

# COMPETENCY STANDARDS

## INDUSTRIAL REFRIGERATION OPERATION & MAINTENANCE LEVEL III



### HEATING, VENTILATING, AIR- CONDITIONING AND REFRIGERATION TECHNOLOGY SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY  
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## **COMPETENCY STANDARDS FOR INDUSTRIAL REFRIGERATION OPERATION & MAINTENANCE LEVEL III**

### **SECTION 1 INDUSTRIAL REFRIGERATION OPERATION & MAINTENANCE LEVEL III QUALIFICATION DESCRIPTION**

The **Industrial Refrigeration Operation & Maintenance Level III** Qualification consists of competencies that a person must achieve to enable him/her to perform start-up, testing and commissioning as well as operate, maintain, troubleshoot and repair industrial refrigeration plant using natural refrigerant.

The Units of Competency comprising this Qualification include the following:

<b>CODE NO.</b>	<b>BASIC COMPETENCIES</b>
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)

  

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

  

<b>CODE NO.</b>	<b>CORE COMPETENCIES</b>
CS-HVC311301	Perform start-up, testing and commissioning for industrial refrigeration plant
CS-HVC311302	Operate industrial refrigeration plant
CS-HVC311303	Maintain industrial refrigeration plant
CS-HVC311304	Troubleshoot and repair industrial refrigeration plant system

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

- Industrial Refrigeration Plant Operator
- Industrial Refrigeration Plant Technician

## SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in Industrial Refrigeration Operation & Maintenance Level 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 <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Communicate information about workplace processes	1.1. Relevant <b>communication method</b> 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 <b>workplace discussions</b> on such issues as production, quality	2.1 Organization requirements for written and electronic communication methods 2.2 Effective verbal communication methods 2.3 Workplace etiquette	2.1 Organizing information 2.2 Conveying intended meaning 2.3 Participating in variety of workplace discussions 2.4 Complying with organization requirements for the use of written

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

## 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 <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Provide team leadership	1.1. <b>Work requirements</b> 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. <b>Team members' queries and concerns</b> 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 <b>monitored</b> 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 <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>instructions</p> <p>4.2 Team members are provided with <b>feedback</b>, positive support and advice on strategies to overcome any deficiencies based on company practices</p> <p>4.3 <b>Performance issues</b> which cannot be rectified or addressed within the team are referenced to appropriate personnel according to employer policy</p> <p>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</p> <p>4.5 Team operations are monitored to ensure that employer/client needs and requirements are met</p> <p>4.6 Follow-up communication is provided on all issues affecting the team</p> <p>4.7 All relevant documentation is completed in accordance with company procedures</p>	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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Examine specific workplace challenges	1.1. Variances are examined from normal operating <b>parameters</b> ; and product quality. 1.2. Extent, cause and nature of the specific problem are defined through observation, investigation and <b>analytical techniques</b> . 1.3. <b>Problems</b> 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 requirements. 1.6. Enterprise information systems and data collation 1.7. Industry codes and standards.	1.1. Using a 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	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	2.1 Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	investigation conducted.	fundamental cause, 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.	workplace. 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. <b>Action plans</b> 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 a 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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
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 a 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: <ul style="list-style-type: none"> <li>1.1 Processes</li> <li>1.2 Procedures</li> <li>1.3 Systems</li> </ul>
2. Analytical techniques	May include: <ul style="list-style-type: none"> <li>2.1. Brainstorming</li> <li>2.2. Intuitions/Logic</li> <li>2.3. Cause and effect diagrams</li> <li>2.4. Pareto analysis</li> <li>2.5. SWOT analysis</li> <li>2.6. Gant chart, Pert CPM and graphs</li> <li>2.7. Scattergrams</li> </ul>
3. Problem	May include: <ul style="list-style-type: none"> <li>3.1. Routine, non – routine and complex workplace and quality problems</li> <li>3.2. Equipment selection, availability and failure</li> <li>3.3. Teamwork and work allocation problem</li> <li>3.4. Safety and emergency situations and incidents</li> <li>3.5. Risk assessment and management</li> </ul>
4. Action plans	May include: <ul style="list-style-type: none"> <li>4.1. Priority requirements</li> <li>4.2. Measurable objectives</li> <li>4.3. Resource requirements</li> <li>4.4. Timelines</li> <li>4.5. Coordination and feedback requirements</li> <li>4.6. Safety requirements</li> <li>4.7. Risk assessment</li> <li>4.8. Environmental requirements</li> </ul>

## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> <li>1.1. Examined specific workplace challenges.</li> <li>1.2. Analyzed the causes of specific workplace challenges.</li> <li>1.3. Formulated resolutions to specific workplace challenges.</li> <li>1.4. Implemented action plans and communicated results on specific workplace challenges.</li> </ol>
<p>2. Resource Implications</p>	<p>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 a bank of questions which will be used to probe the reason behind the observable action.</p>
<p>3. Methods of Assessment</p>	<p>Competency in this unit may be assessed through:</p> <ol style="list-style-type: none"> <li>3.1. Observation</li> <li>3.2. Case Formulation</li> <li>3.3. Life Narrative Inquiry</li> <li>3.4. Standardized Test</li> </ol> <p>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.</p> <p>These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.</p>
<p>4. Context for Assessment</p>	<p>4.1. In all workplace, it may be appropriate to assess this unit concurrently with relevant teamwork or operation units.</p>

**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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
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. <b>Diversity</b> 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	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	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

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	diversity is valued by the business.	excellence	customer service excellence
3. Identify common issues in a multicultural and diverse environment	3.1 <b><i>Diversity-related conflicts</i></b> 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
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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Assess work procedures, processes and systems in terms of innovative practices	1.1. <b>Reasons</b> for innovation are incorporated to work procedures. 1.2. <b>Models of innovation</b> are researched. 1.3. <b>Gaps or barriers</b> to innovation in one's work area are analyzed. 1.4. Staff who can support and foster innovation in the work procedure are identified.	Refer to books, magazines, online research, e.g.  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 <b>workplace requirements</b> (feasible and innovative). 2.4 Practical action plans are proposed to facilitate simple changes in the work procedures, processes and systems.	Refer to books, magazines, online research, e.g.  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).	2.1 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

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
	2.5 <b><i>Critical inquiry</i></b> is applied and used to facilitate discourse on adjustments in the simple work procedures, processes and systems.	2.5 Transtheoretical model of behavior change (Prochaska, DiClemente, & Norcross, 1992).	procedures in the organization.
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 suggestions 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	Refer to books, magazines, online research, e.g.  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

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> <li>1.1. Established the reasons why innovative systems are required</li> <li>1.2. Established the goals of a new innovative system</li> <li>1.3. Analyzed current organizational systems to identify gaps and barriers to innovation.</li> <li>1.4. Assessed work procedures, processes and systems in terms of innovative practices.</li> <li>1.5. Generated practical action plans for improving work procedures, and processes.</li> <li>1.6. Reviewed the trial innovative work system and adjusted reflected evaluation feedback, knowledge management systems and future planning.</li> <li>1.7. Evaluated the effectiveness of the proposed action plans.</li> </ol>
<p>2. Resource Implications</p>	<ol style="list-style-type: none"> <li>2.1. The following resources should be provided:</li> <li>2.2. Pens, papers and writing implements.</li> <li>2.3. Cartolina.</li> <li>2.4. Manila papers.</li> </ol>
<p>3. Methods of Assessment</p>	<p>Competency in this unit may be assessed through:</p> <ol style="list-style-type: none"> <li>3.1. Psychological and behavioral Interviews.</li> <li>3.2. Performance Evaluation.</li> <li>3.3. Life Narrative Inquiry.</li> <li>3.4. Review of portfolios of evidence and third-party workplace reports of on-the-job performance.</li> <li>3.5. Sensitivity analysis.</li> <li>3.6. Organizational analysis.</li> <li>3.7. Standardized assessment of character strengths and virtues applied.</li> </ol>
<p>4. Context for Assessment</p>	<ol style="list-style-type: none"> <li>4.1. Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions.</li> </ol>

**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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Use technical information	1.1. <b>Information</b> 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. <b>Technical information</b> system is operated using agreed procedures 2.2. Appropriate and valid procedures are operated for inputting, maintaining and archiving information 2.3. Required <b>software</b> 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 <b>sources</b> 2.5. Information are	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	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

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

## 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 <u>MUST</u> be provided: 2.1. Computers 2.2. Software and IT system
3. Methods of Assessment	Competency in this unit <u>MUST</u> 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

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Interpret Occupational Safety and Health practices	1.1. <b>OSH work practices issues</b> 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. <b>OSH Indicators</b> 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. <b>OSH work instructions</b> 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. Collaboration 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 <b>OSH metrics</b> 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 number 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 (e.g. get rid of the dangerous machine) 3.3 Isolate the hazard (e.g. 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 (e.g. replace the machine with a safer one) 3.5 Use administrative controls to reduce the risk (e.g. 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 (e.g. 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 accidents and injuries 4.2 Morbidity (Type and Number of Sickness) 4.3 Mortality (Cause and Number of Deaths) 4.4 Accident Rate

## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> <li>1.1. Identify OSH work practices issues relevant to work requirements</li> <li>1.2. Identify gaps in work practices related to relevant OSH work standards</li> <li>1.3. Agree upon OSH Indicators based on gathered information to measure effectiveness of workplace OSH policies and procedures</li> <li>1.4. Receive OSH work instructions in accordance with workplace policies and procedures</li> <li>1.5. Compare Observed OSH practices with against approved OSH work instructions</li> <li>1.6. Assess findings regarding effectiveness based on OSH work standards</li> </ol>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ol style="list-style-type: none"> <li>2.1 Facilities, materials, tools and equipment necessary for the activity</li> </ol>
<p>3. Methods of Assessment</p>	<p><b>Competency in this unit may be assessed through:</b></p> <ol style="list-style-type: none"> <li>3.1 Observation/Demonstration with oral questioning</li> <li>3.2 Third party report</li> <li>3.3 Written exam</li> </ol>
<p>4. Context for Assessment</p>	<ol style="list-style-type: none"> <li>4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center</li> </ol>

**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

<b>ELEMENTS</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Interpret environmental practices, policies and procedures	1.1. <b>Environmental work practices issues</b> 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. <b>Environmental Indicators</b> 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	RANGE
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 2.9 Water Quality

## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p><b>Assessment requires evidence that the candidate:</b></p> <ul style="list-style-type: none"> <li>1.1. Identified environmental issues relevant to work requirements</li> <li>1.2. Identified gaps in work practices related to Environmental Standards and Procedures</li> <li>1.3. Gathered relevant information necessary to determine environmental work targets</li> <li>1.4. Set environmental indicators based on gathered information to measure environmental work targets</li> <li>1.5. Recorded work environmental practices are recorded based on workplace standards</li> <li>1.6. Conveyed results of environmental assessment to appropriate personnel</li> </ul>
<p>2. Resource Implications</p>	<p><b>The following resources should be provided:</b></p> <ul style="list-style-type: none"> <li>2.1 Workplace/Assessment location</li> <li>2.2 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection</li> <li>2.3 Case studies/scenarios relating to environmental protection</li> </ul>
<p>3. Methods of Assessment</p>	<p><b>Competency in this unit may be assessed through:</b></p> <ul style="list-style-type: none"> <li>3.1 Written/ Oral Examination</li> <li>3.2 Interview/Third Party Reports</li> <li>3.3 Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad)</li> <li>3.4 Simulations and role-plays</li> </ul>
<p>4. Context for Assessment</p>	<ul style="list-style-type: none"> <li>4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center</li> </ul>

**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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Develop and maintain micro-small-medium enterprise (MSMEs) skills in the organization	1.1 Appropriate <b>business strategies</b> are determined and set for the enterprise based on current and emerging business environment. 1.2 <b>Business operations</b> 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 <b>Promotional/advertising initiatives</b> 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 through appropriate <b>internal controls</b> . 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
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 Use of social media/Internet 4.3 “Service with a smile” 4.4 Extra attention to regular customers

## EVIDENCE GUIDE

1. Critical Aspects of Competency	<b>Assessment requires evidence that the candidate :</b> 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	<b>Competency in this unit may be assessed through :</b> 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** : CS-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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Identify materials	1.1. <b>Materials</b> are listed as per job requirements 1.2. Quantity and <b>description of materials</b> 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 : CS-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 <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Analyze signs, symbols and data	1.1 <b>Technical plans</b> 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 <b>classification</b> or as appropriate in <b>drawing</b>	1.1 Trade Mathematics 1.1.1 Linear measurement 1.1.2 Dimension 1.1.3 Unit conversion 1.2 White Print Drawings 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 of 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 <b>tools, materials</b> and equipment are identified according to the <b>plan</b> 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 White Print Drawings 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 of 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	3.1 Where applicable, correct freehand sketching is	3.1 Trade Mathematics 3.1.1 Linear	3.1 Interpreting drawing/

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
sketching	produced in accordance with the job requirements	measurement 3.1.2 Dimension 3.1.3 Unit conversion 3.2 White Print Drawings 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	orthographic drawing 3.2 Interpreting technical plans 3.3 Matching specification details with existing resources 3.4 Following instructions 3.5 Handling of drawing instruments

## 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 2.3. Architectural
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

<p>1. Critical aspects of Competency</p>	<p>Assessment requires that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Identified and determined signs, symbols and data according to work plan, job requirements and classifications</li> <li>1.2 Identified tools and equipment in accordance with job requirements</li> <li>1.3 Listed supplies and materials according to blueprint specifications</li> <li>1.4 Drawn work plan following specifications</li> <li>1.5 Demonstrated ability to determine job specifications based on working/technical drawing</li> </ul>
<p>2. Resource implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1 Workplace</li> <li>2.2 Drawings and specification relevant to task</li> <li>2.3 Materials and instrument relevant to proposed activity</li> </ul>
<p>3. Methods of assessment</p>	<p>Competency should be assessed through:</p> <ul style="list-style-type: none"> <li>3.1 Direct Observation</li> <li>3.2 Questions/Interview</li> <li>3.3 Written test related to required knowledge</li> </ul>
<p>4. Context of assessment</p>	<ul style="list-style-type: none"> <li>4.1 Competency assessment may occur in workplace or any appropriate simulated environment</li> <li>4.2 Assessment shall be observed while task are being undertaken whether individually or in group</li> <li>4.3 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</li> </ul>

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

**UNIT CODE : CS-HVC311201**

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

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
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 <i>Manual</i> 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 MENSURATION AND CALCULATION**

**UNIT CODE : CS-HVC311203**

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

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Identify and select measuring instruments	1.2 Object or component to be measured is identified, classified and interpreted to the appropriate regular <b><i>geometric shape</i></b> 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 <b><i>measuring instruments</i></b> 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. Basic 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 <b><i>measurements and calculations</i></b> are obtained to job requirements 2.2 Alternative measuring tools are used without sacrificing cost and quality of work 2.3 Calculation needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x) and division (/) including but not limited to: trigonometric functions, algebraic computations 2.4 Calculations involving fractions, percentages and mixed numbers are used to complete workplace tasks 2.5 Numerical computation is self-checked and corrected for accuracy 2.6 Instruments are read to the limit of accuracy of the tool 2.7 Systems of measurement identified and converted according to job requirements/ISO 2.8 Work pieces are measured according to job requirements	2.1. Calculation & measurement 2.2. Four fundamental operations of arithmetic 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

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
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	3.1. Handling and maintaining measuring instruments 3.2. Properly storing measuring instruments

## RANGE OF VARIABLES

VARIABLE	RANGE	
1. Geometric Shape	Including but not limited to: 1.1 Round 1.2 Square 1.3 Rectangular 1.4 Triangle 1.5 Sphere 1.6 Cylindrical	
2. Measuring instruments	Including but not limited to: 2.1 Micrometer caliper (Out, thickness) 2.2 Vernier caliper (In-out, depth) 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

<p>1. Critical aspects of Competency</p>	<p>Assessment requires that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Selected and prepared appropriate measuring instruments in accordance with job requirements</li> <li>1.2 Performed measurements and calculations according to job requirements/ISO</li> </ul>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1 Workplace location</li> <li>2.2 Problems to solve</li> <li>2.3 Measuring instrument appropriate to carry out tasks</li> <li>2.4 Instructional materials relevant to the proposed activity</li> </ul> <p>Assessment of required knowledge and practical skills may be combined</p>
<p>3. Methods of Assessment</p>	<p>Competency should be assessed through:</p> <ul style="list-style-type: none"> <li>3.1 Actual demonstration</li> <li>3.2 Direct observation</li> <li>3.3 Written test/questioning related to required knowledge</li> </ul>
<p>4. Context for Assessment</p>	<ul style="list-style-type: none"> <li>4.1 Competency assessment may occur in workplace or any appropriate simulated environment</li> <li>4.2 Assessment shall be observed while task are being undertaken whether individually or in group</li> <li>4.3 Competency assessment must be undertaken in accordance with the TESDA assessment guidelines</li> </ul>

**UNIT OF COMPETENCY : PERFORM BASIC BENCHWORKS**

**UNIT CODE : CS-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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Prepare materials, tools and equipment	1.1. <b>Work plan</b> is interpreted to determine job requirements 1.2. <b>Materials, tools and equipment</b> 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. <b>Dimensions/features</b> 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	2.1. Measuring and lay-outing 2.2. Blueprint reading 2.3. Communication skills
3. Perform required basic metal works	3.1. <b>Work instructions are followed</b> to ensure work safety 3.2. <b>Basic metal works</b> are performed applying knowledge on safety procedures and according to job requirements 3.3. Workpieces are clamped in <b>workholding device</b> to avoid damage and accidents 3.4. Work pieces are cut, chipped or filed according to required measurements, tolerance specified in the blueprint and free from burrs and sharp edges 3.5. Drilling is performed according to recommended sequence and specifications	3.1. 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) 3.5. Quality Assurance	3.1. Using tools and equipment 3.2. Basic metal works skills <ul style="list-style-type: none"> <li>○ Grinding</li> <li>○ Cutting</li> <li>○ Drilling</li> <li>○ Filing</li> <li>○ Welding</li> </ul> 3.3. Practice safety skills

ELEMENT	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
	3.6. Proper usage of materials, tools and equipment is observed 3.7. Appropriate <b>PPE</b> 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 Ballpeen 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 6.3 Unit of measure	
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 Ear Plugs 8.4 Hard Hat 8.5 Safety Goggles	
9. Basic metal works	9.1 Cutting 9.2 Filing 9.3 Drilling 9.4 Arc welding	9.5 Gas welding 9.6 Flaring 9.7 Swaging
10. Workholding device	10.1 Machine vise 10.2 Pliers 10.3 Locking pliers (Vise grip)	
11. Manual	11.1 Procedures manual 11.2 Instructional manual	

## EVIDENCE GUIDE

<p>1. Critical aspects of competency</p>	<p>Assessment requires that the candidate:</p> <ol style="list-style-type: none"> <li>1.1. Interpreted work plan to determine job requirements</li> <li>1.2. Identified and prepared supplies, materials, tools and equipment in accordance with job requirements</li> <li>1.3. Selected and used appropriate processes, tools and equipment to carry out task</li> <li>1.4. Laid-out and checked dimensions in accordance with job requirements and within the tolerances</li> <li>1.5. Followed work instructions to ensure safety</li> <li>1.6. Performed benchworks in accordance with job requirements</li> <li>1.7. Cleaned worksite and left in safe state in accordance with OSHA regulations</li> </ol>
<p>2. Resource implications</p>	<p>The following resources should be provided:</p> <ol style="list-style-type: none"> <li>2.1. Workplace</li> <li>2.2. Work plan</li> <li>2.3. Materials, tools and equipment relevant to the proposed activity/task</li> </ol>
<p>3. Methods of assessment</p>	<p>Competency should be assessed through:</p> <ol style="list-style-type: none"> <li>3.1. Actual demonstration</li> <li>3.2. Direct observation</li> <li>3.3. Written/questioning related to required knowledge</li> </ol>
<p>4. Context of assessment</p>	<ol style="list-style-type: none"> <li>4.1. Competency assessment may occur in workplace or any appropriate simulated environment</li> <li>4.2. Assessment shall be observed while task are being undertaken whether individually or in group</li> <li>4.3. Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</li> </ol>

**UNIT OF COMPETENCY : PERFORM BASIC ELECTRICAL WORKS**

**UNIT CODE : CS-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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Prepare electrical tools and test instruments and materials	1.1. <b>Work plan</b> is interpreted to determine job requirements 1.2. <b>Electrical tools and instruments</b> 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) 1.5. Safety practices skills
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. <b>Work instructions</b> 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

<p>1. Critical aspects of competency</p>	<p>Assessment requires that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Interpreted work plan to determine job requirements</li> <li>1.2 Selected and used appropriate processes, tools and equipment to carry out task</li> <li>1.3 Identified electrical tools and instruments are tested in accordance with PEC</li> <li>1.4 Replaced defective tools and instruments</li> <li>1.5 Checked power supply and electrical components in accordance with PEC</li> <li>1.6 Cleaned work place and left in safe state in line with OHSA regulations</li> <li>1.7 Completed electrical wiring in HVAC/R units based in manufacturer's specifications and PEC</li> <li>1.8 Communicated effectively to ensure safety works</li> </ul>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1 Work place</li> <li>2.2 Work plan</li> <li>2.3 Materials, tools and equipment relevant to the proposed activity/task</li> </ul>
<p>3. Methods of Assessment</p>	<p>Competency should be assessed through:</p> <ul style="list-style-type: none"> <li>3.1 Direct observation</li> <li>3.2 Written test/questioning relevant to required knowledge</li> </ul>
<p>4. Context of Assessment</p>	<ul style="list-style-type: none"> <li>4.1 Competency assessment may occur in workplace or any appropriate simulated environment</li> <li>4.2 Assessment shall be observed while task are being undertaken whether individually or in group</li> <li>4.3 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</li> </ul>

**UNIT OF COMPETENCY : MAINTAIN TOOLS, INSTRUMENTS AND EQUIPMENT**

**UNIT CODE : CS-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 <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Check condition of tools, instruments and equipment	1.1. <b>Materials, tools, instruments and equipment</b> 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 <b>PPE</b> are checked in accordance with manufacturer's instructions	1.1. Safety Practices <ul style="list-style-type: none"> <li>○ Use of PPE</li> <li>○ Handling of tools and equipment</li> <li>○ Good housekeeping</li> </ul> 1.2. Materials, Tools, instruments and Equipment <ul style="list-style-type: none"> <li>○ Types and uses of lubricants</li> <li>○ Types and uses of cleaning materials</li> <li>○ Types and uses of HVAC/R tools</li> <li>○ Types and uses of HVAC/R instruments</li> <li>○ Types and uses of HVAC/R equipment</li> </ul> 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 <ul style="list-style-type: none"> <li>○ Use of PPE</li> <li>○ Handling of tools, instruments and equipment</li> <li>○ Good housekeeping</li> </ul> 2.2. Materials, Tools and Equipment <ul style="list-style-type: none"> <li>○ Types and uses of lubricants</li> <li>○ Types and uses of cleaning materials</li> </ul> 2.3. Preventive Maintenance <ul style="list-style-type: none"> <li>○ Methods and techniques</li> <li>○ Procedures</li> </ul>	2.1. Handling of tools, instruments and equipment 2.2. Performing preventive maintenance

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
	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 <ul style="list-style-type: none"> <li>○ Use of PPE</li> <li>○ Handling of tools, instruments and equipment</li> <li>○ Storing procedures and techniques</li> <li>○ Storage conditions/ locations</li> </ul>	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 <ul style="list-style-type: none"> <li>- Cutting tools - hacksaw, crosscut saw, rip saw</li> <li>- Boring tools - auger, brace, grinlet, hand drill</li> <li>- Holding tools - vise grip, C-clamp, bench vise</li> <li>- Threading tools - die and stock, taps</li> </ul> 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

<p>1. Critical aspects of Competency</p>	<p>Assessment requires that the candidate:</p> <ol style="list-style-type: none"> <li>1.1. Selected and used appropriate processes, tools and equipment to carry out task</li> <li>1.2. Identified functional and non-functional tools and equipment</li> <li>1.3. Checked, lubricated and calibrated tools, equipment and instruments according to manufacturer's specifications</li> <li>1.4. Replaced defective tools, equipment and its accessories</li> <li>1.5. Observed and applied safe handling of tools and equipment and safety work practices</li> <li>1.6. Prepared and submitted inventory report, where applicable</li> <li>1.7. Maintained work place in accordance with OSHA regulations</li> <li>1.8. Stored tools and equipment safely in appropriate locations and in accordance with company practices</li> </ol>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ol style="list-style-type: none"> <li>2.1 Work place</li> <li>2.2 Maintenance Schedule</li> <li>2.3 Maintenance materials, tools and equipment relevant to the proposed activity/task</li> </ol>
<p>3. Methods of Assessment</p>	<p>Competency should be assessed through:</p> <ol style="list-style-type: none"> <li>3.1 Direct observation</li> <li>3.2 Written test/questioning relevant to required knowledge</li> </ol>
<p>4. Context for Assessment</p>	<ol style="list-style-type: none"> <li>4.1 Competency assessment may occur in workplace or any appropriate simulated environment</li> <li>4.2 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</li> </ol>

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

**UNIT CODE : CS-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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
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. <b>Hazards</b> in the work area are recognized and reported to designated personnel and appropriate control actions are taken 4.2. Workplace policies and procedures for controlling risks are established and followed	4.1. Composition of safety committee 4.2. Policies and procedures in controlling risk 4.3. Safety signs and first aid 4.4. Safety signs and	4.1. Hazard identification skills 4.2. Practice safety skills 4.3. Identifying safety signs and symbols

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>accurately</p> <p>4.3. Workplace procedures for dealing with <b>emergencies</b> are followed whenever necessary within the scope of responsibilities and competencies</p> <p>4.4. <b>Safety signs and hazard warnings</b> are displayed and observed at all times in line with workplace health and safety regulations</p> <p>4.5. Equipment and safety devices/<b>PPE</b> are used/handled according to company or manufacturer's procedures and guidelines</p> <p>4.6. Work areas are kept clean, free from obstacles and emergency exits are known and kept clear at all times</p> <p>4.7. Safe manual handling/fighting techniques and safe equipment operation techniques are employed at all times</p>	<p>hazards warning preparation</p> <p>4.5. Equipment and safety devices</p> <p>4.6. Safe handling technique in using equipment and safe devices.</p> <p>4.7. Identification of Safety Signs and Symbols</p>	
5. Respond and record accidents	<p>5.1. Workplace accidents are identified</p> <p>5.2. Workplace emergency <b>first-aid procedures/ treatment</b> are followed/carried out correctly in accordance with <b>standards/regulations</b> and enterprise procedures/policies</p> <p>5.3. Medical assistance/rescue is coordinated with concerned personnel in line with organizational policies</p> <p>5.4. Accident/incident records maintained in accordance with standard operating procedures</p>	<p>5.1. Types of accidents</p> <p>5.2. Procedures in applying first aid/ treatment</p> <p>5.3. First aid supplies</p> <p>5.4. Steps in responding to and recording accidents</p>	<p>5.1. First aid application skills</p> <p>5.2. Coordination skills</p> <p>5.3. Documentation skills</p>
6. Follow basic security	<p>6.1. <b>Security policies/</b> procedures are followed according to enterprise practices and <i>appropriate</i> legislation</p> <p>6.2. Security related events are recorded/reported on the relevant forms</p> <p>6.3. Staff are advised of enterprise security procedures and correct methods of implementation</p>	<p>6.1. Basic security procedures</p> <p>6.2. Security signs and symbols</p> <p>6.3. Loss control management</p> <p>6.3.1. Hazards</p> <p>6.3.2. Safety signs</p>	<p>6.1. Coordination skills</p> <p>6.2. Reporting skills</p> <p>6.3. Documentation skills</p> <p>6.4. Practice safety skills</p>

## RANGE OF VARIABLES

VARIABLE	RANGE
1. Hazards	Hazards that may be present in the workplace include but not limited to: <ol style="list-style-type: none"> <li>1.1. Flammable materials</li> <li>1.2. Running machinery/equipment</li> <li>1.3. Toxic substances</li> <li>1.4. Debris</li> <li>1.5. Open flames</li> <li>1.6. Loose objects/fixtures</li> <li>1.7. Chemicals</li> <li>1.8. Electrical faults</li> <li>1.9. Hot metals</li> </ol>
2. Emergencies	Emergencies may include but not limited to: <ol style="list-style-type: none"> <li>2.1. Fire</li> <li>2.2. Explosion</li> <li>2.3. Spills</li> <li>2.4. Falls</li> <li>2.5. Electrocution</li> <li>2.6. Injuries caused by falling objects</li> <li>2.7. Injuries caused by sharp objects</li> <li>2.8. Injuries caused by wrong usage of tools</li> </ol>
3. Safety signs, symbols and hazard warnings	Safety signs and symbols include but not limited to: <ol style="list-style-type: none"> <li>3.1. Industry recognized hazard warning signs and safety symbols               <ul style="list-style-type: none"> <li>- Danger-High Voltage</li> <li>- Unauthorized Persons Keep Out</li> <li>- No Smoking</li> <li>- Poisonous Gases</li> <li>- Caution - Men working on line wires</li> <li>- Flammable Materials</li> </ul> </li> <li>3.2. Internationally recognized hazard warning signs and safety symbols</li> </ol>
4. Personal Protective Equipment (PPE)	PPE may include but not limited to: <ol style="list-style-type: none"> <li>4.1. Goggles</li> <li>4.2. Gas mask</li> <li>4.3. Working gloves</li> <li>4.4. Safety shoes</li> <li>4.5. Face shield</li> <li>4.6. Insulating mat</li> <li>4.7. Over-all apron</li> <li>4.8. Hard hat</li> <li>4.9. Safety belt</li> <li>4.10. Protective eyewear</li> </ol>
5. First-aid Treatment	First-aid treatment includes but is not limited to: <ol style="list-style-type: none"> <li>5.1. CPR</li> <li>5.2. Mouth to mouth resuscitation</li> <li>5.3. Application of tourniquet</li> <li>5.4. Application of pressure to bleeding wounds or cuts</li> <li>5.5. First-aid treatment for burned victims</li> </ol>

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

<p>1. Critical aspects of Competency</p>	<p>Assessment requires that the candidate:</p> <ol style="list-style-type: none"> <li>1.1. Classified materials, tools and equipment according to kind</li> <li>1.2. Cleaned workplace areas, materials, tools and equipment as per standard procedures</li> <li>1.3. Implemented systematize dispensing and retrieval of materials, tools and equipment</li> <li>1.4. Identified and described safety working practices relating to all tasks undertaken in the workplace</li> <li>1.5. Identified and selected appropriate equipment and safety devices for particular workplace tasks and activities</li> <li>1.6. Interpreted hazard warnings and safety signs correctly and described the application of these warnings and signs in the work activities</li> <li>1.7. Workplace emergency first-aid procedures/treatment are carried out in accordance with OHS standards/legislation and enterprise procedures</li> <li>1.8. Responded/maintained accidents/incidents records in accordance with SOPs</li> <li>1.9. Followed security procedures/policies in accordance with enterprise practices and legislation</li> <li>1.10. Workplace kept in safe state in accordance with safety regulations</li> </ol>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ol style="list-style-type: none"> <li>2.1. Work place</li> <li>2.2. Materials, tools and equipment relevant to the proposed activity/task</li> <li>2.3. Safety signs</li> <li>2.4. Safety devices</li> <li>2.5. Accident reporting procedures</li> <li>2.6. First-aid materials and guidelines</li> </ol>
<p>3. Methods of Assessment</p>	<p>Competency should be assessed through:</p> <ol style="list-style-type: none"> <li>3.1. Direct observation while task is being undertaken</li> <li>3.2. Written test/questioning relevant to required knowledge</li> </ol> <p>Assessment of required knowledge and practical skills may be combined</p>
<p>4. Context for Assessment</p>	<ol style="list-style-type: none"> <li>4.1. Competency assessment may occur in workplace or any appropriate simulated environment</li> <li>4.2. Assessment shall be observed while task are being undertaken whether individually or in group in accordance with the approved industry OHS regulations</li> <li>4.3. Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</li> </ol>

**UNIT OF COMPETENCY : DOCUMENT WORK ACCOMPLISHED**

**UNIT CODE : CS-HVC311205**

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

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Identify forms and collect data	1.1. <b>Forms</b> are selected based on the reports to be prepared 1.2. <b>Data</b> 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. <b>Reports</b> 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: <ul style="list-style-type: none"> <li>1.1 Prepared reports used terminology and language appropriate to all users</li> <li>1.2 Prepared reports to include alternatives, views, approaches and other findings and recommendations for consideration by the supervisor</li> <li>1.3 Prepared reports are coherent and based on actual findings/analysis/results</li> <li>1.4 Prepared reports are accomplished, completed as per standard format and submitted within specified time to the concerned supervisor</li> </ul>
2. Resource Implications	Things necessary to conduct method of assessment: <ul style="list-style-type: none"> <li>2.1 Work place location</li> <li>2.2 Materials relevant to the proposed activity</li> </ul>
3. Methods of Assessment	Competency in this unit must be assessed through: <ul style="list-style-type: none"> <li>3.1 Direct observation</li> <li>3.2 Questions related to required knowledge</li> </ul>
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: PERFORM START-UP, TEST AND COMMISSIONING FOR INDUSTRIAL REFRIGERATION PLANT**

**UNIT CODE : CS-HVC311301**

**UNIT DESCRIPTOR :** This unit covers the knowledge, skills and attitudes in performing start-up, test and commissioning in industrial refrigeration plant. This includes competencies in preparing for commissioning of an industrial refrigeration plant, charging compressor refrigerant oil & refrigeration system and performing pre-start checks.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare for commissioning of an industrial refrigeration plant	1.1. Work instructions are read and interpreted to determine job requirements* 1.2. <b>Tools and equipment</b> 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. <b>Commissioning instruments</b> are calibrated in accordance with system documents* 1.6. <b>PPEs</b> are selected in line with job requirements*	1.1. Basic electrical 1.2. Basic refrigeration cycle 1.3. Fundamentals of refrigeration and controls 1.4. Pump principles 1.5. Interlocking control sequence 1.6. Fan characteristics 1.7. Fundamentals of piping 1.8. Cooling tower principles 1.9. Evaporative condenser principles 1.10. Electrical wiring control diagram 1.11. Mechanical plan/symbols and abbreviation 1.12. Compressor test procedures 1.13. Power supply test procedures 1.14. Evaporator test procedures 1.15. Condensing unit test procedures 1.16. Pump test procedures 1.17. Cooling tower test procedures 1.18. Expansion valve test procedures 1.19. Automatic expansion valve test procedures 1.20. Electrical control test procedures 1.21. Leak testing procedure (for refrigeration circuit and water/glycol piping) 1.22. Pressure testing procedure 1.23. Vacuum testing procedure 1.24. Refrigerant charging procedure	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

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		1.25. Pump-out/pump-down procedure	
2. Charge compressor refrigerant oil	2.1. Type of oil is checked based on operating temperature requirements 2.2. Refrigerant oil quantity is prepared based on compressor requirements 2.3. Refrigerant oil is charged according to manufacturer's procedures 2.4. Oil heater is energized as per established manufacturer's procedures	2.1. Types and application of refrigerant oil 2.2. Operating temperature requirements for refrigerant oil 2.3. Compressor operations and maintenance manual 2.3.1. Charging of refrigerant oil 2.4. Charging procedures 2.4.1. Vacuum 2.4.2. Oil pump (manual operation) 2.5. Basic electrical knowledge	2.1. Reading comprehension & interpretation skills 2.2. Preparing materials 2.3. Performing work safety 2.4. Proper handling of electrical tools and testing instruments 2.5. Performing pre-start-up activity 2.6. Communicating effectively 2.7. Basic electrical skills
3. Charge refrigeration system	3.1. Flushing is performed on the refrigeration system based on charging procedures 3.2. Pressure/leak testing is performed based on International Institute of Ammonia Refrigeration (IIAR) standards 3.3. Evacuation/Vacuumping of refrigeration system is performed based IIAR standards 3.4. <b>Natural Refrigerant</b> charging is performed based on IIAR standards	3.1. System operating temperature requirements for refrigerant 3.2. IIAR standards 3.2.1. Pressure/leak system 3.2.2. Vacuuming 3.2.3. Refrigerant charging 3.3. Types of Natural refrigerants 3.3.1. Ammonia 3.3.2. CO <sub>2</sub> 3.3.3. Propane 3.4. Handling of natural refrigerant based on ASHRAE UNEP guide for operation of sustainable RAC plants 3.5. Types of mechanical equipment	3.1. Reading comprehension and interpretation skills 3.2. Preparing and using tools and materials 3.3. Performing work safety 3.4. Proper handling of natural refrigerants 3.5. Interpreting different pressure gauge units 3.6. Communicating effectively
4. Perform pre-start checks	4.1. Functionality testing of main distribution panel (MDP) is checked based on system's electrical requirement 4.2. Functionality of motor control center (MCC) is checked based on motor rating versus actual electrical parameters 4.3. Functionality of SCADA system is checked based on field	4.1. Functionality testing procedure for: 4.1.1. main distribution panel (MDP) 4.1.2. motor control center (MCC) 4.1.3. SCADA system 4.2. Philippine Mechanical Engineering Code (PMEC) 4.3. Philippine Electrical Code (PEC) 4.4. Systems piping and instrumentation diagram	4.1. Documentation skills 4.2. Able to interpret electrical single line diagram 4.3. Reading comprehension and interpretation skills 4.4. Preparing and using tools and materials

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
	<p>instrument parameters</p> <p>4.4. Electromechanical testing is performed based on Philippine Mechanical Engineering Code (PMC) and Philippine Electrical Code (PEC)</p> <p>4.5. Motor insulation testing is performed based on PEC</p> <p>4.6. Field wiring testing is performed based on PEC</p> <p>4.7. Valves and controls are checked based on system's piping and instrumentation diagram (P&amp;ID)</p> <p>4.8. Rotation of electric motors is checked based on directional arrow of equipment</p> <p>4.9. Pre-start up completion is documented</p>	(P&ID)	<p>4.5. Performing work safety</p> <p>4.6. Interpreting different types of electrical parameters</p> <p>4.7. Communicating effectively</p>

\* Critical aspects of competency

## RANGE OF VARIABLES

VARIABLE	RANGE
1 Commissioning instruments	Including but is not limited to: 1.1 Clamp meter 1.2 Multi-tester 1.3 Thermometer 1.4 Electronic leak detector (Natural refrigerant) 1.5 Sulfur Stick/ Leak Detection Tape (Ammonia) 1.6 Solenoid tester 1.7 Pressure gauge 1.8 Vibration analyzer 1.9 Tension meter
2 Tools and equipment	May include but not limited to: 2.1 Tools 2.1.1 Ratchet 2.1.2 Screwdrivers (flat, Philip) 2.1.3 Multi-tester 2.1.4 Precision screwdriver 2.1.5 Solenoid tester 2.1.6 Flashlight (for safety) 2.1.7 Two-way radio (for emergency) 2.1.8 Dial gauge  2.2 Equipment 2.2.1 Vacuum pump with Hydraulic hose 2.2.2 Air compressor
3 PPEs	May include: 3.1 Hard hat 3.2 Safety goggles 3.3 Safety shoes 3.4 Rubber gloves 3.5 Safety vest 3.6 Full-face gas mask 3.7 Self-contained breathing apparatus (SCBA) with chemical suit 3.8 Ear plug/muffle 3.9 Lock out/Tag out (LOTO)
4 Natural Refrigerant	May include: 4.1 Ammonia 4.2 CO <sub>2</sub> 4.3 Propane

## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> <li>1.1. Prepared for commissioning of an industrial refrigeration plant               <ol style="list-style-type: none"> <li>1.1.1. Read and interpreted work instructions to determine job requirements</li> <li>1.1.2. Selected tools and equipment in accordance with job requirements</li> <li>1.1.3. Prepared pre-start-up, testing and commissioning checklists in accordance with manufacturer's manuals</li> <li>1.1.4. Produced commissioning method and program and prepared recording sheets in accordance with manufacturer's manuals</li> <li>1.1.5. Calibrated commissioning instruments in accordance with system documents</li> <li>1.1.6. Selected PPEs in line with job requirements</li> </ol> </li> <li>1.2. Charged compressor refrigerant oil               <ol style="list-style-type: none"> <li>1.2.1. Checked type of oil based on operating temperature requirements</li> <li>1.2.2. Prepared refrigerant oil quantity based on compressor requirements</li> <li>1.2.3. Charged refrigerant oil according to manufacturer's procedures</li> <li>1.2.4. Energized oil heater as per established manufacturer's procedures</li> </ol> </li> <li>1.3. Charged refrigeration system               <ol style="list-style-type: none"> <li>1.3.1. Performed flushing on the refrigeration system based on charging procedures</li> <li>1.3.2. Performed pressure/leak testing based on IIAR standards</li> <li>1.3.3. Performed evacuation/vacuumping of refrigeration system based IIAR standards</li> <li>1.3.4. Performed Natural Refrigerant charging based on IIAR standards</li> </ol> </li> <li>1.4. Performed pre-start checks               <ol style="list-style-type: none"> <li>1.4.1. Checked functionality testing of MDP based on system's electrical requirement</li> <li>1.4.2. Checked functionality of MCC based on motor rating versus actual electrical parameters</li> <li>1.4.3. Checked functionality of SCADA system based on field instrument parameters</li> <li>1.4.4. Performed electromechanical testing based on PMC PEC</li> <li>1.4.5. Performed motor insulation testing based on PEC</li> <li>1.4.6. Performed field wiring testing based on PEC</li> <li>1.4.7. Checked valves and controls based on system's P&amp;ID</li> <li>1.4.8. Checked rotation of electric motors based on directional arrow of equipment</li> <li>1.4.9. Documented pre-start up completion</li> </ol> </li> </ol>
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2. Resource Implications	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1. Appropriate supplies and materials</li> <li>2.2. Applicable tools and equipment</li> <li>2.3. Appropriate materials relevant to the proposed activity</li> <li>2.4. Workplace or assessment area</li> <li>2.5. Drawings and specifications relevant to the task</li> <li>2.6. Manufacturer's manual</li> <li>2.7. Commissioning instruments</li> </ul>
3. Methods of Assessment	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> <li>3.1. Direct observation/Demonstration with oral questioning</li> <li>3.2. Written test</li> </ul>
4. Context for Assessment	<ul style="list-style-type: none"> <li>4.1. Competency maybe assessed in actual workplace or at the designated TESDA Accredited Assessment Center</li> </ul>

**UNIT OF COMPETENCY: OPERATE INDUSTRIAL REFRIGERATION PLANT**

**UNIT CODE : CS-HVC311302**

**UNIT DESCRIPTOR :** This unit covers the knowledge, skills and attitudes to operate industrial refrigeration plant. This includes competencies in monitoring utilities for refrigeration system, starting evaporative condenser & high-stage compressor, running low-stage compressor and preparing documentation.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Monitor utilities for refrigeration system	1.1. Electrical voltage is checked as per standard operating procedure (SOP)* 1.2. Water supply is checked as per SOP* 1.3. Monitoring checklist is accomplished as per SOP	1.1 Basic Electrical knowledge 1.2 Knowledge on water meter reading	1.1. Documentation skills 1.2. Able to interpret electrical single line diagram 1.3. Reading comprehension and interpretation skills 1.4. Interpreting different types of electrical parameters 1.5. Communicating effectively
2. Start evaporative condenser	2.1. <b>Fan motor</b> is started according to operational parameters* 2.2. Water pump motor is started according to operational parameters *	2.1. Basic electrical knowledge 2.2. Basic mechanical knowledge 2.3. Evaporative condenser principles 2.4. Fan principles 2.5. Water pump principle	2.1. Documentation skills 2.2. Able to interpret electrical single line diagram 2.3. Reading comprehension and interpretation skills 2.4. Interpreting different types of electrical and mechanical parameters 2.5. Communicating effectively
3. Start high-stage compressor (Unloaded)	3.1. High-stage <b>compressor</b> is operated based on operational parameters* 3.2. Refrigerant pump is operated based on operational parameters* 3.3. <b>Evaporator</b> is operated based on operational parameters* 3.4. Operating current, temperatures and pressures are checked based on operational parameters*	3.1. Knowledge on refrigeration cycle principles 3.2. Basic electrical knowledge 3.3. Basic mechanical knowledge 3.4. Operational parameters for: 3.4.1. High-stage compressor 3.4.2. Refrigerant pump 3.4.3. Evaporator 3.4.4. Pressure and temperature	3.1. Documentation skills 3.2. Able to interpret electrical single line diagram and P&ID 3.3. Reading comprehension and interpretation skills 3.4. Interpreting different types of electrical and mechanical parameters 3.5. Communicating effectively

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
4. Run low-stage compressor (unloaded)	4.1. Low-stage compressor is operated based on operational parameters* 4.2. Refrigerant pump is operated based on operational parameters* 4.3. Evaporator is operated based on operational parameters* 4.4. Operating current, temperatures and pressures are checked based on operational parameters	4.1. Knowledge on refrigeration cycle principles 4.2. Basic electrical knowledge 4.3. Basic mechanical knowledge 4.4. Operational parameters for: 4.4.1. Low-stage compressor 4.4.2. Refrigerant pump 4.4.3. Evaporator 4.5. Pressure and temperature	4.1. Documentation skills 4.2. Able to interpret electrical single line diagram and P&ID 4.3. Reading comprehension and interpretation skills 4.4. Interpreting different types of electrical and mechanical parameters 4.5. Communicating effectively
5. Prepare documentation	5.1. Actual design condition of the system is checked based on P&ID* 5.2. SCADA screen is checked based on actual operating conditions and parameters* 5.3. Real time data are logged based on actual operating condition* 5.4. Data are printed for report and validation purposes	5.1. Knowledge on refrigeration cycle principles 5.2. Operational parameters for: 5.2.1. High-stage compressor 5.2.2. Low-stage compressor 5.2.3. Refrigerant pump 5.2.4. Evaporator 5.2.5. Evaporative condenser 5.2.6. Liquid receiver 5.2.7. High-stage separator 5.2.8. Low-stage separator 5.2.9. Inter-cooler 5.3. Refrigerant level, refrigerant oil level, pressure and temperature 5.4. SCADA operation 5.5. P&ID	5.1. Documentation skills 5.2. Able to interpret electrical single line diagram and P&ID 5.3. Reading comprehension and interpretation skills 5.4. Interpreting different types of electrical and mechanical parameters 5.5. Communicating effectively

\* Critical aspects of competency

## RANGE OF VARIABLES

VARIABLE	RANGE
1 Fan	May include: 1.1 Axial fan 1.2 Centrifugal blower
2 Motor	May include: 2.1 AC motor 2.2 EC motor
3 Compressor	May include: 3.1 Reciprocating 3.2 Screw compressor 3.2.1 Single screw 3.2.2 Twin screw
4 Evaporator	Types of evaporators may include: 4.1 Finned coil 4.1.1 Blow through 4.1.2 Draw through 4.2 Shell and tube 4.3 Plate heat exchanger (PHE) 4.4 Falling film chiller 4.5 Herringbone coil 4.6 Hairpin coil 4.7 Shell and plate

## EVIDENCE GUIDE

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Monitored utilities for refrigeration system               <ul style="list-style-type: none"> <li>1.1.1 Checked electrical voltage as per standard operating procedure (SOP)</li> <li>1.1.2 Checked water supply as per SOP</li> </ul> </li> <li>1.2 Started evaporative condenser               <ul style="list-style-type: none"> <li>1.2.1 Started fan motor according to operational parameters</li> <li>1.2.2 Started water pump motor according to operational parameters</li> </ul> </li> <li>1.3 Started high-stage compressor (Unloaded)               <ul style="list-style-type: none"> <li>1.3.1 Operated high-stage compressor based on operational parameters</li> <li>1.3.2 Operated refrigerant pump based on operational parameters</li> <li>1.3.3 Operated evaporator based on operational parameters</li> <li>1.3.4 Checked operating current, temperatures and pressures based on operational parameters</li> </ul> </li> <li>1.4 Ran low-stage compressor (unloaded)               <ul style="list-style-type: none"> <li>1.4.1 Operated low-stage compressor based on operational parameters</li> <li>1.4.2 Operated refrigerant pump based on operational parameters</li> <li>1.4.3 Operated evaporator based on operational parameters</li> </ul> </li> <li>1.5 Prepared documentation               <ul style="list-style-type: none"> <li>1.5.1 Checked actual design condition of the system based on P&amp;ID</li> <li>1.5.2 Checked SCADA screen based on actual operating conditions and parameters</li> <li>1.5.3 Logged real time data based on actual operating condition</li> </ul> </li> </ul>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1 Appropriate supplies and materials</li> <li>2.2 Applicable tools and equipment</li> <li>2.3 Appropriate materials relevant to the proposed activity</li> <li>2.4 Workplace or assessment area</li> <li>2.5 Drawings and specifications relevant to the task</li> <li>2.6 Manufacturer's manual</li> </ul>
<p>3. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>3.1 Direct observation / Demonstration with oral questioning</li> <li>3.2 Written test</li> </ul>
<p>4. Context for Assessment</p>	<p>4.1 Competency maybe assessed in actual workplace or at the designated TESDA Accredited Assessment Center</p>

## UNIT OF COMPETENCY: MAINTAIN INDUSTRIAL REFRIGERATION PLANT

UNIT CODE : CS-HVC311303

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in maintaining industrial refrigeration plant. This includes competencies in preparing for maintenance activities, checking and adjusting refrigeration components, maintaining lubrication system, refrigeration charge, secondary heat transfer & electrical equipment and preparing documentation in an industrial refrigeration plant.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare for maintenance activities	1.1. Work instructions are read and interpreted to determine job requirements* 1.2. Appropriate manufacturer's manual is selected based on system requirements* 1.3. <b>Tools, instruments and equipment</b> are selected in accordance with job requirements* 1.4. <b>Personal protective equipment (PPE)</b> is selected and prepared*	1.1 Basic electrical knowledge 1.2 Basic mechanical knowledge 1.3 Preventive maintenance plan as per manufacturers maintenance manual 1.4 Maintenance tools and instruments 1.5 Personal protective equipment (PPE)	1.1. Documentation skills 1.2. Able to interpret electrical single line diagram 1.3. Reading comprehension and interpretation skills 1.4. Interpreting different types of electrical parameters 1.5. Communicating effectively
2. Check and adjust refrigeration components	2.1. <b>Compressor</b> operating parameters are checked/adjusted based on P&ID* 2.2. Evaporative condenser operating parameters are checked/adjusted based on P&ID* 2.3. <b>Evaporator</b> operating parameters are checked/adjusted based on P&ID* 2.4. <b>Valves and controls</b> operating parameters are checked/adjusted based on P&ID* 2.5. Refrigerant pump operating parameters are checked/adjusted based on P&ID* 2.6. Refrigerant electronic leak detector and exhaust fan operating parameters are checked/adjusted based on plant layout* 2.7. Air purgers operating parameters are	2.1. Basic refrigeration cycle 2.2. Basic mechanical principles 2.3. Basic electrical principles 2.4. Operational parameters for: 2.4.1. High-stage compressor 2.4.2. Low-stage compressor 2.4.3. Refrigerant pump 2.4.4. Evaporator 2.4.5. Evaporative condenser 2.4.6. Liquid receiver 2.4.7. High-stage separator 2.4.8. Low-stage separator 2.4.9. Inter-cooler 2.5. Refrigerant level, refrigerant oil level, pressure and temperature 2.6. Air purger operation 2.7. P&ID	2.1. Documentation skills 2.2. Able to interpret mechanical drawings and electrical single line diagram 2.3. Reading comprehension and interpretation skills 2.4. Interpreting different types of mechanical and electrical parameters 2.5. Communicating effectively

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	checked/adjusted based on P&ID* 2.8. Condition of relief valve is checked based on P&ID*	2.8. Refrigerant electronic leak detector operation 2.9. Relief valve operation	
3. Maintain lubrication system in industrial refrigeration plant	3.1. Refrigerant oil analysis of compressor refrigerant oil is checked and performed based on operation maintenance manual* 3.2. Refrigerant oil is changed according to results of oil analysis 3.3. Monitoring and checking of oil level is performed and topped up if needed	3.1. Refrigerant oil charging 3.1.1. Refrigerant pump down procedure 3.1.2. Evacuation procedure 3.2. Refrigerant oil technical data sheet 3.3. P&ID 3.4. Refrigerant oil operating levels 3.5. Operation maintenance manual	3.1. Documentation skills 3.2. Reading comprehension and interpretation skills 3.3. Charging refrigerant oil 3.4. Compressor vacuuming skills 3.5. Interpreting isolation valves 3.6. Pumping down refrigerant skills 3.7. Communicating effectively
4. Maintain refrigerant charge	4.1. Refrigerant level is checked based on designed operating level* 4.2. Refrigerant is charged based on operating level if needed 4.3. Refrigerant purity is checked based on purity testing result* 4.4. Water, dirt, oil (WDO) removal is performed as needed based on purity testing result	4.1. Refrigerant charging 4.2. Refrigerant technical data sheet 4.3. Refrigerant purity testing 4.4. WDO removal procedure 4.5. P&ID 4.6. Refrigerant operating levels	4.1. Documentation skills 4.2. Reading comprehension skills 4.3. Charging refrigerant 4.4. Compressor vacuuming skills 4.5. Interpreting isolation valves 4.6. Pumping down refrigerant skills 4.7. Interpreting technical data sheet 4.8. Refrigerant purity testing skills 4.9. Communicating effectively
5. Maintain secondary heat transfer equipment	5.1. Temperature and pressure of <b>secondary refrigerants/coolants</b> are checked based on P&ID* 5.2. Evaporating temperature of primary refrigerant is checked based on P&ID* 5.3. Plate heat exchanger (PHE) gasket is checked based on condition* 5.4. PHE gasket is replaced if needed based on condition 5.5. Secondary refrigerant/	5.1. Types and application of secondary refrigerants/coolants 5.2. Handling of secondary refrigerants/coolants 5.3. P&ID 5.4. Basic mechanical principles 5.5. Plate heat exchanger principle	5.1. Documentation skills 5.2. Reading comprehension skills 5.3. Skills in handling of secondary refrigerants/coolants 5.4. Charging secondary refrigerant/coolant 5.5. Interpreting isolation valves

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	coolant pump is checked based on ampere rating and total dynamic head*		5.6. Interpreting technical data sheet 5.7. Communicating effectively
6. Maintain electrical equipment	6.1. Medium voltage transformer is checked based on single line diagram (SLD)* 6.2. Low-voltage switch gear is checked based on SLD* 6.3. Main distribution panel (MDP) is checked based on SLD* 6.4. Motor control panel is checked based on SLD* 6.5. <b>Electrical components</b> are replaced as needed based on actual condition	6.1. Basic electrical principles 6.2. Single line diagram interpretation 6.3. Electrical safety 6.4. Transformers 6.5. Motor control 6.6. Electrical components	6.1. Documentation skills 6.2. Reading comprehension skills 6.3. Checking electrical parameters 6.4. Skills in handling and testing electrical components 6.5. Interpreting technical data sheet 6.7. Communicating effectively
7. Prepare documentation	7.1. Actual design condition of the refrigeration system is checked based on P&ID and single line diagram (SLD)* 7.2. SCADA screen is checked based on actual operating conditions and parameters* 7.3. Real time data are logged based on actual operating condition 7.4. Data are printed for report and validation purposes	7.1. Knowledge on refrigeration cycle principles 7.2. Operational parameters for: 7.2.1. High-stage compressor 7.2.2. Low-stage compressor 7.2.3. Refrigerant pump 7.2.4. Evaporator 7.2.5. Evaporative condenser 7.2.6. Liquid receiver 7.2.7. High-stage separator 7.2.8. Low-stage separator 7.2.9. Inter-cooler 7.3. Refrigerant level, refrigerant oil level, pressure and temperature 7.4. SCADA operation 7.5. P&ID	7.1. Documentation skills 7.2. Able to interpret electrical single line diagram and P&ID 7.3. Reading comprehension and interpretation skills 7.4. Interpreting different types of electrical and mechanical parameters 7.5. Communicating effectively

\* Critical aspects of competency

## RANGE OF VARIABLES

VARIABLE	RANGE
1. Tools, instruments and equipment	May include but not limited to: 1.1 Tools 1.1.1 Ratchet 1.1.2 Screwdrivers (flat, Philip) 1.1.3 Multi-tester 1.1.4 Precision screwdriver 1.1.5 Magnetic solenoid tester 1.1.6 Flashlight (for safety) 1.1.7 Two-way radio (for emergency) 1.2 Instruments 1.2.1 Pressure gauge 1.2.2 Vibration analyzer 1.2.3 Tension meter 1.2.4 Dial gauge 1.3 Equipment 1.3.1 Vacuum pump with Hydraulic hose 1.3.2 Air compressor
2. PPEs	May include: 2.1 Hard hat 2.2 Safety goggles 2.3 Safety shoes 2.4 Rubber gloves 2.5 Safety vest 2.6 Full-face gas mask 2.7 SCBA – Self-contained breathing apparatus with chemical suit 2.8 Ear plug/muffle 2.9 Lock out/Tag out (LOTO)
3. Compressor	May include: 3.1 Reciprocating 3.2 Screw compressor 3.2.1 Single screw 3.2.2 Twin screw
4. Evaporator	Types of evaporators may include: 4.1 Finned coil 4.1.1 Blow through 4.1.2 Draw through 4.2 Shell and tube 4.3 Plate heat exchanger (PHE) 4.4 Falling film chiller 4.5 Herringbone coil 4.6 Hairpin coil
5. Valves and controls	5.1 Valves (Mechanical) 5.1.1 Isolating valve 5.1.2 Expansion/Regulating valve 5.1.3 Check valve 5.1.4 Pressure relief valve 5.1.5 Quick release valve

VARIABLE	RANGE
	5.1.6 Dual stop valve 5.2 Controls (Electromechanical) 5.2.1 Solenoid valve 5.2.2 Back pressure regulator 5.2.3 Pilot valve 5.2.4 Level switch 5.2.4.1 Mechanical 5.2.4.2 Electronic 5.2.5 Gas powered valve 5.2.6 Pressure regulator
6. Secondary refrigerants/coolants	May include: 6.1 Water 6.2 Carbon dioxide (CO <sub>2</sub> ) 6.3 Glycol 6.3.1 Propylene (Food grade) 6.3.2 Ethylene 6.4 Brine solution 6.4.1 Calcium chloride (CaCl) 6.4.2 Sodium chloride (NaCl)
7. Electrical components	May include: 7.1 Breaker 7.2 Switch gears (medium, low) 7.3 Starters 7.3.1 Wye-delta 7.3.2 Direct online 7.3.3 Autotransformer 7.3.4 Soft starter 7.3.5 Variable frequency drive (VFD) 7.4 Contactors 7.5 Relays 7.5.1 Phase protection 7.5.2 Over and under voltage 7.5.3 Overload protection 7.6 Electric motors 7.6.1 AC motor 7.6.2 EC motor 7.7 Transformer 7.7.1 Dry type 7.7.2 Oil immersed 7.8 Selector switch 7.9 Pin lights 7.9.1 Green 7.9.2 Orange 7.9.3 Red 7.10 Temperature controller 7.11 Heater 7.11.1 Oil 7.11.2 Condensate

## EVIDENCE GUIDE

<p>1 Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Prepared for maintenance activities               <ul style="list-style-type: none"> <li>1.1.1 Read and interpreted work instructions to determine job requirements</li> <li>1.1.2 Selected appropriate manufacturer's manual based on system requirements</li> <li>1.1.3 Selected tools and equipment in accordance with job requirements</li> <li>1.1.4 Selected and prepared personal protective equipment (PPE)</li> </ul> </li> <li>1.2 Checked and adjusted refrigeration components               <ul style="list-style-type: none"> <li>1.2.1 Checked/adjusted compressor operating parameters based on P&amp;ID</li> <li>1.2.2 Checked/adjusted evaporative condenser operating parameters based on P&amp;ID</li> <li>1.2.3 Checked/adjusted evaporator operating parameters based on P&amp;ID</li> <li>1.2.4 Checked/adjusted valves and controls operating parameters based on P&amp;ID</li> <li>1.2.5 Checked/adjusted refrigerant pump operating parameters based on P&amp;ID</li> <li>1.2.6 Checked/adjusted refrigerant electronic leak detector and exhaust fan operating parameters based on plant layout</li> <li>1.2.7 Checked/adjusted air purgers operating parameters based on P&amp;ID</li> <li>1.2.8 Checked condition of relief valve based on P&amp;ID</li> </ul> </li> <li>1.3 Maintained lubrication system in industrial refrigeration plant               <ul style="list-style-type: none"> <li>1.3.1 Checked and performed refrigerant oil analysis of compressor refrigerant oil based on operation maintenance manual</li> </ul> </li> <li>1.4 Maintained refrigerant charge               <ul style="list-style-type: none"> <li>1.4.1 Checked refrigerant level based on designed operating level</li> <li>1.4.2 Checked refrigerant purity based on purity testing result</li> </ul> </li> <li>1.5 Maintained secondary heat transfer equipment               <ul style="list-style-type: none"> <li>1.5.1 Checked temperature and pressure of secondary refrigerants based on P&amp;ID</li> <li>1.5.2 Checked evaporating temperature of primary refrigerant based on P&amp;ID</li> <li>1.5.3 Checked plate heat exchanger (PHE) gasket based on condition</li> <li>1.5.4 Checked secondary refrigerant pump based on ampere rating and total dynamic head</li> </ul> </li> <li>1.6 Maintained electrical equipment               <ul style="list-style-type: none"> <li>1.6.1 Checked medium voltage transformer based on single line diagram (SLD)</li> <li>1.6.2 Checked low-voltage switch gear based on SLD</li> <li>1.6.3 Checked main distribution panel (MDP) based on SLD</li> <li>1.6.4 Checked motor control panel based on SLD</li> </ul> </li> <li>1.7 Prepared documentation               <ul style="list-style-type: none"> <li>1.7.1 Actual design condition of the refrigeration system is checked based on P&amp;ID and single line diagram (SLD)</li> <li>1.7.2 SCADA screen is checked based on actual operating conditions and parameters</li> </ul> </li> </ul>
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2 Resource Implications	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> <li>2.1 Appropriate supplies and materials</li> <li>2.2 Applicable tools and equipment</li> <li>2.3 Appropriate materials relevant to the proposed activity</li> <li>2.4 Workplace or assessment area</li> <li>2.5 Drawings and specifications relevant to the task</li> <li>2.6 Manufacturer's manual</li> <li>2.7 Appropriate instruments</li> </ul>
3 Methods of Assessment	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> <li>3.1 Direct observation /demonstration with oral questioning</li> <li>3.2 Written test</li> </ul>
4 Context for Assessment	<ul style="list-style-type: none"> <li>4.1 Competency maybe assessed in actual workplace or at the designated TESDA Accredited Assessment Center</li> </ul>

**UNIT OF COMPETENCY: TROUBLESHOOT AND REPAIR INDUSTRIAL REFRIGERATION PLANT SYSTEM**

**UNIT CODE : CS-HVC311304**

**UNIT DESCRIPTOR :** This unit covers the knowledge, skills and attitudes in troubleshooting and performing minor repair of industrial refrigeration plant system. This includes competencies in preparing for troubleshooting and repair work, troubleshooting and repairing electrical and mechanical components and equipment, test-running refrigeration system and preparing documentation.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
1. Prepare for troubleshooting and repair work	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 Basic electrical knowledge 1.2 Basic mechanical knowledge 1.3 P&ID 1.4 Single line diagram (SLD) 1.5 Manufacturers troubleshooting manual 1.6 Troubleshooting tools and instruments 1.7 Personal protective equipment (PPE)	1.1. Documentation skills 1.2. Able to interpret electrical single line diagram and P&ID 1.3. Reading comprehension 1.4. Interpreting different types of electrical and mechanical parameters 1.5. Communicating effectively
2. Troubleshoot and repair electrical components and equipment	2.1 Appropriate <b>PPE</b> for electrical work is selected and used in line with the job requirements* 2.2 <b>Refrigeration system electrical components</b> are tested following correct testing procedures* 2.3 <b>Electrical faults/problems</b> with refrigerant system are diagnosed in line with standard operating procedures (SOPs)* 2.4 <b>Remedial action for electrical</b> is taken to overcome faults/problems in line with SOPs* 2.5 Work is completed safely in line with workplace safety guidelines*	2.1 Electrical safety 2.2 Troubleshooting and repair procedures for electrical components in refrigeration system 2.3 Basic electrical principles 2.4 Electrical faults/problems in refrigeration system 2.5 Single line and wiring diagram interpretation 2.6 Transformers 2.7 Motor control 2.8 Electrical components	2.1 Documentation skills 2.2 Reading comprehension skills 2.3 Checking electrical parameters 2.4 Skills in handling and testing electrical components 2.5 Interpreting technical data sheet 2.6 Communicating effectively

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Troubleshoot and repair mechanical components and equipment	3.1. Appropriate PPE for mechanical work is selected and used in line with the job requirements* 3.2. <b>Refrigeration system mechanical components and equipment</b> are tested following correct testing procedures* 3.3. <b>Mechanical faults/problems</b> with refrigerant system are diagnosed in line with standard operating procedures (SOPs)* 3.4. <b>Remedial action for mechanical</b> is taken to overcome faults/problems in line with SOPs* 3.5. Work is completed safely in line with workplace safety guidelines*	3.1. Troubleshooting and repair procedures for mechanical components in refrigeration system 3.2. Basic mechanical principles 3.3. Mechanical faults/problems in refrigeration cycle 3.4. P&ID 3.5. Refrigerant safety	3.1. Documentation skills 3.2. Reading comprehension skills 3.3. Checking mechanical parameters 3.4. Skills in handling and testing mechanical components 3.5. Interpreting technical data sheet 3.6. Communicating effectively
4. Test-run refrigeration system	4.1. Pressure leak test is performed on repaired/replaced mechanical component based on standard operating procedure (SOP)* 4.2. Evacuation of unwanted non-condensable gases is performed on repaired/replaced mechanical component based on SOP* 4.3. Refrigerant is released into repaired/replaced mechanical component based on SOP* 4.4. Repaired/replaced mechanical component is ran and operated based on operating procedures*	4.1. Pressure leak test procedure 4.2. Procedures on evacuation of unwanted non-condensable gases 4.3. P&ID interpretation 4.4. Operating condition parameters of mechanical components	4.1. Documentation skills 4.2. Reading comprehension skills 4.3. Identifying and using different tools 4.4. Skills in handling and testing electrical components 4.5. Skills in handling and testing mechanical components 4.6. Interpreting technical data sheet 4.7. Communicating effectively
5. Prepare documentation	5.1. Actual design condition of the refrigeration system is checked based on P&ID and single line and wiring diagram (SLD)* 5.2. SCADA screen is checked based on actual operating conditions and parameters* 5.3. Real time data are logged	5.1. Knowledge on refrigeration cycle principles 5.2. Operational parameters for: 5.2.1. High-stage compressor 5.2.2. Low-stage compressor	5.1. Documentation skills 5.2. Able to interpret electrical single line and wiring diagram and P&ID 5.3. Reading comprehension

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> fonts are elaborated in the Range of Variables	<b>REQUIRED KNOWLEDGE</b>	<b>REQUIRED SKILLS</b>
	based on actual operating condition 5.4. Service report is prepared according to assessment findings and work done 5.5. Data are printed for report and validation purposes	5.2.3. Refrigerant pump 5.2.4. Evaporator 5.2.5. Evaporative condenser 5.2.6. Liquid receiver 5.2.7. High-stage separator 5.2.8. Low-stage separator 5.2.9. Inter-cooler 5.3. Refrigerant level, refrigerant oil level, pressure and temperature 5.4. SCADA operation 5.5. P&ID	and interpretation skills 5.4. Interpreting different types of electrical and mechanical parameters 5.5. Communicating effectively

\* Critical aspects of competency

## RANGE OF VARIABLES

VARIABLE	RANGE
1. Refrigeration system electrical components	May include: <ul style="list-style-type: none"> <li>1.1. Circuit breaker</li> <li>1.2. Switch gears (medium, low)</li> <li>1.3. Starters               <ul style="list-style-type: none"> <li>1.3.1. Wye-delta</li> <li>1.3.2. Direct online</li> <li>1.3.3. Autotransformer</li> <li>1.3.4. Soft starter</li> <li>1.3.5. Variable frequency drive (VFD)</li> </ul> </li> <li>1.4. Contactors</li> <li>1.5. Relays               <ul style="list-style-type: none"> <li>1.5.1. Phase protection</li> <li>1.5.2. Over and under voltage</li> <li>1.5.3. Overload protection</li> </ul> </li> <li>1.6. Electric motors               <ul style="list-style-type: none"> <li>1.6.1. AC motor</li> <li>1.6.2. EC motor</li> </ul> </li> <li>1.7. Transformer               <ul style="list-style-type: none"> <li>1.7.1. Dry type</li> <li>1.7.2. Oil immersed</li> </ul> </li> <li>1.8. Selector switch</li> <li>1.9. Pin lights               <ul style="list-style-type: none"> <li>1.9.1. Green</li> <li>1.9.2. Orange</li> <li>1.9.3. Red</li> </ul> </li> <li>1.10. Temperature controller</li> <li>1.11. Heater               <ul style="list-style-type: none"> <li>1.11.1. Oil</li> <li>1.11.2. Condensate</li> </ul> </li> </ul>
2. Electrical faults/problems	May include: <ul style="list-style-type: none"> <li>2.1. Busted/burned contactor terminals</li> <li>2.2. Tripped breaker</li> <li>2.3. Defective solenoids</li> <li>2.4. Defective solenoid controller</li> <li>2.5. Busted drain heater</li> </ul>
3. Remedial action for electrical	May include: <ul style="list-style-type: none"> <li>3.1. Identify and replace busted/burned contactor terminals</li> <li>3.2. Identify and reset/replace tripped breaker</li> <li>3.3. Identify and replace defective solenoids</li> <li>3.4. Identify and replace defective solenoid controller</li> <li>3.5. Identify and replace busted drain heater</li> </ul>
4. PPE (Electrical work)	Includes but is not limited to: <ul style="list-style-type: none"> <li>4.1. Safety shoes</li> <li>4.2. Safety goggles</li> <li>4.3. Hard hat</li> <li>4.4. Rubber gloves</li> </ul>

<b>VARIABLE</b>	<b>RANGE</b>
5. Refrigeration system mechanical components and equipment	May include: 5.1. Compressor 5.2. Condensers 5.2.1. Evaporative condenser 5.2.2. Air cooled condenser 5.2.3. Water cooled condenser 5.3. Evaporator (Refrigerant Flow Control) 5.4. Metering device 5.4.1. Thermostatic expansion valve 5.4.2. Hand expansion or regulating valves 5.4.3. Back pressure valves
6. Mechanical faults/problems	May include: 6.1. Inadequate cooling 6.2. High discharge temperature/pressure 6.3. High/low suction temperature/pressure 6.4. High/low evaporating temperature/pressure 6.5. High oil temperature
7. Remedial action for mechanical	May include: 7.1. Pump-out/pump down 7.1.1. Repair/replace solenoid valve 7.2. Check vibration of compressor 7.2.1. Change bearing 7.2.2. Align compressor and motor 7.3. Check evaporator 7.3.1. Check frost accumulation 7.3.2. Check drain pipe/pan heater 7.3.3. Check hot gas defrost valve 7.4. Check evaporative condenser 7.4.1. Check fan motor 7.4.2. Check pump motor 7.4.3. Check condenser coil 7.4.4. Check spray nozzle
8. PPE (Mechanical work)	May include: 8.1. Full face Mask with breathing apparatus 8.2. SCBA with chemical suit 8.3. Safety goggles 8.4. Hard hat 8.5. Rubber gloves 8.6. Safety vest 8.7. Ear plug/muff 8.8. Safety harness 8.9. Safety shoes

## EVIDENCE GUIDE

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1. Prepared for troubleshooting and repair           <ul style="list-style-type: none"> <li>1.1.1. Interpreted appropriate wiring diagrams, charts and manuals in line with the job requirements</li> <li>1.1.2. Selected appropriate materials, tools and equipment based on job requirements</li> <li>1.1.3. Checked power supply to ensure compliance with nameplate rating and/or manufacturer's specifications</li> </ul> </li> <li>1.2. Troubleshooted and repaired electrical components and equipment           <ul style="list-style-type: none"> <li>1.2.1. Selected and used appropriate PPE for electrical work in line with the job requirements</li> <li>1.2.2. Tested refrigeration system electrical components following correct testing procedures</li> <li>1.2.3. Diagnosed electrical faults/problems with refrigerant system in line with standard operating procedures (SOPs)</li> <li>1.2.4. Toke remedial action for electrical to overcome faults/problems in line with SOPs</li> <li>1.2.5. Completed work safely in line with workplace safety guidelines</li> </ul> </li> <li>1.3. Troubleshooted and repaired mechanical components and equipment           <ul style="list-style-type: none"> <li>1.3.1. Selected and used appropriate PPE for mechanical work in line with the job requirements</li> <li>1.3.2. Tested refrigeration system mechanical components and equipment following correct testing procedures</li> <li>1.3.3. Diagnosed mechanical faults/problems with refrigerant system in line with standard operating procedures (SOPs)</li> <li>1.3.4. Toke remedial action for mechanical to overcome faults/problems in line with SOPs</li> <li>1.3.5. Completed work safely in line with workplace safety guidelines</li> </ul> </li> <li>1.4. Test-ran refrigeration system           <ul style="list-style-type: none"> <li>1.4.1. Performed pressure leak test on repaired/replaced mechanical component based on standard operating procedure (SOP)</li> <li>1.4.2. Performed evacuation of unwanted non-condensable gases on repaired/replaced mechanical component based on SOP</li> <li>1.4.3. Released refrigerant into repaired/replaced mechanical component based on SOP*</li> <li>1.4.4. Ran and operated repaired/replaced mechanical component based on operating procedures</li> </ul> </li> <li>1.5. Prepared documentation           <ul style="list-style-type: none"> <li>1.5.1. Checked actual design condition of the refrigeration system based on P&amp;ID and single line and wiring diagram (SLD)</li> <li>1.5.2. Checked SCADA screen based on actual operating conditions and parameters</li> <li>1.5.3. Prepared service report according to assessment findings and work done</li> </ul> </li> </ul>
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2. Resource Implications	The following resources <b>MUST</b> be provided: 2.1. Appropriate supplies and materials 2.2. Applicable tools, instruments and equipment 2.3. Appropriate materials relevant to the proposed activity 2.4. Workplace or assessment area 2.5. Drawings and specifications relevant to the task 2.6. Manufacturer's manual
3. Methods of Assessment	Competency must be assessed through: 3.1. Direct observation / demonstration with oral questioning 3.2. Written test
4. Context for Assessment	4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center

\* Critical aspects of competency

## **SECTION 3 TRAINEE ENTRY REQUIREMENTS, TRAINER'S QUALIFICATIONS, LIST OF TOOLS, MATERIALS AND EQUIPMENT, AND TRAINING FACILITIES**

### **3.1 TRAINEE ENTRY REQUIREMENTS**

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

- Must have any of the following:
  - Holder of RAC Servicing (DomRAC) NC II or higher NC in HVAC-R sector
  - At least two-years work experience in RAC servicing
  - B.S degree or technology course graduate with refrigeration and air-conditioning subjects
- 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.

### **3.2 TRAINER'S QUALIFICATION FOR HVAC/R SECTOR COMMERCIAL REFRIGERATION INSTALLATION & SERVICING NC III**

- Must be a holder of Trainer's Methodology Certificate (TMC) **or** must have training of trainer's certificate **or** must be a practicing trainer for two (2) years within the last five (5) years;
- Must have at least 3-years relevant industry experience as industrial refrigeration practitioner for the past 5-years;

### 3.3 LIST OF TOOLS, EQUIPMENT AND MATERIALS INDUSTRIAL REFRIGERATION OPERATION & MAINTENANCE NC III

Recommended list of tools, equipment and materials for the training of 25 trainees for Industrial Refrigeration Operation & Maintenance 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.

<b>TOOLS</b>		
<b>Quantity</b>	<b>Unit</b>	<b>Description/Specification</b>
10	pcs	Screwdriver, flat
10	pcs	Screwdriver, philips
10	pcs	Electrical pliers
10	pcs	Pliers, long nose
10	pcs	Pliers, diagonal
10	pcs	Box Wrench
5	units	Vernier caliper
5	units	Micrometer caliper, digital
5	pcs	Ratchet wrench (service valve)
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	Thermometer, digital, down to at least -50 degrees Celsius
5	pcs	Pyrometer, digital
5	pcs	Torque wrench, ½ drive
5	pcs	Dial gauge, analog
<b>EQUIPMENT</b>		
<b>Quantity</b>	<b>Unit</b>	<b>Description/Specification</b>
2	units	Electric drill, portable
3	units	Vacuum pump, 2 stage, at least 1 HP
2	sets	Nitrogen regulator
5	units	Electric Grinder, handheld, 4in dia
5	units	Pencil grinder, handheld, A#5
1	unit	Vibration analyzer, digital
1	unit	Refrigerant compressor (screw or reciprocating)
1	unit	Evaporative condenser
1	unit	Natural refrigerant evaporator, any type, stainless coil
1	unit	Refrigerant valves and controls
1	unit	Refrigerant pump, hermetic or open type
1	unit	Refrigerant pumping station
1	unit	High-pressure receiver
1	unit	High- and Low-pressure separator
1	unit	Intercooler
1	unit	Air purger
1	unit	Ice maker (optional)
1	unit	Motor control center (MCC)
1	unit	PLC-SCADA

5	units	Grease gun
		<b>PPE &amp; safety accessories</b>
25	sets	Personal protective equipment
10	pcs	Thermal jacket
1	pcs	SCBA with chemical suit, at least 30 minutes oxygen capacity
2	pcs	Full face gas mask with canister
5	pcs	Flashlight
5	pcs	head lamp

<b>MATERIALS</b>		
<b>Quantity</b>	<b>Unit</b>	<b>Description/Specification</b>
10	rolls	Electrical tape
3	liters	Vacuum pump oil
5	cylinder	Nitrogen gas
1	roll	Ammonia Leak detection tape
10	pcs	Sulfur stick
20	liters	Refrigerant oil
1	cylinder	Ammonia refrigerant, 99.95% purity minimum
5	tube	Grease
1	pc	Contactator
1	pc	Circuit breaker
1	pc	Relays
1	pc	Solenoid
1	pc	Variable frequency drive
1	pc	Soft starter
1	set	Valves repair kit
1	set	Gasket or garlock
1	cylinder	CO <sub>2</sub>
1	cylinder	Propane

NOTE: Access to and use of complex/advanced tools, equipment, materials and facilities can be provided through cooperative arrangements or MOA with other partner-companies.

### 3.5 TRAINING FACILITIES INDUSTRIAL REFRIGERATION OPERATION & MAINTENANCE 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
<b>TOTAL AREA</b>				<b>193</b>

\* Common facilities for all HVAC/R Courses

**Subject to conformity of the health and safety protocols**

NOTE: Access to and use of tools, equipment, materials and facilities can be provided through cooperative arrangements or MOA with other partner-companies

## GLOSSARY OF TERMS:

### GENERAL

- 1) **Basic Competencies** - are the skills and knowledge that everyone needs for work
- 2) **Common Competencies** - are the skills and knowledge needed by all people working in a particular industry or sector
- 3) **Competency** - is the possession and application of knowledge, skills and attitudes to perform work activities to the standard expected in the workplace
- 4) **Competency Standards (CS)** - is the industry-determined specification of competencies required for effective work performance
- 5) **Context of Assessment** - refers to the place where assessment is to be conducted or carried out
- 6) **Core Competencies** - are the specific skills and knowledge needed in a particular area of work - industry sector/occupation/job role
- 7) **Critical aspects of competency** - refers to the evidence that is essential for successful performance of the unit of competency
- 8) **Elective Competencies** - are the additional skills and knowledge required by the individual or enterprise for work
- 9) **Elements** - are the building blocks of a unit of competency. They describe in outcome terms the functions that a person performs in the workplace
- 10) **Evidence Guide** - is a component of the unit of competency that defines or identifies the evidences required to determine the competence of the individual. It provides information on critical aspects of competency, resource implications, assessment method and context of assessment
- 11) **Level** - refers to the category of skills and knowledge required to do a job
- 12) **Method of Assessment** - refers to the ways of collecting evidence and when evidence should be collected
- 13) **Performance Criteria** - are evaluative statements that specify what is to be assessed and the required level of performance
- 14) **Qualification** - is a cluster of units of competencies that meets job roles and are significant in the workplace. It is also a certification awarded to a person on successful completion of a course in recognition of having demonstrated competencies in an industry sector
- 15) **Range of Variables** - describes the circumstances or context in which the work is to be performed

- 16) **Resource Implications** - refers to the resources needed for the successful performance of the work activity described in the unit of competency. It includes work environment and conditions, materials, tools and equipment.
- 17) **TVET** – refers to technical vocation education and training
- 18) **Unit of Competency** – is a component of the competency standards stating a specific key function or role in a particular job or occupation; it is the smallest component of achievement that can be assessed and certified under the Philippine TVET Qualification Framework (PTQF)

## SECTOR SPECIFIC

- 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 Cooler or Unit Cooler** – evaporator that consist of fan motors and evaporator coil
- 4) **Air Handling Unit (AHU)/Indoor Unit** – an air-conditioning component that consists of a fan motor and an evaporator coil. This equipment is used in process room cooling that absorbs heat from the space
- 5) **Air Distribution** – the process of distributing conditioned air into a confined space
- 6) **ASHRAE** – American Society of Heating, Refrigerating and Air-Conditioning Engineers
- 7) **Check** – to verify, inspect, or test an HVAC/R component for satisfactory condition with the use of an instrument or a device
- 8) **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.
- 9) **Evacuation** – removal of air/any gas and moisture from a refrigeration system
- 10) **Evaporator** – the component in a refrigeration system where liquid refrigerant is changed into a vapor by the absorption of heat
- 11) **Fan** – a mechanical device for moving air
- 12) **Hot Gas Defrost** – component part used to remove frosting on the evaporator coil using hot gas refrigerant from the compressor discharge or high pressure liquid receiver

- 13) **HVAC-R** – Heating, Ventilation, Air-Conditioning and Refrigeration
- 14) **IIAR** – International Institute of Ammonia Refrigeration
- 15) **Inspect** – determine the actual condition of HVAC/R component without the use of instrument
- 16) **Interlocking** – it is the action of interconnecting electric control wires to achieve a sequential action
- 17) **Leak Test** – the procedure of determining/pinpointing leaks in a pressurized system
- 18) **Liquid Line Solenoid Valve** – electrically operated valve that shuts-off the flow of the refrigerant to the evaporator
- 19) **MCC** – Motor Control Center
- 20) **MDP** – Main Distribution Panel
- 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) **PEC** – Philippine Electrical Code
- 23) **PHE** – Plate Heat Exchanger
- 24) **PLC** – Programmable Logic Controller
- 25) **PMC** – Philippine Mechanical Code
- 26) **PPE** – Personal Protective Equipment
- 27) **P&ID** – Piping & Instrumentation Diagram
- 28) **Pressure Test** – a procedure whereby pressure is applied to the piping system, the purpose of which is to determine its soundness and stability
- 29) **Pull-out** – to remove from a place of installation
- 30) **Pump Down** - a process of using the compressor to pump and contain all the refrigerant charge into the condenser and/or receiver
- 31) **Pump Out** – a process of using a separate compressor to contain all the refrigerant charge into the pressure vessel.
- 32) **Refrigerant Charging** – the process of introducing into the system the proper amount of refrigerant
- 33) **SCADA** – Supervisory Control and Data Acquisition
- 34) **SCBA** – Self-contained Breathing Apparatus

- 35) **SLD** – Single Line Diagram
- 36) **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
- 37) **Troubleshoot** – the process of analyzing system defect or malfunction
- 38) **Vacuum** – pressure lower than atmospheric pressure measured in inches of mercury. Complete vacuum is 29.92 in. mercury or at least 500 microns mercury

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