeration 2.10. Basic masonry 2.11. Basic sheet metal	2.1. Interpreting plan and details 2.2. Preparing materials 2.3. Proper handling of tools and equipment 2.4. Performing work safety practices 2.5. Work set-up and planning 2.6. Tube processing 2.7. Plumbing works 2.8. Communication skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	specifications	2.12. Basic welding (SMAW and Gas) 2.13. Basic plumbing 2.14. RA 11058 provisions	
3. Install commercial refrigeration equipment electrical systems	3.1. ***Electrical materials*** are prepared consistent with job requirements and are checked for damage 3.2. Appropriate PPE is selected and used in line with the job requirements 3.3. ***Electrical system*** is laid-out and installed in accordance with the approved designs, specifications, working plans, drawings and applicable provisions of the latest edition of PEC 3.4. Electrical system is tested/energized in line with applicable provisions of the latest edition of PEC 3.5. Report on testing/ energization of electrical system is prepared in line with enterprise procedures	3.1. Protective personal equipment/safety gears 3.2. Handling of tools, equipment and accessories 3.3. Safety signs and symbols 3.4. Good housekeeping 3.5. Trade mathematics/ mensuration ○ Linear measurements ○ Ratio and proportion ○ Dimension 3.6. Electrical plans, symbols and abbreviations 3.7. Architectural/Structural plans 3.8. Basic electricity 3.9. Fundamental of refrigeration 3.10. How to select wire size 3.11. Equipment selection and application 3.12. Knowledge to understand the geographical location/site location 3.13. PEC Provisions 3.14. RA 11058 provisions	3.1. Interpreting plan and details 3.2. Preparing materials 3.3. Proper handling of tools and equipment 3.4. Performing work safety practices 3.5. Work set-up and planning 3.6. Basic electrical installation 3.7. Communication skills
4. Install fan coil units/evaporator and condensers (air-cooled or water-cooled) and accessories	4.1. ***Fan coil units/ evaporator and condensers*** are mounted in accordance with site conditions and manufacturer's specifications 4.2. ***Accessories*** are installed according to manufacturer's specifications 4.3. ***Refrigerant lines*** are connected in accordance with manufacturer's specifications 4.4. Electrical connections are terminated in accordance with manufacturer's specifications 4.5. ***Condensate drain*** line is installed in accordance with manufacturer's specification.	4.1. Protective personal equipment/safety gears 4.2. Handling of tools, equipment and accessories 4.3. Safety signs and symbols 4.4. Good housekeeping 4.5. Trade mathematics/ mensuration ○ Linear measurements ○ Ratio and proportion ○ Dimension 4.6. Mechanical plans, symbols and abbreviations 4.7. Electrical plans, symbols and abbreviations 4.8. Architectural/Structural plans 4.9. Plumbing plans, symbols and abbreviations 4.10. Basic masonry work 4.11. Basic sheet metal work 4.12. Basic bench work 4.13. Basic welding (SMAW and Gas)	4.1. Interpreting plan and details 4.2. Preparing materials 4.3. Proper handling of tools and equipment 4.4. Performing work safety practices 4.5. Work set-up and planning 4.6. Basic electrical installation 4.7. Tube processing 4.8. Plumbing works 4.9. Communication skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	4.6. ***Pre-start up checks*** are undertaken in accordance with manufacturer's specifications and enterprise policies 4.7. ***Faults/problems*** arising from installation are corrected in line with standard installation guidelines	4.14. Basic electricity 4.15. Basic plumbing 4.16. Fundamental of refrigeration 4.17. How to select conductor wire size 4.18. Principles of air distribution 4.19. Equipment selection and application 4.20. Knowledge to understand the geographical location/site location 4.21. Clean Air Act (RA 8749) 4.22. Montreal Protocol/DENR rules 4.23. Ozone Depleting / Global warming Refrigerants (ODS/GWP) 4.24. RA 11058 provisions	

RANGE OF VARIABLES

VARIABLE	RANGE	
1 Installation requirements	May include: 1.1 Piping requirements 1.1.1 Refrigerant piping 1.1.2 Drain piping 1.1.3 Hot gas defrost piping (optional) 1.2 Electrical requirements 1.3 Drain location 1.4 Mounting location 1.5 Equipment requirements 1.6 Permits and licenses 1.6.1 Installation permit 1.6.2 Mechanical permit 1.6.3 Government and private permits	
2 Piping materials	May include: 2.1 Pipes and fittings 2.2 Tubing 2.3 Insulations 2.4 Hangers, clamps, brackets	
3 Electrical materials	May include: 3.1 Electrical tape 3.2 Wire connector 3.3 Wires and cables 3.4 Breaker 3.5 Terminal clips/plugs	
4 Electrical system	May include: 4.1 Electrical conduits 4.2 Controls and protective devices 4.3 Electrical control wires/cables 4.4 Power supply	
5 Fan coil units/ evaporator and condensers	May include: 5.1 Fan coil units/evaporator 5.1.1 Walk-in cooler/freezer evaporator 5.1.2 Reach-in chiller/freezer evaporator 5.2 Condensers 5.2.1 Air-cooled condenser 5.2.2 Water-cooled condenser	
6 Accessories	May include: 6.1 filter drier (soldered/flared) 6.2 sight glass or moisture indicator 6.3 solenoid valve 6.4 high pressure control (HPC) 6.5 low pressure control (LPC) 6.6 defrost timer 6.7 evaporator pressure regulator (EPR)	6.8 non-return valve 6.9 drain line heater 6.10 defrost heater 6.11 crankcase heater 6.12 accumulator 6.13 oil separator

VARIABLE	RANGE
7 Refrigerant lines	May include: 7.1 Gas lines (vapor lines) 7.2 Liquid lines 7.3 Hot gas lines
8 Condensate drain	May include: 8.1 PVC pipe/clamp 8.2 Plastic tubing/clamp 8.3 G.I. or metal tubing/clamp
9 Pre-start up checks	May include: 9.1 Insulation 9.2 Termination 9.3 Sequence test 9.4 Refrigerant leakage 9.5 Equipment
10 Faults/problems	May include: 10.1 factory defects 10.2 material defects 10.3 loose connections 10.4 wrong connections 10.5 mismatching of indoor and outdoor units (for multi-unit installations)

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Conducted survey of site for installation of the unit. 1.2 Prepared and installed piping materials correctly. 1.3 Used and installed correct insulation and sealing/adhesive materials. 1.4 Prepared, laid out and installed electrical system correctly. 1.5 Tested/Energized electrical system in line with applicable provision of latest edition of PEC. 1.6 Installed indoor and outdoor units and accessories accordingly. 1.7 Corrected faults/problems arising from installation. 1.8 Undertook pre-start up checks.
2. Resource Implications	The following resources **MUST** be provided: 2.1 Technical plan/drawing relevant to the task 2.2 Work place location 2.3 Tools and equipment appropriate to installing commercial refrigeration processes 2.4 Materials relevant to the proposed activity 2.5 Drawings and specifications relevant to the task
3. Methods of Assessment	Competency may be assessed through: 3.1 Direct observation / Demonstration with oral questioning 3.2 Written test 3.3 Portfolio with interview
4. Context for Assessment	4.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: SERVICE AND MAINTAIN COMMERCIAL REFRIGERATION EQUIPMENT (CRE)

UNIT CODE : HVC723343

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in servicing and maintaining refrigeration system, components and accessories including lubrication and air-distribution systems in commercial refrigeration equipment (CRE).

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare for service and maintenance activities	1.1. ***Work instructions*** are read interpreted to determine job requirements 1.2. Appropriate manufacturer's manual is consulted if available; otherwise, RAC Code of Practice and/or enterprise maintenance policy procedures are adopted. 1.3. Tools and equipment are selected in accordance with job requirements 1.4. Work safety is observed according to enterprise regulations	1.1. Protective personal equipment/ safety gear 1.2. Safety hazards 1.3. Handling of tools and equipment and accessories 1.4. Safety signs and symbols 1.5. Good housekeeping 1.6. Proper use and care of tools needed 1.7. Types of refrigerant 1.8. Types of coil cleaner 1.9. Types of fins and materials use 1.10. Plan specification 1.11. Electrical wiring diagram 1.12. Electrical plans, symbols and abbreviations	1.1. Interpreting plans and details 1.2. Preparing materials
2. Check and adjust commercial refrigeration equipment (CRE) accessories, controls and operating conditions	2.1. Maintenance procedures are applied according to manufacturer's maintenance manual 2.2. Evaporator/condenser coils are cleaned in accordance with manufacturer's maintenance manual. 2.3. Refrigerant piping is checked for ***abnormal condition***s based on procedure. 2.4. ***Operation/Controls/ Settings*** are checked and adjusted in accordance with manufacturer's specifications. 2.5. ***Refrigeration accessories*** are adjusted accordingly	2.1. Protective personal equipment/safety gear 2.2. Handling of tools and equipment and accessories 2.3. Safety signs and symbols 2.4. Unit conversion 2.5. Types of electrical controls 2.6. Types refrigerant flow control devices 2.7. Types of compressor 2.8. Types of refrigerant 2.9. Types of pulley 2.10. Types of belts 2.11. Types of latches 2.12. Types of door hinges 2.13. Types of coil cleaner 2.14. Types of fins and materials use 2.15. RA 11058 provisions	2.1. Interpreting plans and details 2.2. Preparing materials 2.3. Using of electrical and mechanical tools and equipment properly 2.4. Troubleshooting technique 2.5. Calibrating of refrigerant flow control valve 2.6. Performing work safety practices 2.7. Adjusting superheat 2.8. belt and pulley 2.9. Aligning door

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	based on manufacturer's maintenance manual.	2.16. Plan specification 2.17. Electrical wiring diagram 2.18. Electrical plans, symbols and abbreviations 2.19. Fundamentals of refrigeration 2.20. Basic refrigeration cycle 2.21. Refrigeration service valves 2.22. Basic electricity 2.23. Understanding of troubleshooting charts/service charts 2.24. Refrigerant flow control device 2.25. How to charge the system 2.26. How to evaluate the system 2.27. Pump down procedure 2.28. Resistance testing procedure 2.29. Mechanical testing procedure 2.30. Compressor construction 2.31. Refrigerant charging procedure 2.32. TXV adjustment procedure 2.33. AXV adjustment procedure	
3. Maintain lubrication system in commercial refrigeration equipment (CRE)	3.1. Lubrication system variables and components are checked and adjusted based on manufacturer's maintenance manual 3.2. ***Oil parameters*** are checked and corrected based on manufacturer's specifications 3.3. Oil leaks and restrictions are detected and rectified based on standard maintenance procedures 3.4. Used oil is disposed properly according to government oil disposal regulations and	3.1. Protective personal equipment/safety gear 3.2. Safety and Health hazards 3.3. Handling of tools and equipment and accessories 3.4. Safety signs and symbols 3.5. Good housekeeping 3.6. Ratio and proportion 3.7. Unit conversion 3.8. Types of refrigerant 3.9. Types of oil 3.10. Clean Air Act (RA 8749) 3.11. R.A. 6969 – Toxic substances and	3.1. Interpreting plans and details 3.2. Preparing materials 3.3. Using of electrical and mechanical tools & equipment properly 3.4. Performing work safety practices 3.5. Refrigerant recovery skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	enterprise policy.	hazardous and nuclear wastes control act of 1990. 3.12. RA 11058 provisions 3.13. Fundamentals of refrigeration 3.14. Refrigeration service valves 3.15. Pump down procedure	
4. Maintain refrigeration system in commercial refrigeration equipment (CRE)	4.1. ***Operating parameters*** are measured and analyzed based on manufacturer's standards and/or RAC Code of Practice. 4.2. Pressure and temperature drops across strainer, filters and filter driers are checked and recorded based on standard maintenance procedures and/or RAC Code of Practice 4.3. Leak testing is performed based on RAC Code of Practice. 4.4. ***Refrigeration components*** and accessories are checked for operability in accordance manufacturer's manual or RAC Code of Practice. 4.5. ***Consumables*** are checked for contaminants in accordance manufacturer's manual or RAC Code of Practice.	4.1. Protective personal equipment/safety gear 4.2. Safety hazards 4.3. Handling of tools and equipment and accessories 4.4. Safety signs and symbols 4.5. Proper handling of refrigerant pressure testing device 4.6. Good housekeeping 4.7. Linear measurements 4.8. Unit conversion 4.9. Proper use and care of tools needed 4.10. Proper use and care of tools needed 4.11. Types of electrical controls 4.12. Types of expansion valves/motoring devices 4.13. Types of compressor 4.14. Types of refrigerant 4.15. Types of pulley 4.16. Types of belts 4.17. Types of latches 4.18. Types of door hinges 4.19. Types of coil cleaner 4.20. Types of fins and materials use 4.21. Clean Air Act (RA 8749) 4.22. Plan specification 4.23. Electrical wiring diagram 4.24. Electrical plans, symbols and abbreviations 4.25. Fundamentals of refrigeration 4.26. Basic refrigeration cycle	4.1. Interpreting plans and details 4.2. Preparing materials 4.3. Using of electrical and mechanical tools & equipment properly 4.4. Troubleshooting technique 4.5. Calibrating of expansion valve 4.6. Replacing defective part 4.7. Troubleshooting of CRE system 4.8. Performing work safety practices 4.9. Adjusting superheat 4.10. Aligning belt and pulley

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		4.27. Refrigeration service valves 4.28. Basic electricity 4.29. Understanding of troubleshooting charts/service charts 4.30. Expansion device and low pressure side of the system 4.31. How to evaluate the system 4.32. Pump down procedure 4.33. Resistance testing procedure 4.34. Mechanical testing procedure 4.35. Compressor construction 4.36. Refrigerant charging procedure 4.37. TXV adjustment procedure 4.38. AXV adjustment procedure	
5. Maintain air distribution system in commercial refrigeration equipment (CRE)	5.1. ***Evaporator air distribution system*** components are checked and airflows (product load arrangement) are balanced based on manufacturer's specifications. 5.2. Air-cooled condenser ventilation systems are checked and maintained to meet operational and regulatory requirements.	5.1. Protective personal equipment/safety gear 5.2. Safety hazards 5.3. Handling of tools and instruments 5.4. Safety signs and symbols 5.5. Good housekeeping 5.6. Proper use and care of tools needed 5.7. Types of electrical controls 5.8. Types of pulley 5.9. Types of belts 5.10. RA 11058 provisions 5.11. Clean Air Act (RA 8749) 5.12. National Building Code provision (ventilation) 5.13. Fire Code (RA 9514) 5.14. Plan specification 5.15. Electrical wiring diagram 5.16. Electrical plans, symbols and abbreviations 5.17. Basic electricity	5.1. Interpreting plans and details 5.2. Preparing materials 5.3. Using of electrical and mechanical tools & equipment properly 5.4. Replacing defective part 5.5. Troubleshooting skills 5.6. Performing work safety practices 5.7. Aligning belt and pulley

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work instructions	May include: 1.1 Work permits 1.2 Job orders 1.3 Blueprints
2. Abnormal conditions	May include: 2.1 leaks 2.2 insulation cracks 2.3 looseness of supports/brackets
3. Operation/Controls/Settings	May include: 3.1 Pressures 3.2 Temperatures 3.3 Voltages 3.4 Current draws 3.5 Air flow 3.6 Noise level 3.7 Vibrations
4. Refrigeration accessories	May include: 4.1 Pressure switch 4.2 Temperature control 4.3 Pulley alignment/belt tension 4.4 Unloader 4.5 Fan blades/blower 4.6 Fan motors 4.7 Filter/Driers 4.8 Sight glass 4.9 Defrost heaters 4.10 Timers and relays 4.11 Drain line heaters 4.12 Crankcase heaters 4.13 Evaporator pressure regulators 4.14 Solenoid valves 4.15 Suction/discharge service valves 4.16 Accumulators 4.17 Oil separators
5. Oil parameters	May include: 5.1 Oil levels 5.2 Oil properties 5.3 Purity of oil 5.4 Oil viscosity
6. Operating parameters	May include: 6.1 Operating temperature 6.2 Superheat 6.3 Pressure 6.4 Voltage 6.5 Current 6.6 Air velocity

VARIABLE	RANGE
7. Refrigeration components	May include: 7.1 Refrigerant flow controls 7.2 Evaporator 7.3 Compressor 7.4 Condenser
8. Consumables	May include: 8.1 Oil 8.2 Refrigerant 8.3 V-belts
9. Air distribution system	May include: 9.1 Grilles 9.2 Louvers 9.3 Evaporator blower

EVIDENCE GUIDE

1 Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Prepared for maintenance activities. 1.2 Checked and adjusted refrigeration equipment accessories, controls and operating conditions 1.3 Applied maintenance procedures according to manufacturer's maintenance manual. 1.4 Checked and maintained lubrication system in CRE. 1.5 Checked and maintained refrigeration system in CRE. 1.6 Checked and maintained air distribution system in CRE. 1.7 Communicated interactively with others where applicable to ensure safe and effective work operations
2 Resource Implications	The following resources should be provided: 2.1 Work place location 2.2 Tools and equipment appropriate to maintaining commercial refrigeration equipment processes 2.3 Materials relevant to the activity 2.4 Drawings and specifications relevant to the task
3 Methods of Assessment	Competency must be assessed through: 3.1 Direct observation /demonstration with oral questioning 3.2 Written test 3.3 Portfolio with interview
4 Context for Assessment	4.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: TROUBLESHOOT AND REPAIR COMMERCIAL REFRIGERATION EQUIPMENT (CRE)

UNIT CODE : HVC723345

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in troubleshooting and repairing commercial refrigeration equipment systems. It includes planning troubleshooting and repair, preparing materials, tools and equipment and identifying and repairing faults including recovery/recycle of refrigerants.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for troubleshooting and repair	1.1. Appropriate wiring diagrams, charts and manuals are interpreted in line with the job requirements 1.2. Appropriate materials, tools and equipment are selected based on job requirements 1.3. Power supply is checked to ensure compliance with nameplate rating and/or manufacturer's specifications 1.4. Nameplates are interpreted as per manufacturer's specifications	1.1. **SAFETY PRACTICES** 1.2. Protective personal equipment/safety gears 1.3. Safe handling of tools and equipment 1.4. Safety signs and symbols 1.5. Safety hazard 1.6. Good housekeeping 1.7. Electrical wiring control diagram 1.8. Mechanical plan/symbols and abbreviation 1.9. Fundamentals of refrigeration and control 1.10. PEC provisions 1.11. Montreal protocol 1.12. EMB/DENR regulations 1.13. RA 11058 provisions 1.14. Fire Code (RA 9514)	1.1. Interpreting plan and details 1.2. Preparing materials 1.3. Following work safety 1.4. Using electrical tools and testing equipment 1.5. Communicating skills
2. Identify and repair faults/ troubles in CRE	2.1. Appropriate ***PPE*** is selected and used in line with the job requirements 2.2. ***Refrigeration system components and accessories*** are tested following manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy 2.3. ***Faults/problems*** with refrigerant system are diagnosed in line with manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy 2.4. Electronic control system components are diagnosed following	2.1. Protective personal equipment/safety gears 2.2. Safe handling of tools and equipment 2.3. Proper handling of refrigerants 2.4. Safety signs and symbols 2.5. Safety hazard 2.6. Good housekeeping (5'S) 2.7. Electrical wiring control diagram 2.8. Mechanical plan/symbols and abbreviation 2.9. Basic electricity 2.10. Fundamentals of refrigeration 2.11. Interlocking control sequence 2.12. Fundamentals of piping 2.13. Pump principles 2.14. Cooling tower principles	2.1. Interpreting plan and details 2.2. Preparing materials 2.3. Following work safety 2.4. Using electrical tools and testing equipment 2.5. Performing electrical testing 2.6. Performing mechanical testing 2.7. Communicating skills 2.8. Reading wiring diagram of PCB 2.9. Identifying electronics system

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	manufacturer's manual and/or enterprise troubleshooting policy. 2.5. Repairs are done in line with manufacturer's manual, RAC Code of Practice and/or enterprise troubleshooting policy 2.6. Work is completed safely in line with enterprise safety guidelines 2.7. Report on testing procedure, including faults and repair, is completed in line with RAC Code of Practice and/or enterprise troubleshooting policies.	2.15. PEC provisions 2.16. Electronics system components and symbols 2.17. Types of electrical controls 2.18. Types of refrigerant flow control 2.19. Types of compressor motor 2.20. Types of condenser 2.21. Types of evaporator 2.22. Types of refrigerant 2.23. Types of pressure control 2.24. Types of defrost timer 2.25. Types of defrost system 2.26. Types of fan and fan motor 2.27. Types of filter drier 2.28. Types of filter/strainer element 2.29. Types of thermostat 2.30. Types of circuit breaker 2.31. Types of magnetic contactor 2.32. Types of unloader 2.33. Clean Air Act 2.34. Montreal Protocol 2.35. Ozone Depleting Refrigerants 2.36. (ODRs) 2.37. RAC Code of Practice 2.38. Chemical Control Orders (CCOs) and other issuances relating to ozone-depleting substances (ODS): • R.A. 6969 – Toxic substances and hazardous and nuclear wastes control act of 1990. • DENR-AO 1992-29 - IRR of R.A. 6969 • DENR-AO 2004-08 – Revised CCO for ODS • EMB MC 2005-03 – Alternatives to ODS 2.39. Kigali Amendment 2.40. RA 11058 provisions 2.41. Compressor test procedures 2.42. Power supply test	components and symbols

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		procedures 2.43. Cooler/evaporator test procedures 2.44. Condensing unit test procedures 2.45. Pump test procedures 2.46. Cooling tower test procedures 2.47. Refrigerant flow control test procedures 2.48. Electrical control test procedures 2.49. Leak testing procedure (for refrigeration circuit and water piping) 2.50. Pressure testing procedure 2.51. Evacuation procedure 2.52. Refrigerant charging procedure 2.53. Pump down procedure 2.54. Crank case heater test procedures 2.55. Unloading test procedures 2.56. Start-up procedure 2.57. Fire Code (RA 9514)	
3. Perform refrigerant recovery/ recycling on commercial refrigeration systems	3.1 Safe working practices are applied throughout the task as per enterprise procedure 3.2 Suitable tools and equipment are selected and used based on job requirement 3.3 Optimum recovery of refrigerant is performed in line with RAC Code of Practice 3.4 Refrigerants recovery/ recycling is performed according to ***manufacturer's recommendations*** and RAC Code of Practice	3.1. Protective personal equipment/safety gears 3.2. Safe handling of tools and equipment 3.3. Proper handling of refrigerants 3.4. Safety signs and symbols 3.5. Safety hazards 3.6. Good housekeeping 3.7. Electrical wiring and mechanical diagram of recovery machine 3.8. Recovery/recycling procedures 3.9. Method of recovery/ recycling of refrigerants 3.10. Types of refrigerant 3.11. Clean Air Act 3.12. Montreal Protocol 3.13. Ozone Depleting Refrigerants 3.14. (ODRs) 3.15. Chemical Control Orders (CCOs) and other issuances relating to ozone-depleting	3.1. Preparing tools and equipment 3.2. Following work safety 3.3. Performing recovery/ recycling of refrigerant 3.4. Communicating skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		substances (ODS): • R.A. 6969 – Toxic substances and hazardous and nuclear wastes control act of 1990. • DENR-AO 1992-29 - IRR of R.A. 6969 • DENR-AO 2004-08 – Revised CCO for ODS • EMB MC 2005-03 – Alternatives to ODS 3.16. Kigali Amendment 3.17. RA 11058 provisions 3.18. Fire Code (RA 9514)	
4. Test run CRE	4.1 Commercial refrigeration equipment is tested in line with manufacturer's instructions 4.2 Report on testing equipment is prepared in line with enterprise procedures	4.1. Protective personal equipment/safety gears 4.2. Safe handling of tools and equipment 4.3. Safety signs and symbols 4.4. Safety hazard 4.5. Good housekeeping 4.6. Electrical wiring control diagram 4.7. Mechanical plan/symbols and abbreviation 4.8. Basic electricity 4.9. Fundamentals of refrigeration and control 4.10. Interlocking control sequence 4.11. Pump principles 4.12. Cooling tower principles 4.13. RA 11058 provisions 4.14. Compressor test procedures 4.15. Power supply test procedures 4.16. Condensing unit test procedures 4.17. Pump test procedures 4.18. Cooling tower test procedures 4.19. Electrical control test procedures 4.20. Leak testing procedure 4.21. Pressure testing procedure 4.22. Start-up procedure	4.1. Following work safety 4.2. Using electrical tools and testing equipment 4.3. Performing electrical testing 4.4. Performing mechanical testing 4.5. Data gathering skills 4.6. Communicating skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. PPE	Includes but is not limited to: 1.1. Mask 1.2. Safety shoes 1.3. Safety goggles 1.4. Apron 1.5. Gloves
2. Refrigeration system components	2.1. Components: 2.1.1. Refrigerant flow control valves 2.1.2. Evaporator 2.1.3. Compressor 2.1.4. Condenser 2.2. Accessories 2.2.1. Pressure switch 2.2.2. Temperature control 2.2.3. Pulley alignment/belt tension 2.2.4. Unloader 2.2.5. Fan blades/blower 2.2.6. Fan motors 2.2.7. Filter/Driers 2.2.8. Sight glass 2.2.9. Defrost heaters 2.2.10. Timers and relays 2.2.11. Drain line heaters 2.2.12. Crankcase heaters 2.2.13. Evaporator pressure regulators 2.2.14. Solenoid valves 2.2.15. Suction/discharge service valves 2.2.16. Accumulators 2.2.17. Oil separators
3. Faults/problems in diagnosing	May include: 3.1 Leakage 3.2 Contamination 3.3 Fractionation 3.4 Restriction
4. Manufacturer's recommendations	Includes but not limited to: 4.1. Equipment operator's manual 4.2. Equipment service manual 4.2.1. Error codes 4.2.2. Troubleshooting guide 4.3. Nameplate data

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Interpreted appropriate wiring diagrams, charts and manuals. 1.2 Checked power supply in compliance with nameplate rating and/or manufacturer's standard 1.3 Tested refrigerant system components as per standard procedures 1.4 Diagnosed and repaired faults/problems. 1.5 Demonstrated compliance with safety regulations applicable to worksite operations 1.6 Performed refrigerant recovery/recycling accordingly. 1.7 Test run air-conditioning unit in line with manufacturer's instruction. 1.8 Communicated Interactively others where applicable to ensure safe and effective work operations
4. Resource Implications	The following resources **MUST** be provided: 4.1 Work place location 4.2 Tools and equipment appropriate to troubleshooting refrigerant system 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 Direct observation / demonstration with oral questioning 5.2 Written test 5.3 Portfolio with interview
6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: PERFORM START-UP, TEST AND COMMISSIONING FOR COMMERCIAL REFRIGERATION EQUIPMENT

UNIT CODE : HVC723347

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in performing start-up, test and commissioning in commercial refrigeration equipment (CRE).

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare for start-up, test and commissioning of commercial refrigeration equipment (CRE)	1.1. Work instructions are read and interpreted to determine job requirements 1.2. Tools and equipment are selected in accordance with job requirements 1.3. Pre-start-up, testing and commissioning checklists are prepared in accordance with manufacturer's manuals. 1.4. Commissioning method and program are produced and recording sheets are prepared in accordance with manufacturer's manuals. 1.5. ***Commissioning instruments*** are calibrated in accordance with system documents 1.6. PPEs are selected in line with job requirements	1.1. Protective personal equipment/safety gears 1.2. Safe handling of tools and instruments 1.3. Safety signs and symbols 1.4. Safety hazard 1.5. Good housekeeping 1.6. Blueprint reading and plan specification 1.7. Electrical wiring control diagram 1.8. HVAC-R plan/symbols and abbreviation	1.1. Interpreting plan and details 1.2. Preparing materials 1.3. performing work safety 1.4. Proper handling of electrical tools and testing instruments 1.5. Performing pre-start-up activity 1.6. Communicating effectively
2. Conduct start-up, test and commissioning of commercial refrigeration equipment (CRE)	2.1. ***Electrical related checks*** are performed based on manufacturer's manuals. 2.2. ***Refrigerant piping related checks*** are performed based on manufacturer's manuals. 2.3. ***Condensing unit related checks*** are performed based on manufacturer's manuals. 2.4. ***Compressor unit related checks*** are performed based on manufacturer's manuals. 2.5. ***Fan coil unit/evaporator unit related checks*** are performed based on	2.1. Safety practices 2.2. Protective personal equipment/safety gears 2.3. Safe handling of tools and instruments 2.4. Proper handling of refrigerants 2.5. Safety signs and symbols 2.6. Safety hazard 2.7. Good housekeeping 2.8. Blueprint reading and plan specification 2.9. Electrical wiring control diagram 2.10. HVAC-R plan/symbols and abbreviation 2.11. Types of electrical controls 2.12. Types of refrigerant flow	2.1. Interpreting plan and details 2.2. Preparing materials 2.3. performing work safety 2.4. Proper handling of electrical tools and testing equipment 2.5. Performing pre-start-up activity 2.6. Performing electrical testing 2.7. Performing mechanical testing 2.8. Performing commissioning

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	manufacturer's manuals and site conditions 2.6. ***Metering device related checks*** are performed based in manufacturer's manuals 2.7. Systems are charged with the correct refrigerant to system specifications and in accordance with manufacturer's manual 2.8. Appropriate lubricating oil is added as necessary to the refrigeration systems in accordance with standard operating procedures 2.9. Performance parameters are gathered and recorded in accordance with manufacturer's manual and standard operating procedures 2.10. Start-up, testing and commissioning reports are accomplished in line with enterprise policies and procedures.	control 2.13. Types of compressor motor 2.14. Types of condenser 2.15. Types of evaporator 2.16. Types of refrigerant 2.17. Types of pressure control 2.18. Types of fan and fan motor 2.19. Types of filter drier 2.20. Types of filter/strainer element 2.21. Types of thermostat 2.22. Types of circuit breaker 2.23. Types of magnetic contactor 2.24. Types of unloader 2.25. Types of compressor 2.26. Types of pump 2.27. Types of overload protector 2.28. Basic electricity 2.29. Fundamentals of refrigeration systems 2.30. Interlocking control sequence 2.31. Fundamentals of piping 2.32. Fan characteristics 2.33. Pump principles 2.34. Cooling tower principles 2.35. Compressor test procedures 2.36. Power supply test procedures 2.37. Cooler/evaporator test procedures 2.38. Condensing unit test procedures 2.39. Pump test procedures 2.40. Cooling tower test procedures 2.41. Refrigerant flow control test procedures 2.42. Electrical control test procedures 2.43. Pressure/Leak testing procedure 2.44. Refrigerant charging procedure 2.45. Crank case heater test procedures 2.46. Unloading test	activity 2.9. Communicating effectively

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		procedures 2.47. Start-up procedure 2.48. Oil failure pressure switch test procedure 2.49. Clean Air Act (RA 8749) 2.50. Montreal Protocol 2.51. Ozone Depleting Refrigerants (ODRs) 2.52. RAC Code of Practice 2.53. Existing Chemical Control Orders (CCOs) and other issuances relating to ozone-depleting substances (ODS): • R.A. 6969 – Toxic substances and hazardous and nuclear wastes control act of 1990. 2.54. Kigali amendments 2.55. RA 11058 provisions 2.56. Fire Code (RA9514)	

RANGE OF VARIABLES

VARIABLE	RANGE
1 Commissioning instruments	Including but is not limited to: 1.1 Manifold gauge 1.2 Clamp meter 1.3 Multi-tester 1.4 Psychrometer 1.5 Thermometer 1.6 Electronic leak detector
2 Electrical related checks	This includes: 2.1 Power supply source checks 2.2 Power supply isolation checks 2.3 Safety and circuit protection checks 2.4 Wirings and piping checks 2.5 Grounding systems checks
3 Refrigerant piping related checks	May include: 3.1 Inspection of U-traps/ pipe riser installation 3.2 Leak testing 3.3 Pipe insulation inspection 3.4 Pipe and fittings inspection
4 Condensing unit related checks	May include: 4.1 Leveling and dimension validation 4.2 Spacing and positioning validation 4.3 Verification of access for servicing
5 Compressor unit related checks	May include: 5.1 Connection of crankcase heater 5.2 Oil level verification 5.3 Terminal connection inspection
6 Fan coil unit/evaporator related checks	May include but not limited to: 6.1 Condensate drain pipe inspection 6.2 Leveling and dimension verification 6.3 Temperature and pressure check 6.4 Verification of the installation quality of unit 6.5 Air leakage check (i.e. door hinges alignment, door gasket)
7 Refrigerant flow control related checks	May include but not limited to: 7.1 Sensing valve tightness and location verification 7.2 Vibration check

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Completed pre-start-up, testing and commissioning checks and complied with manufacturer's manuals. 1.2. Performed electrical related checks. 1.3. Performed refrigerant piping related checks. 1.4. Performed condensing unit related checks. 1.5. Performed compressor unit related checks. 1.6. Performed indoor unit related checks. 1.7. Performed metering device related checks. 1.8. Charged refrigeration system with the correct refrigerant 1.9. Tested and set electrical, pneumatic and other controls to meet specified and safety performance requirements 1.10. Communicated interactively with others where applicable to ensure safe and effective work operations 1.11. Completed commissioning and starting-up procedures in accordance with the standard procedures
2. Resource Implications	The following resources should be provided: 2.1. Work place location 2.2. Tools and equipment appropriate in performing start-up, testing and commissioning refrigeration and air-conditioning systems 2.3. Materials relevant to the proposed activity 2.4. Drawings and specifications relevant to the task
3. Methods of Assessment	Competency must be assessed through: 3.1. Direct observation /demonstration with oral questioning 3.2. Written test 3.3. Portfolio with interview
4. Context for Assessment	4.1. Competency may be assessed in the work place or in a simulated work place setting

SECTION 3. - TRAINING STANDARDS

These standards 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 Commercial Refrigeration Installation and Servicing NC III.

3.1 CURRICULUM DESIGN

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

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

Course Title	:	**Commercial Refrigeration Installation and Servicing**
PQF	:	**NC III**
Nominal Training Duration:		**40 Hours (Basic)** **40 Hours (Common)** **240 Hours (Core)** [inclusive of SIL]* --- 320 Hours – Total 400 Hours – Supervised Industry Learning (SIL) --- **720 Hours - Total training duration**

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

Course Description:

This course is designed to provide the learner with knowledge, skills and attitudes applicable in installing, servicing and maintaining, troubleshooting and repairing including starting-up, testing and commissioning commercial refrigeration equipment. This includes classroom learning activities and practical work in actual work site or simulation area.

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

BASIC COMPETENCIES
(40 hrs)

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

1. Lead workplace communication	1.1. Communicate information about workplace processes	• Read
		  ○ Effective verbal communication methods
		  ○ Sources of information
		• Practice organizing information
		• Identify organization requirements for written and electronic communication methods
		• Follow organization requirements for the use of written and electronic communication methods
		• Perform exercises on understanding and conveying intended meaning scenario
			• Lecture
			• Demonstration
			• Practical exercises
			• Role Play
				• Written Test
				• Observation
					2 hours

	1.2. Lead workplace discussions	• Describe:
		  ○ Organizational policy on production, quality and safety
		  ○ Goals/ objectives and action plan setting
		• Read
		  ○ Effective verbal communication methods
		• Prepare/set action plans based on organizational goals and objectives
			• Group discussion
			• Lecture
			• Demonstration
				• Oral evaluation
				• Written Test
				• Observation
					2 hours

	1.3. Identify and communicate issues arising in the workplace	• Describe:
		  ○ Organizational policy in dealing with issues and problems
		• Read
		  ○ Effective verbal communication methods
			• Group discussion
			• Lecture
				• Oral evaluation
				• Written Test
					2 hours

2. Lead small teams	2.1. Provide team leadership	• Discussion of Company policies and procedures • Read web pages on situational leadership • Role play on situational leadership	• Group work • Role Play • Lecture/ Discussion • Individual Work	• Role Play • Written Test	1 Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	2.2. Assign responsibilities	• Read web pages on performance management • Case study on allocating roles and responsibilities based on competencies of current staff	• Individual Work • Case Study	• Role Play • Written Test	1 Hour
	2.3. Set performance expectations for team members	• Role play to communicate performance expectations with staff • Discussion on performance issues	• Lecture/ Discussion • Role Play	• Role Play • Written Test	1 Hour
	2.4. Supervise team performance	• Discussion on performance monitoring • Role play on providing feedback on performance • Role play on performance coaching • Discussion on keeping the team informed of team performance • Case study on Team performance monitoring and feedback	• Lecture/ Discussion • Role Play • Case Study	• Role Play • Written Test	1 Hour
3. Apply critical thinking and problem-solving techniques in the workplace	3.1. Examine specific workplace strategies	• Show thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations • Show mastery of the current industry hardware and software products and services • Discuss process of identification of fundamental causes of specific workplace challenges • Show mastery of knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations - Relevant equipment and operational processes	• Group discussion • Lecture • Demonstration • Role playing	• Case Formulation • Life Narrative Inquiry (Interview) • Standardized test	1 Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		- Enterprise goals, targets and measures - Enterprise quality OHS and environmental requirement - Enterprise information systems and data collation - Industry codes and standards			
	3.2. Analyze the causes of specific workplace challenges	• Show thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations • Show mastery of the current industry hardware and software products and services • Discuss process of identification of fundamental causes of specific workplace challenges • Show mastery of knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations - Relevant equipment and operational processes - Enterprise goals, targets and measures - Enterprise quality OHS and environmental requirement - Enterprise information systems and data collation - Industry codes and standards • Identify extent and causes of specific challenges in the workplace • Use of range of analytical problem-solving techniques • Formulate clear-cut findings on the nature of each identified workplace challenges	• Group discussion • Lecture • Demonstration • Role playing	• Case Formulation • Life Narrative Inquiry (Interview) • Standardized test	1 Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	3.3. Formulate resolutions to specific workplace challenges	• Show thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations • Show mastery of the current industry hardware and software products and services • Discuss process of identification of fundamental causes of specific workplace challenges • Show mastery of knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations - Relevant equipment and operational processes - Enterprise goals, targets and measures - Enterprise quality OHS and environmental requirement - Enterprise information systems and data collation - Industry codes and standards • Identify extent and causes of specific challenges in the workplace • Use of range of analytical problem-solving techniques • Formulate clear-cut findings on the nature of each identified workplace challenges • Discus strategies on devising, communicating, implementing and evaluating strategies and techniques in addressing specific workplace challenges	• Group discussion • Lecture • Demonstration • Role playing	• Case Formulation • Life Narrative Inquiry (Interview) • Standardized test	1 Hour
	3.4. Implement action plans and	• Identify extent and causes of specific challenges in the workplace	• Group discussion • Lecture	• Case Formulation • Life Narrative	1 Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	communicate results	• Use of range of analytical problem-solving techniques • Formulate clear-cut findings on the nature of each identified workplace challenges • Discus strategies on devising, communicating, implementing and evaluating strategies and techniques in addressing specific workplace challenges	• Demonstration • Role playing	Inquiry (Interview) • Standardized test	
4. Work in a Diverse Environment	4.1. Develop an individual's cultural awareness and sensitivity	• Show understanding of cultural diversity in the workplace • Recognize norms of behavior for interacting and dialogue with specific groups (e. g., Muslims and other non-Christians, non-Catholics, tribes/ethnic groups, foreigners) • Demonstrate different methods of verbal and non-verbal communication in a multicultural setting • Apply cross-cultural communication skills (i.e. different business customs, beliefs, communication strategies) • Show affective skills – establishing rapport and empathy, understanding, etc. • Demonstrate openness and flexibility in communication • Recognize diverse groups in the workplace and community as defined by divergent culture, religion, traditions and practices	• Small Group Discussion • Interactive Lecture • Brainstorming • Demonstration • Role-playing	• Demonstration or simulation with oral questioning • Group discussions and interactive activities • Case studies/ problems involving workplace diversity issues • Written examination • Role Playing	1 Hour
	4.2. Work effectively in an environment that acknowledges and values	• Explain the value of diversity in the economy and society in terms of Workforce development • Discuss the importance of inclusiveness in a diverse environment • Discuss the importance of shared vision and	• Small Group Discussion • Interactive Lecture • Brainstorming • Demonstration • Role-playing	• Demonstration or simulation with oral questioning • Group discussions and interactive activities	1 Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	cultural diversity	understanding of and commitment to team, departmental, and organizational goals and objectives • Identify and exhibit strategies for customer service excellence • Demonstrate cross-cultural communication skills and active listening • Recognize diverse groups in the workplace and community as defined by divergent culture, religion, traditions and practices • Demonstrate collaboration skills		• Case studies/ problems involving workplace diversity issues • Written examination • Role Playing	
	4.3. Identify common issues in a multicultural and diverse environment	• Explain the value, and leverage of cultural diversity • Discuss the inclusivity and conflict resolution • Describe the workplace harassment • Explain the change management and cite ways to overcome resistance to change • Demonstrate advanced strategies for customer service excellence • Address diversity-related conflicts in the workplace • Eliminate discriminatory behavior towards customers and co-workers • Utilize change management policies in the workplace	• Small Group Discussion • Interactive Lecture • Brainstorming • Demonstration • Role-playing	• Demonstration or simulation with oral questioning • Group discussions and interactive activities • Case studies/ problems involving workplace diversity issues • Written examination • Role Playing	1 Hour
5. Propose methods of applying learning and innovation in the organization	5.1. Assess work procedures, processes and systems in terms of innovative practices	• Show mastery of the following practical concepts (e.g., 7 habits of highly effective people, character strengths that foster learning and innovation, five minds of the future, adaptation concepts and transtheoretical model of behavior change) • Demonstrate collaboration and networking	• Interactive Lecture • Appreciative Inquiry • Demonstration • Group work	• Psychological and behavioral Interviews • Performance Evaluation • Life Narrative Inquiry	1 Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		skills • Show basic skills in research • Generate practical insights on how to improve organizational procedures, processes and systems		• Review of portfolios of evidence and third-party workplace reports of on-the-job performance. • Standardized assessment of character strengths and virtues applied	
	5.2. Generate practical action plans for improving work procedures, processes	• Show mastery of the following practical concepts (e.g., 7 habits of highly effective people, character strengths that foster learning and innovation, five minds of the future, adaptation concepts and transtheoretical model of behavior change) • Demonstrate collaboration and networking skills • Show basic skills in research • Generate practical insights on how to improve organizational procedures, processes and systems • Set up action plans on how to apply innovative procedures in the organization • Set up action plans on how to apply innovative procedures in the organization • Generate practical insights on how to improve organizational procedures, processes and systems	• Interactive Lecture • Appreciative Inquiry • Demonstration • Group work	• Psychological and behavioral Interviews • Performance Evaluation • Life Narrative Inquiry • Review of portfolios of evidence and third-party workplace reports of on-the-job performance. • Standardized assessment of character strengths and virtues applied	Hour
	5.3. Evaluate the effectiveness of the proposed	• Show mastery of the following practical concepts (e.g., 7 habits of highly effective people, character strengths that foster	• Interactive Lecture • Appreciative Inquiry • Demonstration	• Psychological and behavioral Interviews	Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	action plans	learning and innovation, five minds of the future, adaptation concepts and transtheoretical model of behavior change) • Demonstrate collaboration and networking skills • Show basic skills in research • Generate practical insights on continuous improvement	• Group work	• Performance Evaluation • Life Narrative Inquiry • Review of portfolios of evidence and third-party workplace reports of on-the-job performance. • Standardized assessment of character strengths and virtues applied	
6. Use information systematically	6.1. Use technical information	• Lecture and discussion on: - Application in collating information - Procedures for inputting, maintaining and archiving information - Guidance to people who need to find and use information • Organizing information into a suitable form for reference and use • Classify stored information for identification and retrieval • Operate the technical information system by using agreed procedures	• Lecture • Group Discussion • Hands on • Demonstration	• Oral evaluation • Written Test • Observation • Presentation	4 Hours
	6.2. Apply information technology (IT)	• Lecture and discussion on: - Attributes and limitations of available software tool - Procedures and work instructions for the use of IT - Operational requirements for IT systems	• Lecture • Group Discussion • Self-paced handout/ module • Hands on • Demonstration	• Oral evaluation • Written Test • Observation • Presentation	2 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		- Sources and flow paths of data - Security systems and measures that can be used - Methods of entering and processing information • Use procedures and work instructions for the use of IT • Extract data and format reports • Use WWW applications			
	6.3. Edit, format and check information	• Lecture and discussion on: - Basic file-handling techniques - Techniques in checking documents - Techniques in editing and formatting - Proof reading techniques • Use different techniques in checking documents • Edit and format information applying different techniques • Proof read information applying different techniques	• Lecture • Group Discussion • Self-paced handout/ module • Hands on • Demonstration	• Oral evaluation • Written Test • Observation • Presentation	2 hours
7. Evaluate Occupational Safety And Health Work Practices	7.1. Interpret Occupational Safety and Health practices	• Discuss the OSH standards, principles and legislations • Identify OSH work practices issues • Discuss standard safety requirements	• Lecture • Group Discussion	• Written Exam • Demonstration • Observation • Interviews / Questioning	Hours
	7.2. Set OSH work targets	• Discussion in actions plans that are necessary in achieving the OSH target	• Lecture • Group Discussion	• Written Exam • Demonstration • Observation • Interviews / Questioning	1 Hour
	7.3. Evaluate effectiveness of Occupational	• Practice evaluating safety data (Historical or Simulated)	• Lecture • Group Discussion	• Written Exam • Demonstration • Observation	1.5 Hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	Safety and Health work instructions			• Interviews / Questioning	
8. Evaluate Environmental Work Practices	8.1. Interpret Environmental practices, policies and procedures	• Discussion Environmental Issues regarding - Water Quality - National and Local Government Issues - Safety - Endangered Species - Noise - Air Quality - Historic - Waste - Cultural • Updating of existing occupation practices	• Lecture • Group Discussion • Demonstration	• Written Exam • Demonstration • Observation • Interviews / Questioning	1 Hour
	8.2. Establish targets to evaluate environmental practices	• Discussion on - lower production costs and energy consumption - Environmentally Sound Processes - Resource Efficient - Recycling and Waste Management • Simple case study regarding energy efficiency	• Lecture • Group Discussion • Demonstration	• Written Exam • Demonstration • Observation • Interviews / Questioning	1 Hour
	8.3. Evaluate effectiveness of environmental practices	• Identifying effective environmental practices relevant to the industry/occupation - Implementation of energy efficiency	• Lecture • Group Discussion • Demonstration • Case Study	• Written Exam • Demonstration • Observation • Interviews / Questioning • Third Party Reports	1 Hour
9. Facilitate Entrepreneurial Skills For	9.1. Develop and maintain micro-small-medium	• Discussions on business models and strategies • Discussion on Types and categories of	• Lecture/ Discussion • Case Study • Demonstration	• Written Test • Portfolio • Work Related	2 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
Micro-Small-Medium Enterprises (MSMEs)	enterprise (MSMEs) skills in the organization	businesses and business internal control • Discussion on Relevant National and local legislations affecting businesses • Prepare promotional materials • Practice basic bookkeeping		Project	
	9.2. Establish and Maintain client-base/market	• Role play on customer and employee relations • Discussion on Basic product promotion strategies • Preparation of Basic Feasibility study • Case studies on Basic Business ethics • Prepare basic advertising materials	• Role Play • Lecture Discussion • Case study	• Case problem • Written Test	2 hours
	9.3. Apply budgeting and financial management skills	• Discussion on: - Basic cost-benefit analysis - Basic financial management - Basic financial accounting - Business internal controls	• Role Play • Lecture Discussion • Group work	• Written Test • Case problem	1 Hour

COMMON COMPETENCIES
(40 hours)

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
1. Prepare materials and tools	1.1. Identify materials and tools	1.1.1. Read and familiarize ○ Different work specifications ○ Types, uses and description of HVAC/R materials and accessories ○ Types, uses and description of HVAC/R tools ○ List of materials as per company standards 1.1.2. Identify and prepare tools according to the job requirements 1.1.3. Identify and prepare materials and accessories according to the job requirements	• Lecture-demonstration • Group discussion • PowerPoint presentation	• Written • Practical / Performance Test	1 hour
	1.2. Request materials and tools	1.2.1. Read and familiarize ○ Work requirements ○ Types & uses of HVAC/R materials & tools ○ Material take-off ○ Requisition procedures 1.2.2. Prepare material take-off 1.2.3. Request materials and tools	• Simulation/ Demonstration • Discussion	• Written • Practical / Performance Test	1 hour
	1.3. Receive and inspect materials and tools	1.3.1. Read and familiarize ○ Policy on receiving material deliveries ○ Material and tools quality and defects ○ Material handling ○ Check and inspect materials and tools 1.3.2. Store/stack tools and materials	• Lecture/ discussion • Demonstration	• Written / Oral Test • Demonstration • Practical Exercise	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
2. Interpret technical drawings and plans	2.1. Analyze signs, symbols and data	2.1.1. Read and familiarize ○ Blueprint reading and plan specifications - Electrical plan, symbols & abbreviations ○ Written communication ○ Signs and symbols - Electrical and Mechanical ○ Parts and specification 2.1.2. Identify signs and symbols 2.1.3. Interpret different type of plans	• Discussion • Lecture • Modular	• Written • Practical / Performance Test	1 hour
	2.2. Interpret technical drawings and plans	2.2.1. Read and familiarize ○ Alphabet of lines ○ Orthographic drawings ○ Perspective view ○ Trade mathematics/ Mensuration ○ Types technical plans ○ Notes and specifications 2.2.2. Perform drawing exercises 2.2.3. Perform technical plan interpretation 2.2.4. Follow measuring procedures	• Discussion • Lecture • Modular	• Written • Practical / Performance Test	2 hours
	2.3. Apply freehand sketching	2.3.1. Read and familiarize ○ Drawing conventions ○ Dimensioning Conventions ○ Trade mathematics 2.3.2. Trace electrical/electronic/RAC schematics and drawings 2.3.3. Perform measurement 2.3.4. Sketch drawings and plans 2.3.5. Sketch pictures 2.3.6. Compute formulas 2.3.7. Use drawing instruments	• Discussion • Lecture • Modular	• Written • Practical / Performance Test	2 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
3. Observe procedures, specifications and manuals of instructions	3.1. Identify and access specifications and manuals	3.1.1. Read and familiarize ○ Types of manuals used in HVAC/R ○ Identification of symbols used in the manuals 3.1.2. Identify manuals and specifications 3.1.3. Access information and data	• Discussion • Lecture	• Oral questioning • Written Test	1 hour
	3.2. Interpret manuals	3.2.1. Read and familiarize ○ Types of manuals used in HVAC/R ○ Types of symbols used in manuals ○ System of measurements ○ Unit conversion 3.2.2. Interpret symbols and specifications 3.2.3. Access information and data 3.2.4. Compute/Determine conversion of units of measurements	• Discussion • Lecture • Modular	• Written • Practical / Performance Test	1 hour
	3.3. Apply information in manuals	3.3.1. Read and familiarize ○ Types of manuals used in HVAC/R ○ Types and application of symbols in manuals ○ Unit conversion 3.3.2. Apply information from manuals	• Discussion • Lecture • Demonstration • Group discussion	• Demonstration (able to impart knowledge and skills) • Practical and oral exam	1 hour
	3.4. Store Manual	3.4.1. Read and familiarize ○ types of manuals used in HVAC/R ○ Manual storing and maintenance procedures 3.4.2. Store and maintain manuals	• Demonstration • Group discussion	• Demonstration • Practical and oral exam	1 hour
4. Perform mensuration and calculation	4.1. Select measuring instruments;	4.1.1. Identify category and types of measuring tools and its uses 4.1.2. Select measuring instruments as per category 4.1.3. Interpret shapes and dimensions of objects/components	• Lecture • Group discussion	• Written examination • Oral evaluation	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
	4.2. Carry-out measurements and calculations	4.2.1. Read ○ Measurements - Linear measurement - Geometrical measurement ○ Trade Mathematics - Unit conversion - Ratio and proportion - Area 4.2.2. Interpret formulas for volume, areas, perimeters of plane and geometric figures 4.2.3. Perform measurement 4.2.4. Compute measurement formulas	• Lecture • Group discussion • Problem analysis	• Written examination • Oral evaluation • Problem solving	2 hours
	4.3. Maintain measuring instruments	4.3.1. Identify and practice safe handling procedures in using measuring instruments 4.3.2. Describe procedures on maintenance of measuring instruments 4.3.3. Demonstrate proper cleaning and storage of measuring instruments	• Lecture • Demonstration • Group discussion • Simulation	• Written examination • Oral evaluation	1 hour
5. Perform basic bench work	5.1. Prepare materials, tools and equipment	5.1.1. Read and familiarize ○ Communication methods ○ Work plan interpretation ○ Materials, tools and equipment; uses and specifications 5.1.2. Interpret work plan 5.1.3. List and prepare materials, tools and equipment needed	• Self-paced instruction • Film viewing • Direct laboratory experience • Group discussion	• Written test/ examination • Demonstration • Direct Observation	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
	5.2. Lay-out and mark dimensions/ features on workplace	5.2.1. Read and familiarize ○ Measuring tools; functions and use ○ Communication principles ○ Trade mathematics ○ Mensuration ○ Calculation ○ Conversion ○ Plan specifications 5.2.2. Plan drawing/lay-outing activity 5.2.3. Perform measuring activity 5.2.4. Perform marking and labeling activity	• Self-paced instruction • Film viewing • Direct laboratory experience • Group discussion • Industry Immersion	• Interview • Demonstration • Direct Observation	1 hour
	5.3. Perform required basic metal works	5.3.1. Read and familiarize ○ Tools and equipment: use and specifications ○ Grinding, cutting, drilling, filing techniques ○ Basic welding principles and application ○ Applied occupational health and safety (OH&S) 5.3.2. Perform measuring activity 5.3.3. Perform grinding activity 5.3.4. Perform cutting activity 5.3.5. Perform drilling activity 5.3.6. Perform filing activity 5.3.7. Perform welding activity	• Self -paced Instruction • Film viewing • Direct laboratory experience • Group discussion	• Interview • Written test/ examination • Observation with questioning • Demonstration with questioning	6 hours
6. Perform basic electrical works	6.1. Prepare electrical tools and test instruments	6.1.1. Read and familiarize ○ Uses of tools and testing instruments ○ Calibration of testing instruments ○ Safe handling and proper care of tools and testing instruments ○ Communication (oral and written) 6.1.2. Calibrate and testing of instruments 6.1.3. Interpret work plans	• Self -paced Instruction • Film viewing • Direct laboratory experience • Group discussion	• Interview • Written test/ examination • Observation with questioning • Demonstration with questioning	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		6.1.4. Identify and prepare electrical tools and test instruments	• Industry immersion		
	6.2. Test power supply and electrical components	6.2.1. Read and familiarize o Functions and uses of testing instruments o Basic electricity o Electrical safety and hazards o Testing procedures 6.2.2. Perform resistance reading 6.2.3. Perform voltage reading 6.2.4. Perform continuity testing 6.2.5. Perform current reading 6.2.6. Perform ground testing	• Self -paced Instruction • Film viewing • Group discussion	• Interview • Written test/ examination • Observation with questioning • Demonstration with questioning	1 hour
	6.3. Perform basic electrical repair	6.3.1. Read and familiarize o Types of electrical fixtures o Electrical joints and splices o Electrical safety and hazards o Applied occupational health & safety (OH&S) 6.3.2. Repair minor electrical system troubles 6.3.3. Test simple electrical components and connections	• Self-paced instruction • Film viewing • Direct laboratory experience • Industry Immersion • E-learning	• Interview • Written test/ examination • Observation with questioning • Demonstration with questioning	2 hours
7. Maintain tools and equipment	7.1. Check the conditions of tools and equipment;	7.1.1. Read and familiarize safety practices o handling of tools and equipment o good housekeeping o materials, tools and equipment - types and uses of cleaning materials - types and uses of HVAC/R tools - types and uses of HVAC/R equipment o operational conditions of HVAC/R tools and equipment o HVAC/R tools and equipment defects	• Small Group Discussion • Demonstration of Practical Skills	• Observation and Oral questioning • Demonstration and Oral questioning • Written test	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		○ Maintaining tools and equipment 7.1.2. Observe proper handling of tools and equipment 7.1.3. Identify tools and equipment defects			
	7.2. Perform basic preventive maintenance	7.2.1. Read and familiarize safety practices ○ use of PPE ○ good housekeeping ○ usage of materials, tools and equipment - types and uses of lubricants - types and uses of cleaning materials - types and uses of HVAC/R equipment ○ Preventive maintenance on tools and equipment - Methods and techniques - Procedures 7.2.2. Practice proper handling of tools and equipment 7.2.3. Perform preventive maintenance on tools and equipment	• Simulation • Group discussion • Practical Lab • Demonstration	• Observation and Oral questioning • Demonstration and Oral questioning • Written test	2 hours
	7.3. Store tools and equipment	7.3.1. Read and familiarize safety practices ○ Handling of tools and equipment ○ good housekeeping ○ Storing procedures and techniques ○ Storage conditions/ locations 7.3.2. Store tools and equipment	• Demonstration • Group discussion • Practical Lab	• Practical exam • Direct observation • Written test	1 hour
8. Perform housekeeping and safety practices	8.1. Sort materials, tools and equipment	8.1.1. Read and familiarize ○ Classification of tools, equipment and materials - Consideration in the selection of appropriate areas for storing	• Self-paced instruction • Film viewing • Direct laboratory	• Interview • Written test/ examination • Observation with questioning	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		materials, tools and equipment - Sorting procedures and considerations - Identify tools, equipment and materials - Perform sorting activities	experience • Group discussion Industry Immersion	• Demonstration with questioning	
	8.2. Clean workplace area, materials, tools and equipment	8.2.1. Read and familiarize ○ Cleaning materials, types and applications. ○ Procedures in cleaning workplace area, tools and equipment. ○ Consideration of a safe workplace area, tools and equipment ○ Identification of cleaning materials and its applications 8.2.2. Apply procedures in cleaning workplace area, tools and equipment	• Self-paced instruction • Film viewing • Direct laboratory experience • Group discussion • Immersion	• Interview • Written test/ examination • Observation with questioning • Demonstration with questioning	1 hour
	8.3. Systematize dispensing and retrieval of materials, tools and equipment	8.3.1. Read and familiarize ○ Procedures in dispensing and retrieval of materials; tools, and equipment ○ Things to be considered in returning the borrowed tools and equipment. 8.3.2. Apply procedures in dispensing and retrieval of materials; tools, and equipment	• Self-paced instruction • Film viewing • Direct laboratory experience • Group discussion • Immersion	• Interview • Written test/ examination • Observation with questioning • Demonstration with questioning	1 hour
	8.4. Identify and minimize/ eliminate hazards	8.4.1. Read and familiarize ○ Composition of safety committee ○ Policies and procedures in controlling risk ○ Basic first aid procedure ○ Safety signs and hazards warning preparation	• Self-paced instruction • Film viewing • Direct laboratory experience • Group	• Interview • Written test/ examination • Observation with questioning • Demonstration with questioning	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		○ Equipment and safety devices ○ Safe handling technique in using equipment and safe devices. ○ roles of safety committee 8.4.2. Identify safety signs and workplace hazards 8.4.3. Demonstrate the first aid procedure 8.4.4. Demonstrate safe handling of equipment and safety devices	discussion • Industrial/Plant visit		
	8.5. Respond and record accidents	8.5.1. Read and familiarize ○ Types of accidents ○ Procedures in applying first aid /treatment ○ First aid supplies ○ Steps in responding to and recording accidents 8.5.2. Demonstrate first aid/ treatment procedures 8.5.3. Prepare incident/ accident report	• Self-paced instruction • Film viewing • Direct laboratory experience • Group discussion	• Interview • Written test/ examination • Observation with questioning • Demonstration with questioning	1 hour
	8.6. Follow basic securities	8.6.1. Read and familiarize ○ Basic security procedures ○ Security signs and symbols ○ Loss control management - Hazards - Safety signs 8.6.2. Apply basic security procedures 8.6.3. Prepare incident/ accident report	• Small Group Discussion • Demonstration of Practical Skills • Modular • Self-paced instruction • Film viewing • Demonstration Group discussion	• Actual demonstration • Written test/exam • Observation • Oral questioning	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
9. Document work accomplished	9.1. Identify forms and data	9.1.1. Read and familiarize ○ Selecting and interpreting forms ○ Interpreting work accomplished ○ Data gathering techniques 9.1.2. Identify and interpret forms and data	• Lecture • Discussion • Group work	• Interview • Written • demonstration with questioning	1 hour
	9.2. Prepare reports	9.2.1. Read and familiarize ○ Details of work completion ○ Kinds of reports ○ Preparation of reports 9.2.2. Prepare completion/ accomplishment reports	• Lecture • Discussion • Group work	• demonstration with questioning	1 hour

CORE COMPETENCIES

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

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
1 Install commercial refrigeration equipment (CRE) (72 hours)	1.1 Survey site for installation	1.1.1 Lecture and discussion on: ○ Safety signs and symbols ○ Linear measurement and dimensions ○ Blueprint readings (e.g. mechanical, electrical, plumbing and architectural plans and symbols) ○ Knowledge to understand the geographical location/site location ○ Types of permits ○ Securing permits and licenses 1.1.2 Familiarization on survey procedures and requirements 1.1.3 Identification of installation requirements 1.1.4 Installation checklist preparation	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	16 hours
	1.2 Install commercial refrigeration equipment piping systems	1.2.1 Lecture and discussion on: ○ PPE ○ Blueprint readings of plumbing plans and symbols ○ Plumbing equipment selection and application ○ Types of pipes ○ Piping accessories ○ Piping insulations ○ Sealing/Adhesive materials ○ RA 11058 provisions (piping works) 1.2.2 Identification of piping materials/ accessories 1.2.3 Mounting of brackets and supports 1.2.4 Installation of piping system	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	24 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
	1.3 Install commercial refrigeration equipment electrical systems	1.3.1 Lecture and discussion on: ○ PPE ○ Linear measurement ○ Blueprint readings of electrical plans and symbols ○ Electrical equipment selection and application ○ Electrical materials ○ Layout and installation of electrical system ○ Types of electrical and electronic controls ○ PEC provisions on layout and installation of electrical system ○ RA 11058 provisions (electrical works) 1.3.2 Identification of electrical materials 1.3.3 Installation of electrical system 1.3.4 Testing electrical system	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	16 hours
	1.4 Install fan coil units/evaporator and condensers (air-cooled or water-cooled) and accessories	1.4.1 Lecture and discussion on: ○ Types and functions of fan coil units/evaporator and condensers (air-cooled or water-cooled) and accessories ○ Types of compressors ○ Types of refrigerant flow control ○ Principles of air distribution ○ Refrigerant line connection to fan coil units/evaporator and condensers ○ Wiring connections and terminations ○ Condensate drain installation ○ Manufacturer's specifications on installation of fan coil units/evaporator and condensers and required	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	16 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		accessories 1.4.2 Trainee hands-on fan coil units/evaporator and condensers and accessories installation 1.4.3 Conduct pre-start up checks following manufacturer's specifications and enterprise policies			
		Supervised Industry Learning	• **SIL**		**100 hours**
2 Service and maintain commercial refrigeration equipment (CRE) (56 hours)	2.1 Prepare for service and maintenance activities	2.1.1 Lecture and discussion on: ○ PPE/safety gear ○ Work safety procedures ○ Safety hazards ○ Handling of tools and equipment and accessories ○ Standard maintenance procedures ○ RA 11058 provisions 2.1.2 Read and interpret work instructions	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	4 hours
	2.2 Check and adjust refrigeration accessories, controls and operating conditions	2.2.1 Lecture and discussion on: ○ Commercial refrigeration accessories ○ Adjustment of refrigerant flow control ○ Anti-freeze control ○ Types of refrigerant filters ○ Types of fans and blades ○ Types of electrical controls ○ Types of coil cleaner ○ Types of fins and materials use ○ Commercial refrigeration operations, controls and settings ○ Manufacturer's maintenance manuals ○ Abnormal conditions ○ RA 11058 provisions 2.2.2 Check and adjust controls/settings of commercial refrigeration equipment and	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	20 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		its accessories according to manufacturer's specifications 2.2.3 Apply service and maintenance procedures as per maintenance manual			
	2.3 Maintain lubrication system in commercial refrigeration equipment (CRE)	2.3.1 Lecture and discussion on: ○ Lubrication system variables and components ○ Types of oils and lubricants ○ Oil parameters ○ Oil leaks and restrictions ○ Basic refrigeration cycle ○ Provisions on R.A. 6969 - Toxic substances and hazardous and nuclear wastes control act of 1990 (*re: disposal of chemicals*). ○ RA 11058 provisions 2.3.2 Check and adjust lubrication system and components 2.3.3 Apply maintenance procedures on lubrication system as per maintenance manual	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	8 hours
	2.4 Maintain refrigeration system in commercial refrigeration equipment (CRE)	2.4.1 Lecture and discussion on: ○ Commercial refrigeration equipment operating parameters ○ Refrigeration components, accessories and consumables ○ Proper handling of refrigerants ○ Pressure and temperature checking ○ Types and principles of refrigerant flow control devices ○ Types of compressor ○ Pump down system operation	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	16 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		○ Clean Air Act (RA 8749) provisions ○ Montreal Protocol/ DENR rules ○ RAC Code of Practice provisions ○ RA 11058 provisions 2.4.2 Gathering and analyzing of performance parameters 2.4.3 Cleaning and dismantling of fan coil units/evaporator and condensers 2.4.4 Perform leak testing procedures 2.4.5 Perform pressure and temperature checks			
	2.5 Maintain air distribution system in commercial refrigeration equipment (CRE)	2.5.1 Lecture and discussion on: ○ Air distribution system of refrigeration ○ Air distribution system components ○ Air-cooled condenser ventilation requirements ○ Building code ventilation requirements ○ Methods of calculating ventilation requirements ○ Clean Air Act (RA 8749) provisions ○ RA 11058 provisions 2.5.2 Perform air distribution system components check 2.5.3 Calculate minimum air supply requirement 2.5.4 Perform air-cooled condenser ventilation systems check	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	8 hours
		Supervised Industry Learning	• **SIL**		**100 hours**
3 Troubleshoot and Repair Commercial Refrigeration Equipment (CRE)	3.1 Plan and prepare for troubleshooting and repair	3.1.1 Lecture and discussion on: ○ Interpretation of wiring diagrams, charts and manuals ○ Equipment selection and application ○ RA 11058 provisions 3.1.2 Interpret plan, diagrams, charts, manuals	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration	8 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
(80 hours)		and details 3.1.3 Identify appropriate materials, tools and testing instruments for troubleshooting and repair works		with questioning	
	3.2 Identify and repair faults/problems	3.2.1 Lecture and discussion on: ○ Protective personal equipment/safety gears ○ Types of faults/problems with refrigeration system ○ Fundamentals of refrigeration system, piping and control ○ Interlocking control sequence ○ Electronic control system components ○ RA 11058 provisions ○ Troubleshooting procedures 3.2.2 Perform faults diagnosis and repair on refrigeration and electrical systems as per RAC Code of Practice and standard troubleshooting policies 3.2.3 Perform testing and replacement of defective electronic control system components as per manufacturer's manual and/or enterprise troubleshooting policy.	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	32 hours
	3.3 Perform refrigerant recovery/ recycling on commercial refrigeration systems	3.3.1 Lecture and discussion on: ○ Types of refrigerants ○ Proper handling of refrigerant ○ Electrical wiring and mechanical diagram of recovery machine ○ Method of recovery/recycling of refrigerants ○ Refrigerant recovery/recycling procedures	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	16 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		○ Ozone Depleting Substances (ODS) ○ Global warning potential of substances (GWP) ○ Existing Chemical Control Orders (CCOs) and other issuances relating to ozone-depleting substances (ODS): ○ R.A. 6969 – Toxic substances and hazardous and nuclear wastes control act of 1990. ○ DENR-AO 1992-29 - IRR of R.A. 6969 ○ DENR-AO 2004-08 – Revised CCO for ODS ○ EMB MC 2005-03 – Alternatives to ODS ○ Kigali Amendment ○ RA 11058 provisions 3.3.2 Hands-on performance of refrigerant recovery/ recycling on commercial refrigeration systems			
	3.4 Test run commercial refrigeration equipment (CRE)	3.4.1 Lecture and discussion on: ○ How to start-up and test-run commercial refrigeration equipment ○ Power supply test procedures ○ Electrical and electronic control test procedures ○ Condensing unit test procedures ○ Compressor test procedures ○ RA 11058 provisions 3.4.2 Apply start-up and test run procedures on commercial refrigeration equipment 3.4.3 Prepare sample report on testing the refrigeration equipment	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	24 hours
		Supervised Industry Learning	• **SIL**		**100 hours**

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
4 Perform start-up test and commissioning for commercial refrigeration equipment (CRE) (32 hours)	4.1 Prepare for pre-start-up, test and commissioning for commercial refrigeration equipment (CRE)	4.1.1 Lecture and discussion on: ○ Pre-start-up, testing and commissioning procedures ○ Types of commissioning tools and instruments ○ Calibration of commissioning instruments ○ Pre-start-up, testing and commissioning checklists 4.1.2 Interpret work instructions for pre-start-up, testing and commissioning 4.1.3 Identify/Select commissioning tools, equipment and instruments 4.1.4 Prepare sample pre-start-up, testing and commissioning checklists	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	8 hours
	4.2 Conduct pre-start-up, testing and commissioning for commercial refrigeration equipment (CRE)	4.2.1 Lecture and discussion on commissioning: ○ Electrical related checks ○ Refrigerant piping related checks ○ Condensing unit related checks ○ Compressor unit related checks ○ Fan coil unit/evaporator related checks ○ Refrigerant flow control and accessories related checks ○ Refrigerant charging methods ○ Methods of adding refrigerant oil to the system ○ Manufacturer's manual instructions on pre-start-up, testing and commissioning ○ RAC Code of practice provisions (commissioning) ○ Kigali amendments ○ RA 11058 provisions	• Lecture • Demonstration • Trainee Hands-on • Webminar?? • Video presentation	• Written test/ examination • Direct Observation with questioning • Demonstration with questioning	24 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		4.2.2 Apply pre-start-up, test and commissioning related checks procedures based on manufacturer's manuals 4.2.3 Perform refrigerant charging to the system 4.2.4 Record gathered data of refrigeration system parameters 4.2.5 Prepare sample start-up, testing and commissioning reports			
		Supervised Industry Learning	• **SIL**		**100 hours**

3.2 TRAINING DELIVERY

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

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

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

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

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

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

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

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

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

    2.1. Institution- Based:

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

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

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

2.2. Enterprise-Based:

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

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

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

2.3. Community-Based:

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

3.3 TRAINEE ENTRY REQUIREMENTS

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

- Must a holder RAC Servicing (DomRAC) NC II or must have at least two-years work experience in RAC servicing
- Can communicate both oral and written
- Can perform basic mathematical computation

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

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS COMMERCIAL REFRIGERATION INSTALLATION AND SERVICING NC III

Recommended list of tools, equipment and materials for the training of 25 trainees for Commercial Refrigeration Installation and Servicing NC III.

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

TOOLS		
Quantity	**Unit**	**Description/Specification**
10	pcs.	Push and Pull Rule
5	pcs.	Steel rule, 2 ft.
10	pcs.	Spirit level/water level
10	pcs.	Screwdriver, flat
10	pcs.	Screwdriver, philips
10	pcs.	Electrical pliers
10	pcs.	Pliers, long nose
10	pcs.	Pliers, diagonal
10	pcs.	Capillary tube cutter
10	pcs.	Box Wrench
10	sets	Crimping tools (terminal leads/clips)
2	pcs.	Tube bender (lever type), 5/8
3	pcs.	Tube bender (lever type), 1/2
3	pcs.	Tube bender (lever type), 5/16
3	pcs.	Tube bender (lever type), 3/8
3	pcs.	Tube bender (lever type), 1/4
3	sets	Tube bender (spring type)
10	sets	Swaging tool
10	sets	Flaring tool
10	sets	Tube cutters
2	units	Vernier caliper
5	pcs.	Adjustable wrench 8”
5	pcs.	Adjustable wrench 10”
2	sets	Open wrench, metric
2	sets	Open wrench, English
5	pcs.	Ratchet wrench (service valve)
5	pcs	Monkey wrench, adjustable
5	pcs	Vise grip, 8”
5	pcs	Piercing valves
2	pcs	Piercing pliers
5	pcs	Charging valves
5	units	Multi-tester, digital
5	units	Multi tester, analog
5	units	Clamp ammeter, digital
5	units	Clamp ammeter, analog
3	units	Leak detector
5	units	System analyzer (gauge manifold), multi
5	units	Digital thermometer

5	units	Sling psychrometer
EQUIPMENT		
Quantity	**Unit**	**Description/Specification**
2	units	Electric drill, portable
5	units	Motor compressor
2	units	High Pressure washer
3	units	Vacuum pump
5	sets	Evaporator fan and motor
5	units	Oxy-Acetylene welding machine with complete outfit
2	units	Overload protector
2	units	Commercial Refrigeration units, inverter, 2hp
3	units	Commercial Refrigeration units, non-inverter, 2hp
3	units	Arc welding machine, portable, inverter, 300 amp
2	units	Recovery/recycling machine, 220v
3	units	Recovery Cylinder 20 kg
2	sets	Nitrogen regulator
5	pcs.	Condenser fan motor
25	sets	Personal protective equipment

MATERIALS		
Quantity	**Unit**	**Description/Specification**
5	sets	Condensate drain
2	rolls	Electrical wire, 2.5 mm
2	rolls	Electrical wire, 3.5 mm
2	rolls	Electrical wire, 1.5 mm
2	rolls	Electrical wire, 4.0 mm
5	units	Circuit breaker/safety switch
10	sets	Capacitor, running
10	sets	Relay, potential
10	sets	Electrical tape
3	liters	Vacuum pump oil
5	units	Refrigerant recovery cylinder
1	cylinder	Refrigerant, R600a
1	cylinder	Refrigerant, R134a
1	cylinder	Refrigerant, R404
5	cylinder	Nitrogen gas
5	rolls	Tubes, Copper, 0.028 in. x ¼", x 50 ft.
5	rolls	Tubes, Copper, 0.028 in. x 5/16" x 50 ft.
5	rolls	Tubes, Copper, 0.028 in. x 3/8" x 50 ft.
5	rolls	Tubes, Copper, 0.028 in. x ½" x 50 ft.
5	rolls	Tubes, Copper, 0.028 in. x 5/8" x 50 ft.
5	rolls	Tubes, Copper, 0.028 in. x ¾" x 50 ft.
5	kilos	Tubes, Aluminum, 5/16"
100	pcs	Filler rods, Aluminum
100	pcs	Filler rods, Bronze
100	pcs	Filler rods, Silver
2	cans	Fluxes, Aluminum
2	cans	Fluxes, Borax
2	cans	Fluxes, Silver
5	sets	Timer, time delay relay
2	units	Thermostat, CRE

MATERIALS		
Quantity	**Unit**	**Description/Specification**
10	pcs	Filter drier, 5/16”
10	pcs	Filter drier, 1/4”
20	pcs	Flare nuts, 1/4”
20	pcs	Flare nuts, 5/16”
25	pcs	Teflon tape
10	pcs.	Copper elbow 5/8” OD
10	pcs.	Copper elbow ½” OD
10	pcs.	Copper onion5/8 OD
10	pcs.	Copper onion ½” OD
10	pcs.	Copper elbow 3/8” OD
10	pcs.	Copper elbow 5/16” OD
5	pcs.	Sight glass/ moisture indicator 1/4“ connection
5	units	Defrost heater
5	units	Door strip heater
2	units	Air blower, 220v, 60 Hz

Note: Subject to conformity of the health and safety protocols

3.5 TRAINING FACILITIES
COMMERCIAL REFRIGERATION INSTALLATION AND SERVICING NC III

Based on a class intake of 25 students/trainees.

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

*Common facilities for all HVAC/R Courses

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

Subject to conformity of the health and safety protocols

3.6 TRAINER'S QUALIFICATION FOR HVAC/R SECTOR
COMMERCIAL REFRIGERATION INSTALLATION AND SERVICING NC III

- Must be National TVET Trainers Certificate (NTTC) Level 1 Holder in Commercial Refrigeration Installation and Servicing NC III **or** graduate in Education BSIE/BTTE/BTVTEd-Major in RAC and with Commercial Refrigeration Installation and Servicing NC III certificate
- Must be computer literate
- Must have at least two (2) years related industry experience for the past 5 years

3.7 INSTITUTIONAL ASSESSMENT

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

SECTION 4 ASSESSMENT AND CERTIFICATION ARRANGEMENTS

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

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

4.1 NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

4.1.1 To attain the National Qualification of **Commercial Refrigeration Installation and Servicing NC III**, the candidate must demonstrate competence covering all the units listed in Section 1. Successful candidates shall be awarded a National Certificate signed by the TESDA Director General.

4.1.2 The qualification of **Commercial Refrigeration Installation and Servicing NC III** can be attained through demonstration of competence through project-type assessment covering all the units required in the qualification.

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

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

4.1.4.1 Graduates of WTR-registered program, NTR-registered programs or formal/non-formal/informal including enterprise-based trainings related to RAC installation and servicing

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

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

4.1.6 The Existing National Certificate (NC) and Certificate of Competency (COC) of individuals in RAC Servicing (PACU-CRE) NCIII will still be in effect until such time that such NC and COC will have expired. Individuals are advised to take the assessment for this amended/updated TR on or before the expiration of such certificates.

4.1.7 The guidelines on assessment and certification are discussed in detail in the "Procedures Manual on Assessment and Certification" and "Guidelines on the

Implementation of the Philippine TVET Competency Assessment and Certification System (PTCACS)".

4.2 COMPETENCY ASSESSMENT REQUISITE

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

This document can:

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

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

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

ANNEX A

COMPETENCY MAP - HVAC/R Sector

Commercial Refrigeration Installation and Servicing NC III

CORE COMPETENCIES

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

COMMON COMPETENCIES

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

BASIC COMPETENCIES

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

GLOSSARY OF TERMS:

1) **Air Cooled Condensing Unit (ACCU)/Outdoor Unit** – an equipment that condenses refrigerant vapor using air as the condensing medium. It consists 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) **Commissioning** - process by which an equipment, facility, or plant (*which is installed, or is complete or near completion*) is tested to verify if it functions according to its design objectives or specifications.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

30) **Split-type Air-conditioner** – an air conditioning system that comes in two pieces: one piece contains the compressor, condenser, and a fan; the other unit contains the evaporator and a fan. The condenser, installed outside the house, connects to several evaporators, one in each room to be cooled, mounted inside the house. Each evaporator is individually controlled, allowing different rooms or zones to be cooled to varying degrees.

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

enhanced competencies in a workplace and thus enable the learner to practice those competencies in a variety of workplace situation

32) **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

33) **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.

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

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

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

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

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

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