

# **TRAINING REGULATIONS**

**for**

# **ELECTRICAL INSTALLATION & MAINTENANCE NC IV**



**CONSTRUCTION INDUSTRY  
ELECTRICAL SECTOR**

**TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY**

East Service Road, South Superhighway, Taguig City, Metro Manila

# TRAINING REGULATIONS

## CONSTRUCTION INDUSTRY - ELECTRICAL SECTOR ELECTRICAL INSTALLATION & MAINTENANCE NC IV

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# TRAINING REGULATIONS

FOR

## CONSTRUCTION INDUSTRY – ELECTRICAL SECTOR

### ELECTRICAL INSTALLATION & MAINTENANCE NC IV

#### 1.00 THE ELECTRICAL INSTALLATION & MAINTENANCE NC IV QUALIFICATION

**1.10 General Description.** The Electrical Installation & Maintenance NC IV qualification consists of a set of competencies that a candidate must achieve in order to obtain a national certificate for this qualification as specified by TESDA requirements. This particular set of competencies excludes core technical competencies required for related highly specialized vocational skilled workers such as linemen, substation technicians, electrical motors/generators repair technicians, etc. A candidate who has achieved all these competencies is qualified to be:

- a. Electrical Foreman, or
- b. Electrical Supervisor, or
- c. Supervising Technician

**1.20 Required Units of Competency.** The list of required units of competency for this qualification consisting of Basic Worker Competencies; (2) Common Construction Industry Competency; (3) Core Electrical Competency are summarized herein and are detailed in Section 2.00, Competency Standards:

<u>1.21 Basic Worker Units of Competency</u>	<u>Code No</u>
(1) Lead in utilizing specialized communication skills.	500311115
(2) Assist in developing teams and individuals.	500311116
(3) Apply problem solving techniques in the workplace.	500311117
(4) Collect, analyze and organize information.	500311118
(5) Plan and organize work for several working teams.	500311119
(6) Promote environmental protection	500311120
<u>1.22 Common Construction Industry Units of Competency</u>	<u>Code No</u>
(1) Supervise preparation of construction materials, tools and equipment for assigned tasks.	CON724201
(2) Ensure compliance with standard procedures, specifications and manuals of instructions.	CON311201
(3) Interpret and follow technical drawings and plans.	CON311202
(4) Supervise mensuration and related computations.	CON311203
(5) Supervise proper use and maintenance of tools and equipment.	CON311204

<u>1.23 Core Electrical Units of Competency</u>	<u>Code No.</u>
(1) Prepare Electric and hydraulic tools.	CON724308
(2) Perform roughing-in and wiring for activities for bus and underfloor ducts.	CON724309
(3) Perform installation of wiring devices for floor and ground fault current interrupting outlets.	CON724310
(4) Perform installation of standard electrical protection system for lightning and grounding.	CON724311
(5) Perform installation of electrical lighting systems, auxiliary outlets and lighting fixtures.	CON724312
(6) Perform installation of data measurement and control system on electrical and auxiliary equipment.	CON724319
(7) Assemble and install electrical lighting and motor control systems.	CON724320
(8) Perform maintenance and troubleshooting works.	CON724321
(9) Supervise/Monitor installation and maintenance on electrical systems, auxiliary including control, lighting, power and protection equipment.	CON724322
(10) Perform commissioning of electrical equipment/system.	CON724323
(11) Perform programming and installation of basic PLC systems.	CON724324

**Note:** *Units 1 to 5 are the core competencies under electrical Installation and Maintenance NC II. Units 1 to 8 of Core Electrical Competencies are equivalent to same competencies under Electrical Installation and Maintenance NC III. Hence, valid holders of these qualifications are not required demonstrate competence in these units.*

**1.30 Underpinning Skills, Knowledge and Competencies.** It is necessary to prove in accordance with TESDA Evidence Plans that the candidate for this qualification has adequate underpinning knowledge, skills and all competencies of Electrical Installation & Maintenance NC III, especially of (1) relevant provisions of RA 7920 (New Electrical Engineering Law) and the Philippine Electrical Code, (2) safety and health requirements, aside from the competencies of this qualification, (3) supervisory skills to accomplish the tasks specified in required core electrical competencies.

#### **1.40 Definition of Terms**

1.41 Technical Terms - All technical terms are used with meanings as defined in the latest published edition of the Philippine Electrical Code, in applicable laws, such as R.A. 7920 (The New Electrical Engineering Law), and current electrical engineering practice.

1.42 Other Terms - All other terms are used as defined in applicable TESDA documents.

**2.00 COMPETENCY STANDARDS**

**2.10 Basic Worker Competencies -** This section gives the details of Basic Worker Competencies including (1) Performance Criteria for Unit of Competency Elements; (2) Range of Variable Training Components; (3) Evidence Guide for Assessment required for ELECTRICAL INSTALLATION AND MAINTENANCE NC IV Qualification.

2.11 (1) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY: (1) LEAD IN UTILIZING SPECIALIZED COMMUNICATION SKILLS**

**UNIT CODE : 500311115**

**UNIT DESCRIPTOR :** This unit of Basic Worker Competency covers the knowledge, skills and attitudes required to use specialized communication skills to meet specific needs of internal clients, conduct interviews, facilitate group of discussions, and contribute to the development of communication strategies.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Meet common and specific communication needs of clients and colleagues	1.1 Specific communication needs of clients and colleagues are identified and met 1.2 Different approaches are used to meet communication needs of clients and colleagues 1.3 Conflict is addressed promptly and in a timely way and in a manner which does not compromise the standing of the organization

2. Contribute to the development of communication strategies	<p>2.1 <b>Strategies</b> for internal and external dissemination of information are developed, promoted, implemented and reviewed as required</p> <p>2.2 Channels of communication are established and reviewed regularly</p> <p>2.3 Coaching in effective communication is provided</p> <p>2.4 Work related network and relationship are maintained as necessary</p> <p>2.5 Negotiation and conflict resolution strategies are used where required</p> <p>2.6 Communication with clients and colleagues is appropriate to individual needs and organizational objectives</p>
ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
3. Represent the organization	<p>3.1 When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization</p> <p>3.2 Presentation is clear and sequential and delivered within a predetermined time</p> <p>3.3 Utilize appropriate media to enhance presentation</p> <p>3.4 Differences in views are respected</p> <p>3.5 Written communication is consistent with organizational standards</p> <p>3.6 Inquiries are responded in a manner consistent with organizational standard</p>
4. Facilitate group discussion	<p>4.1 Mechanisms which enhance effective group interaction is defined and implemented</p> <p>4.2 Strategies which encourage all group members to participate are used routinely</p> <p>4.3 Objectives and agenda for meetings and discussions are routinely set and followed</p> <p>4.4 Relevant information is provided to group to facilitate outcomes</p> <p>4.5 Evaluation of group communication strategies is undertaken to promote participation of all parties</p> <p>4.6 Specific communication needs of individuals are identified and addressed</p>

5. Conduct interview	5.1 A range of appropriate communication strategies are employed in interview situations 5.2 Records of interviews are made and maintained in accordance with organizational procedures 5.3 Effective questioning, listening and nonverbal communication techniques are used to ensure that required message is communicated.
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**2.12 (1) Range of Variable Training Components**

<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
1. Strategies	1.1 Recognizing own limitations 1.2 Referral to specialists 1.3 Utilizing techniques and aids 1.4 Providing written drafts 1.5 Verbal and non verbal communication
<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
2. Effective group interaction	2.1 Identifying and evaluating what is occurring within an interaction in a non judgmental way 2.2 Using active listening 2.3 Making decision about appropriate words, behavior 2.4 Putting together response which is culturally appropriate 2.5 Expressing an individual perspective 2.6 Expressing own philosophy, ideology and background and exploring impact with relevance to communication
3. Types of Interview	3.1 Related to staff issues 3.2 Routine 3.3 Confidential 3.4 Evidential 3.5 Non disclosure 3.6 Disclosure
4. Interview situations	4.1 Establish rapport 4.2 Elicit facts and information

- 4.3 Facilitate resolution of issues
- 4.4 Develop action plans
- 4.5 Diffuse potentially difficult situation

2.13 (1) Evidence Guide for Assessment

<b>ASPECTS OF COMPETENCY</b>	<b>ASSESSMENT EVIDENCE REQUIREMENTS</b>
1. Critical aspects of Competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> <li>1.1 Demonstrated effective communication skills with clients accessing service and work colleagues</li> <li>1.2 Adopted relevant communication techniques and strategies to meet client particular needs and difficulties</li> </ul>
2. Underpinning Knowledge	<ul style="list-style-type: none"> <li>2.1 Communication process</li> <li>2.2 Dynamics of groups and different styles of group leadership</li> <li>2.3 Communication skills relevant to client groups</li> </ul>
<b>ASPECTS OF COMPETENCY</b>	<b>ASSESSMENT EVIDENCE REQUIREMENTS</b>
3. Underpinning Skills	<ul style="list-style-type: none"> <li>3.1 Full range of communication techniques including:               <ul style="list-style-type: none"> <li>3.1.1 Full range of communication</li> <li>3.1.2 Active listening</li> <li>3.1.3 Feedback</li> <li>3.1.4 Interpretation</li> <li>3.1.5 Role boundaries setting</li> <li>3.1.6 Negotiation</li> <li>3.1.7 Establishing empathy</li> </ul> </li> <li>3.2 Communication skills required to fulfill job roles as specified by the organization</li> </ul>
4. Resource Implications	4.1 Access to appropriate workplace where assessment can take place
5. Methods of Assessment	Competency may be assessed through <ul style="list-style-type: none"> <li>5.1 Direct observation</li> <li>5.2 Oral Interview</li> </ul>
6. Context for Assessment	6.1 This unit should be assessed on the job through simulation

2.11 (2) Performance Criteria for Unit of Competency Elements



**UNIT OF COMPETENCY : (2) ASSIST IN DEVELOPING TEAMS AND INDIVIDUALS**

**UNIT CODE : 500311116**

**UNIT DESCRIPTOR** : This unit of Basic Worker Competency covers the skills, knowledge and attitudes required to determine individual and team development needs and facilitate the development of the workgroup.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Provide team leadership	1.1. <b>Learning and development needs</b> are systematically identified and implemented in line with <b>organizational requirements</b> 1.2. Learning plan to meet individual and group training and developmental needs is collaboratively developed and implemented 1.3. Individuals are encouraged to self evaluate performance and identify areas for improvement 1.4. <b>Feedback on performance</b> of team members is collected from relevant sources and compared with established team learning process
<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
2. Foster individual and organizational growth	2.1. Learning and development program goals and objectives are identified to match the specific knowledge and skills requirements of competency standards 2.2. <b>Learning delivery methods</b> are appropriate to the learning goals, the learning style of participants and availability of equipment and resources 2.3. Workplace learning opportunities and coaching/mentoring assistance are provided to facilitate individual and team achievement of competencies 2.4. Resources and timelines required for learning activities are identified and approved in accordance with organizational requirements
3. Monitor and evaluate workplace learning	3.1. Feedback from individuals or teams is used to identify and implement improvements in future learning arrangements 3.2. Outcomes and performance of individuals/teams are assessed and recorded to determine the effectiveness of development programs and the extent of additional support

	<p>3.3. Modifications to learning plans are negotiated to improve the efficiency and effectiveness of learning</p> <p>3.4. Records and reports of competency are maintained within organizational requirement</p>
<p>4. Develop team commitment and cooperation</p>	<p>4.1. Open communication processes to obtain and share information is used by team</p> <p>4.2. Decisions are reached by the team in accordance with its agreed roles and responsibilities</p> <p>4.3. Mutual concern and camaraderie are developed in the team</p>
<p>5. Facilitate accomplishment of organizational goals</p>	<p>5.1. Team members actively participated in team activities and communication processes</p> <p>5.2. Teams members developed individual and joint responsibility for their actions</p> <p>5.3. Collaborative efforts are sustained to attain organizational goals</p>

2.12 (2) Range of Variable Training Components

<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
<p>1. Learning and development needs</p>	<p>1.1 Coaching, mentoring and/or supervision</p> <p>1.2 Formal/informal learning program</p> <p>1.3 Internal/external training provision</p> <p>1.4 Work experience/exchange/opportunities</p> <p>1.5 Personal study</p> <p>1.6 Career planning/development</p> <p>1.7 Performance appraisals</p> <p>1.8 Workplace skills assessment</p> <p>1.9 Recognition of prior learning</p>

<p>2. Organizational requirements</p>	<p>2.1 Quality assurance and/or procedures manuals                  2.2 Goals, objectives, plans, systems and processes                  2.3 Legal and organizational policy/guidelines and requirements                  2.4 Safety policies, procedures and programs                  2.5 Confidentiality and security requirements                  2.6 Business and performance plans                  2.7 Ethical standards                  2.8 Quality and continuous improvement processes and standards</p>
<p>3. Feedback on performance</p>	<p>3.1 Formal/informal performance appraisals                  3.2 Obtaining feedback from supervisors and colleagues                  3.3 Obtaining feedback from clients                  3.4 Personal and reflective behavior strategies                  3.5 Routine and organizational methods for monitoring service delivery</p>
<p>4. Learning delivery methods</p>	<p>4.1 On the job coaching or mentoring                  4.2 Problem solving                  4.3 Presentation/demonstration                  4.4 Formal course participation                  4.5 Work experience                  4.6 Involvement in professional networks                  4.7 Conference and seminar attendance                  4.8 Induction</p>

2.13 (2) Evidence Guide for Assessment

<p><b>ASPECTS OF COMPETENCY</b></p>	<p><b>ASSESSMENT EVIDENCE REQUIREMENTS</b></p>
<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:                  1.1. Identified and implemented learning opportunities for others                  1.2. Gave and received feedback constructively                  1.3. Facilitated participation of individuals in the work of the team                  1.4. Negotiated learning plans to improve the effectiveness of learning                  1.5. Prepared learning plans to match skill needs                  1.6. Accessed and designated learning opportunities</p>

<p>2. Underpinning Knowledge</p>	<p>2.1. Coaching and mentoring principles                  2.2. Understanding how to work effectively with team members who have diverse work styles, aspirations, cultures and perspective                  2.3. Understanding how to facilitate team development and improvement                  2.4. Understanding methods and techniques for eliciting and interpreting feedback                  2.5. Understanding methods for identifying and prioritizing personal development opportunities and options                  2.6. Knowledge of career paths and competency standards in the industry</p>
<p>3. Underpinning Skills</p>	<p>3.1. Ability to read and understand a variety of texts, prepare general information and documents according to target audience; spell with accuracy; use grammar and punctuation effective relationships and conflict management                  3.2. Communication skills including receiving feedback and reporting, maintaining effective relationships and conflict management                  3.3. Planning skills to organize required resources and equipment to meet learning needs                  3.4. Coaching and mentoring skills to provide support to colleagues                  3.5. Reporting skills to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes                  3.6. Facilitation skills to conduct small group training sessions                  3.7. Ability to relate to people from a range of social, cultural, physical and mental backgrounds</p>
<p>ASPECTS OF COMPETENCY</p>	<p>ASSESSMENT EVIDENCE REQUIREMENTS</p>
<p>4. Resource Implications</p>	<p>The following resources <b>MUST</b> be provided:                  4.1. Access to relevant workplace or appropriately simulated environment where assessment can take place                  4.2. Materials relevant to the proposed activity or tasks</p>

<p>5. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <p>5.1. Observation of work activities of the individual member in relation to the work activities of the group</p> <p>5.2. Observation of simulation and or role play involving the participation of individual member to the attainment of organizational goal</p> <p>5.3. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork</p>
<p>6. Context for Assessment</p>	<p>6.1. Competency may be assessed in workplace or in a simulated workplace setting</p> <p>6.2. Assessment shall be observed while task are being undertaken whether individually or in-group</p>

2.11 (3) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY: (3) APPLY PROBLEM SOLVING TECHNIQUES IN THE WORKPLACE**

**UNIT CODE : 500311117**

**UNIT DESCRIPTOR :** This Unit of Basic Worker Competency covers the knowledge, skills and attitudes required to apply the process of problem solving and other problems beyond those associated directly with the process unit. It includes the application of structured processes and improvement tools. This competency is typically performed by an experienced technician, team leader or supervisor.

<p><b>ELEMENT</b></p>	<p><b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components</p>
<p>1. Analyze the problem</p>	<p>1.1. Issues/concerns are evaluated based on data gathered</p> <p>1.2. Possible causes of problem are identified within the <b>area of responsibility</b> as based on experience and the use of problem solving tools/analytical techniques</p> <p>1.3. Possible cause statements are developed based on findings</p>
<p><b>ELEMENT</b></p>	<p><b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components</p>
<p>2. Identify possible solutions</p>	<p>2.1 All possible options are considered for resolution of the problem in accordance with <b>safety</b> and operating procedures</p> <p>2.2 Strengths and weaknesses of possible options are considered</p> <p>2.3 Corrective action is determined to resolve the problem</p>

	and its possible future causes
3. Recommend solution to higher management	3.1 Report/ <b>communication</b> or <b>documentation</b> are prepared 3.2 Recommendations are presented to appropriate personnel 3.3 Recommendations are followed-up, if required
4. Implement solution	4.1 Measurable objectives are identified 4.2 Resource needs are identified 4.3 Timelines are identified in accordance with plan
5. Evaluate/Monitor results and outcome	5.1. Processes and improvements are identified based on evaluative assessment of problem 5.2. Recommendations are prepared and submitted to superiors.

2.12 (3) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Area of responsibility	Variables may include but are limited to: 1.1. Work environment 1.2. Problem solution processes 1.3. Preventative maintenance and diagnostic policy 1.4. Roles and technical responsibilities
2. Occupational Health and Safety	2.1. As per company, statutory and vendor requirements, ergonomic and environmental factors must be considered during the demonstration of this competency.
3. Communication	3.1. Variables may include but are not limited to: 3.2. Written communication can involve both hand written and printed material, internal memos, electronic mail, briefing notes and bulletin boards.
4. Documentation	4.1. Audit trails 4.2. Naming standards 4.3. Version control

2.12 (3) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1. Analyzed the problem</li> <li>1.2. Identified possible solutions</li> <li>1.3. Implemented solutions</li> <li>1.4. Recommended solutions to higher management</li> <li>1.5. Outcome evaluated/monitored</li> </ul> <p>Evidence of satisfactory performance in this unit can be obtained by observation of performance and questioning to indicate knowledge and understanding of the elements of the competency and performance criteria.</p>
<p>2. Underpinning Knowledge</p>	<ul style="list-style-type: none"> <li>2.1. Broad understanding of systems, organizational systems and functions</li> <li>2.2. Broad knowledge of help desk and maintenance practices</li> <li>2.3. Current industry accepted hardware and software products with broad and detailed knowledge of its general features and capabilities</li> <li>2.4. Broad knowledge of the operating system</li> <li>2.5. Broad knowledge of the client business domain</li> <li>2.6. Broad knowledge based incorporating current industry practices related to escalation procedures</li> <li>2.7. Broad knowledge based of diagnostic tools</li> <li>2.8. General principles of OHS</li> <li>2.8. Divisional/unit responsibilities</li> </ul>

<p><b>ASPECTS OF COMPETENCY</b></p>	<p><b>ASSESSMENT EVIDENCE REQUIREMENTS</b></p>
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<p>3. Underpinning Skills</p>	<p>3.1. Decision making within a limited range of options.</p> <p>3.2. Communication is clear, precise and varies according to the type of audience</p> <p>3.3. Teamwork in reference to personal responsibility</p> <p>3.4. Time management as applied to self-management.</p> <p>3.5. Analytical skills in relation to routine malfunctions.</p> <p>3.6. General customer service skills displayed.</p> <p>3.7. Questioning and active listening is employed to clarify general information</p>
<p>4. Resource Implications</p>	<p>4.1. Assessment will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability over a range of situations. A bank of scenarios/case studies/what ifs will be required as well as bank of questions which will be used to probe the reasoning behind the observable actions.</p>
<p>5. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <p>5.1. Through direct observation of application to tasks and questions related to underpinning knowledge</p> <p>Under general guidance, checking various stages of operation and at the completion of the activity against performance criteria and specifications</p>
<p>6. Context for Assessment</p>	<p>6.1. Competency may be assessed in the work place or in a simulated work place setting</p> <p>6.2. Assessment shall be carried out through TESDA's Accredited Assessment Centers/Venues while tasks are undertaken either individually or as part of a team under limited supervision</p>



**UNIT OF COMPETENCY : (4) COLLECT, ANALYZE AND ORGANIZE INFORMATION**

**UNIT CODE : 500311118**

**UNIT DESCRIPTOR** : This unit of Basic Worker Competency covers the outcomes required to process, analyze, interpret and organize workplace information and other relevant data.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Study information requirements	1.1 Needs are identified using established research procedures 1.2 Relevant forms and recording systems are used to gather the information. 1.3 Respondents are selected to implement survey / research based on established procedures.
2. Process data	2.1 Data are collected and collated based on the prescribed method. 2.2 Relevant data are used as references in accordance with the objectives of the program. 2.3 Information is compiled according to the required form.
3. Analyze, interpret and organize information gathered	3.1 Data are analyzed using relevant methodologies 3.2 Where applicable, statistical analysis/methods are employed according to the objectives of the program 3.3 Graphs and other visual presentations are prepared to facilitate analysis / interpretation of information
4. Present findings/ recommendations	4.1 Findings/recommendations summarized and presented/packaged in user-friendly manner 4.2 Relevant inputs gathered to finalize report 4.3 Draft report prepared based on standard format. 4.4 Technical reports are submitted and disseminated to concerned offices.

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Research procedures	May include but are not limited to: 1.1 TNA 1.2 Front-end analysis 1.3 Surveys 1.4 Interviews 1.5 Functional analysis 1.6 DACUM research
2. Forms	May include but are not limited to: 2.1 Survey forms/Questionnaires 2.2 Personal information/Profile 2.3 Accident report form 2.4 Requisition slip 2.5 Job orders 2.6 Purchase request form 2.7 Incident report form
3. Methodologies	3.1 Qualitative methods 3.2 Quantitative methods
4. Statistical analysis/methods	4.1. Averages (Mean, Median, Mode) 4.2. Percentage 4.3. Ranks 4.4. Frequency Distribution 4.5. Statistical test
5. Data	5.1. Raw Data
6. Information	6.1. Processed and packaged data

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical Aspects of Competency	Assessment requires evidence that the candidate 1.1 Determined information requirements based on organizational goals and objectives. 1.2 Used relevant forms and recording systems to gather data 1.3 Processed data based on the objectives of the program 1.4 Utilized relevant research methods based on the objective of the program 1.5 Analyzed and organized information gathered 1.6 Submitted/Disseminated technical reports to concerned offices
2. Underpinning Knowledge	2.1 Data processing, Information analysis and interpretation 2.2 Research methods 2.2.1 Qualitative 2.2.2 Quantitative 2.2.3 Statistical 2.3 Report writing 2.4 Use of relevant software 2.4.1 Spreadsheets 2.4.2 Presentation graphics 2.4.3 Work processor 2.4.4 Statistical package
3. Underpinning Skills	3.1 Communicating effectively 3.2 Performing research and analysis 3.3 Reading / interpreting data and information 3.4 Problem solving
4. Resource Implications	The following resources <b>MUST</b> be provided: 4.1 Workplace or assessment location 4.2 Access to office equipment and facilities relevant to the unit 4.3 Case studies/scenarios
5. Methods of Assessment	Competency may be assessed through: 5.1 Written/ Oral Examination 5.2 Interviews 5.3 Portfolio
6. Context for Assessment	6.1 Competency may be assessed in actual workplace or TESDA Accredited Assessment Center

**UNIT OF COMPETENCY : (5) PLAN AND ORGANIZE WORK FOR SEVERAL WORKING TEAMS**

**UNIT CODE : 500311119**

**UNIT DESCRIPTOR :** This unit of Basic Worker Competency covers the outcomes required in planning and organizing work. It may be applied to a small independent operation or to a section of a large organization.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Set objectives	1.1 <b>Objectives</b> are consistent with and linked to work activities in accordance with organizational aims 1.2 Objectives are stated as measurable targets with clear time frames 1.3 Support and commitment of team members are reflected in the objectives 1.4 Realistic and attainable objectives are identified
2. Plan and schedule work activities	2.1 Tasks/work activities to be completed are identified and prioritized as directed 2.2 Tasks/work activities are broken down into steps in accordance with set time frames achievable components in accordance with set time frames 2.3 Resources are allocated as per requirements of the activity 2.4 Schedule of work activities is coordinated with personnel concerned
3. Implement work plans	3.1 Work methods and practices are identified in consultation with personnel concerned 3.2 Work plans are implemented in accordance with set time frames, resources and standards
4. Monitor work activities	4.1 Work activities are monitored and compared with set objectives 4.2 Work performance is monitored 4.3 Deviations from work activities are reported and recommendations are coordinated with appropriate personnel and in accordance with set standards 4.4 Reporting requirements are complied with in accordance with recommended format 4.5 Observe timeliness of report 4.6 Files are established and maintained in accordance with standard operating procedures

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
5. Review and evaluate work plans and activities	5.1 Work plans, strategies and implementation are reviewed based on accurate, relevant and current information 5.2 Review is based on comprehensive consultation with appropriate personnel on outcomes of work plans and reliable feedback 5.3 Results of review are provided to concerned parties and formed as the basis for adjustments/simplifications to be made to policies, processes and activities 5.4 Performance appraisal is conducted in accordance with organization rules and regulations 5.5 Performance appraisal report is prepared and documented regularly as per organization requirements. 5.6 Recommendations are prepared and presented to <b><i>appropriate personnel/authorities</i></b> 5.7 <b><i>Feedback mechanisms</i></b> are implemented in line with organization policies

2.12 (5) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Objectives	1.1. Specific 1.2. General
2. Resources	2.1. Personnel 2.2. Equipment and technology 2.3. Services 2.4. Supplies and materials 2.5. Sources for accessing specialist advice 2.6. Budget
3. Schedule of work activities	3.1. Daily 3.2. Work-based 3.3. Contractual 3.4. Regular 3.5. Confidential 3.6. Disclosure 3.7. Non-disclosure

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
4. Work methods and practices	4.1. Work methods and practices may include but not limited to: 4.2. Legislated regulations and codes of practice 4.3. Industry regulations and codes of practice 4.4. Occupational health and safety practices
5. Work plans	5.1. Daily work plans 5.2. Project plans 5.3. Program plans 5.4. Organization strategic and restructuring plans 5.5. Resource plans 5.6. Skills development plans 5.7. Management strategies and objectives
6. Standards	6.1. Performance targets 6.2. Performance management and appraisal systems 6.3. National competency standards 6.4. Employment contracts 6.5. Client contracts 6.6. Discipline procedures 6.7. Workplace assessment guidelines 6.8. Internal quality assurance 6.9. Internal and external accountability and auditing requirements 6.10. Training Regulation Standards 6.11. Safety Standards
7. Appropriate personnel/authorities	7.1. Appropriate personnel include: 7.2. Management 7.3. Line Staff
8. Feedback mechanisms	8.1. Feedback mechanisms include: 8.2. Verbal feedback 8.3. Informal feedback 8.4. Formal feedback 8.5. Questionnaire 8.6. Survey 8.7. Group discussion

2.13 (5) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of Competency	Assessment requires evidence that the candidate: <ol style="list-style-type: none"> <li>1.1. Set objectives</li> <li>1.2. Planned and scheduled work activities</li> <li>1.3. Implemented work plans</li> <li>1.4. Monitored work activities</li> <li>1.5. Reviewed and evaluated work plans and activities</li> </ol>
2. Underpinning Knowledge	<ol style="list-style-type: none"> <li>2.1. Organization's strategic plan, policies rules and regulations, laws and objectives for work unit activities and priorities</li> <li>2.2. Organizations policies, strategic plans, guidelines related to the role of the work unit</li> <li>2.3. Team work and consultation strategies</li> </ol>
3. Underpinning Skills	<ol style="list-style-type: none"> <li>3.1. Planning</li> <li>3.2. Leading</li> <li>3.3. Organizing</li> <li>3.4. Coordinating</li> <li>3.5. Communication Skills</li> <li>3.6. Inter-and intra-person/motivation skills</li> <li>3.7. Presentation skills</li> </ol>
4. Resource Implications	The following resources <b>MUST</b> be provided <ol style="list-style-type: none"> <li>4.1. Tools, equipment and facilities appropriate to the proposed activities</li> <li>4.2. Materials relevant to the proposed activities</li> <li>4.3. Work plan schedules</li> <li>4.4. Drawings, sketches or blueprint</li> </ol>
5. Methods of Assessment	Competency may be assessed through: <ol style="list-style-type: none"> <li>5.1. Direct observation/questioning</li> <li>5.2. Practical exercises on Planning and Scheduling Work Activities</li> <li>5.3. Third Party Report (collection of competency evidence)</li> </ol>
6. Context for Assessment	<ol style="list-style-type: none"> <li>6.1. Competency may be assessed in the workplace or in simulated work</li> </ol>

2.11 (6) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY : (6) PROMOTE ENVIRONMENTAL PROTECTION**

**UNIT CODE : 500311120**

**UNIT DESCRIPTOR :** This unit of Basic Worker Competency covers the knowledge, skills and attitudes required in adhering to environmental protection principles, strategies and-guidelines

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Study guidelines for environmental concerns.	1.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact. 1.2 Industrial standard/environmental practices are described according to the different environmental concerns.
2. Implement specific environmental programs.	2.1 Programs/Activities are identified according to organizations policies and guidelines. 2.2 Individual roles/responsibilities are determined and performed based on the activities identified. 2.4 Problems/ constraints encountered are resolved in accordance with organizations’ policies and guidelines 2.5 Stakeholders are consulted based on company guidelines.
3. Monitor activities on environmental protection /programs	3.1 Activities are periodically monitored and evaluated according to the objectives of the environmental program 3.2 Feedback from stakeholders are gathered and considered in proposing enhancements to the program based on consultations 3.3 Data gathered are analyzed based on evaluation requirements 3.4 Recommendations are submitted based on the findings. 3.5 Management support systems are set/established to sustain and enhance the program 3.6 Environmental incidents are monitored and reported to concerned/proper authorities



2.12 (6) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Legislations/Conventions	May include but are not limited to: 1.1 Clean Air act 1.2 Clean Water Act 1.3 Solid Waste Management 1.4 Montreal Protocol 1.5 Kyoto Protocol
2. Environmental aspects/impacts	2.1 Air pollution 2.2 Water pollution 2.3 Noise pollution 2.4 Solid waste 2.5 Flood control 2.6 Deforestation/Denudation Radiation/Nuclear /Radio Frequency/ Microwaves 2.8 Situation 2.9 Soil erosion (e.g. Quarrying, Mining, etc.) 2.10 Coral reef/marine life protection
3. Industrial standards/ Environmental practices	3.1 ECC standards 3.2 ISO standards 3.3 company environmental management systems (EMS)
4. Periodic	4.1 hourly 4.2 daily 4.3 weekly 4.4 monthly 4.5 quarterly 4.6 yearly
5. Programs/Activities	5.1 Waste disposal (on-site and off-site) 5.2 Repair and maintenance of equipment 5.3 Treatment and disposal operations 5.4 Clean-up activities 5.5 Laboratory and analytical test 5.6 Monitoring and evaluation 5.7 Environmental advocacy programs

2.13 (6) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of Competency	Assessment requires evidence that the candidate: <ol style="list-style-type: none"> <li>1.1 Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues/concerns.</li> <li>1.2 Described industrial standard environmental practices according to the different environmental issues/concerns.</li> <li>1.3 Resolved problems/ constraints encountered based on management standard procedures</li> <li>1.4 Implemented and monitored environmental practices on a periodic basis as per company guidelines</li> <li>1.5 Recommended solutions for the improvement of the program</li> <li>1.6 Monitored and reported to proper authorities any environmental incidents</li> </ol>
2. Underpinning Knowledge	<ol style="list-style-type: none"> <li>2.1 Features of an environmental management strategy</li> <li>2.2 Environmental issues/concerns</li> <li>2.3 International Environmental Protocols (Montreal, Kyoto)</li> <li>2.4 Waste minimization hierarchy</li> <li>2.5 Environmental planning/management</li> <li>2.6 Community needs and expectations</li> <li>2.7 Resource availability</li> <li>2.8 Environment-friendly/environmental advocates</li> <li>2.9 5S of Good Housekeeping</li> <li>2.10 3Rs – Reduce, Reuse &amp; Recycle</li> <li>2.11 Sanitary Code</li> <li>2.12 Environmental Code of practice</li> </ol>
3. Underpinning Skills	<ol style="list-style-type: none"> <li>3.1 Communicating effectively</li> <li>3.2 Performing research and analysis</li> <li>3.3 Reading / interpreting data and information</li> <li>3.4 Problem solving</li> </ol>
4. Resource Implications	The following resources <b>MUST</b> be provided: <ol style="list-style-type: none"> <li>4.1 Workplace/Assessment location</li> <li>4.2 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection</li> <li>4.3 Case studies/scenarios relating to environmental protection</li> </ol>
5. Methods of Assessment	Competency may be assessed through: <ol style="list-style-type: none"> <li>5.1 Written/ Oral Examination</li> <li>5.2 Interview/Third Party Reports</li> <li>5.3 Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad)</li> <li>5.4 Simulations and role-plays</li> </ol>
6. Context for Assessment	<ol style="list-style-type: none"> <li>6.1 Competency may be assessed in actual workplace or at the designated TESDA center.</li> </ol>

**2.20 Common Construction Industry Competencies**

2.21 (1) Performance Criteria for Unit of Competency Elements - This section gives the details of Common Construction Industry Competencies including (1) Performance Criteria for Unit of Competency Elements; (2) Range of Variable Training Components; (3) Evidence Guide for Assessment required for ELECTRICAL INSTALLATION AND MAINTENANCE NC IV Qualification.

**UNIT OF COMPETENCY: (1) SUPERVISE PREPARATION OF CONSTRUCTION MATERIALS, TOOLS AND EQUIPMENT FOR ASSIGNED TASKS.**

**UNIT CODE : CON724201**

**UNIT DESCRIPTOR :** This unit of Common Construction Industry Competency covers the knowledge, skills and attitudes on identifying, requesting and receiving construction materials and tools based on the required performance standards.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Identify materials	1.1 Materials are listed as per job requirements 1.2 Quantity and description of materials conform with the job requirements 1.3 Tools and accessories are identified according to job requirements
2. Requisition materials	2.1 Materials and tools needed are requested according to the list prepared 2.2 Request is done as per company standard operating procedures (SOP) 2.3 Substitute materials and tools are provided without sacrificing cost and quality of work
3. Receive and inspect materials	3.1 Materials and tools issued are inspected as per quantity and specification 3.2 Tools, accessories and materials are checked for damages according to enterprise procedures 3.3 Materials and tools are set aside to appropriate location nearest to the workplace

2.22 (1) Range of Variable Training Components

<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
1. Materials and Tools	1.1 Electrical supplies 1.2 Structural 1.3 Plumbing 1.4 Welding/pipefitting 1.5 Carpentry 1.6 Masonry
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

2.23 (1) Evidence Guide for Assessment

<b>ASPECTS OF COMPETENCY</b>	<b>ASSESSMENT EVIDENCE REQUIREMENTS</b>
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 SOP 1.3 Inspected issued materials and tools as per quantity and job specifications 1.4 Tools provided with appropriate safety devices
2. Underpinning knowledge	2.1 Types and uses of construction materials and tools 2.2 Different forms 2.3 Requisition procedures
3. Underpinning skills	3.1 Preparing materials and tools 3.2 Proper handling of tools and equipment 3.3 Following instructions
4. Resource implications	The following resources should be provided: 4.1 Workplace location 4.2 Materials relevant to the unit of competency 4.3 Technical plans, drawings and specifications relevant to the activities

<b>ASPECTS OF COMPETENCY</b>	<b>ASSESSMENT EVIDENCE REQUIREMENTS</b>
5. Methods of assessment	Competency in this unit must be assessed through: 5.1 Direct observation and oral questioning
6. Context of assessment	6.1 Competency may be assessed in the workplace or in a simulated workplace 6.2 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines
<p style="text-align: center;">2.21 (2) <u>Performance Criteria for Unit of Competency Elements</u></p> <p><b>UNIT OF COMPETENCY:</b>   <b>(2) ENSURE COMPLIANCE WITH STANDARD PROCEDURES, SPECIFICATIONS AND MANUALS OF INSTRUCTIONS.</b></p> <p><b>UNIT CODE</b>                    <b>:</b>   <b>CON311201</b></p> <p><b>UNIT DESCRIPTOR</b>        <b>:</b>   This unit of Common Construction Industry Competency covers the knowledge, skills and attitudes on identifying, interpreting, applying services to specifications and manuals and storing manuals.</p>	
<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
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 are checked to ensure that correct specification and procedures are identified
2. Interpret manuals	2.1 Relevant sections, chapters of specifications/ manuals are located in relation to the work to be conducted 2.2 Information and procedure in the manual are interpreted in accordance with industry practices

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
3. Apply information in manual	3.1 Manual is interpreted according to job requirements 3.2 Work steps are correctly identified in accordance with manufacturer's specification 3.3 Manual data are applied according to the given task 3.4 All correct sequencing and adjustments are interpreted in accordance with information contained on the manual or specifications
4. Store manuals	4.1 Manual or specification is stored appropriately to prevent damage, ready access and updating of information when required in accordance with company requirements

2.22 (2) Range of Variable Training Components

<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
1. Procedures, Specifications and Manuals of Instructions	Kinds of Manuals: 1.1 Manufacturer's Specification Manual 1.2 Repair Manual 1.3 Maintenance Procedure Manual 1.4 Periodic Maintenance Manual

2.23 (2) Evidence Guide for Assessment

<b>ASPECTS OF COMPETENCY</b>	<b>ASSESSMENT EVIDENCE REQUIREMENTS</b>
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 with industry practices 1.3 Applied information in manuals according to the given task 1.4 Stored manuals in accordance with company requirements
2. Underpinning knowledge	2.1 Types of manuals used in construction sector 2.2 Identification of symbols used in the manuals 2.3 Identification of units of measurements 2.4 Unit conversion

<b>ASPECTS OF COMPETENCY</b>	<b>ASSESSMENT EVIDENCE REQUIREMENTS</b>
3. Underpinning skills	3.1 Reading and comprehension skills required to identify and interpret construction manuals and specifications 3.2 Accessing information and data
4. Resource implications	The following resources should be provided: 4.1 All manuals/catalogues relative to construction sector
5. Methods of assessment	Competency should be assessed through: 5.1 Direct observation 5.2 Questions/interview  Assessment of underpinning knowledge and practical skills may be combined
6. Context of assessment	6.1 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines 6.2 Assessment may be conducted in the workplace or a simulated environment

2.21 (3) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY: (3) INTERPRET AND FOLLOW TECHNICAL DRAWINGS AND PLANS**

**UNIT CODE : CON311202**

**UNIT DESCRIPTOR :** This unit of Common Construction Industry Competency covers the knowledge, skills and attitudes on analyzing and interpreting symbols, data and work plan based on the required performance standards.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Analyze signs, symbols and data	1.1 Technical plans are obtained according to job requirements 1.2 Signs, symbols and data are identified according to job specifications 1.3 Signs symbols and data are determined according to classification or as appropriate in drawing
2. Interpret technical drawings and plans	2.1 Necessary tools, materials and equipment are identified according to the plan

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables Training Components
	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 and in line with job requirements 2.6 Work plan is drawn following the specifications
3. Apply freehand sketching	3.1 Where applicable, correct freehand sketching is produced in accordance with the job requirements
2.21 (3) <u>Range of Variable Training Components</u>	
<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
1. Technical plans	Including but not limited to: 1.1 Electrical plans 1.2 Structural plans 1.3 Architectural plans 1.4 Plumbing plans 1.5 Welding Procedures Specifications (WPS)
2. Work plan	2.1 Job requirements 2.2 Installation instructions 2.3 Components instruction
3. Classification	Including but not limited to: 3.1 Electrical 3.2 Mechanical 3.3 Plumbing
4. Drawing	4.1 Drawing symbols 4.2 Alphabet of lines 4.3 Orthographic views <ul style="list-style-type: none"> <li>- Front view</li> <li>- Right side view/left side view</li> <li>- Top view</li> <li>- Pictorial</li> </ul> 4.4 Schematic diagram 4.5 Electrical drawings 4.6 Structural drawings 4.7 Plumbing drawings



VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
	<ul style="list-style-type: none"> <li>- Water</li> <li>- Sewerage/Drainage</li> <li>- Ventilation</li> </ul> 4.8 Welding symbols
5. Tools and materials	Including but not limited to: <ul style="list-style-type: none"> <li>5.1 Compass</li> <li>5.2 Divider</li> <li>5.3 Rulers</li> <li>5.4 Triangles</li> <li>5.5 Drawing tables</li> <li>5.6 Computer</li> </ul>

2.23 (3) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires that the candidate: <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 Determined job specifications based on working/technical drawing</li> </ul>
2. Underpinning knowledge	<b>2.1 TRADE MATHEMATICS</b> <ul style="list-style-type: none"> <li>• Linear measurement</li> <li>• Dimension</li> <li>• Unit conversion</li> </ul> <b>2.2 BLUEPRINT READING AND PLAN SPECIFICATION</b> <ul style="list-style-type: none"> <li>• Electrical, mechanical plan, symbols and abbreviations</li> <li>• Drawing standard symbols</li> </ul> <b>2.3 TRADE THEORY</b> <ul style="list-style-type: none"> <li>• Basic technical drawing</li> <li>• Types technical plans</li> <li>• Various types of drawings</li> <li>• Notes and specifications</li> </ul>
3. Underpinning skills	<ul style="list-style-type: none"> <li>3.1 Interpreting drawing/orthographic drawing</li> <li>3.2 Interpreting technical plans</li> <li>3.3 Matching specification details with existing resources</li> <li>3.4 Following instructions</li> <li>3.5 Handling of drawing instruments</li> </ul>

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
4. Resource implications	The following resources should be provided: 4.1 Workplace 4.2 Drawings and specification relevant to task 4.3 Materials and instrument relevant to proposed activity
5. Methods of assessment	Competency should be assessed through: 5.1 Direct observation 5.2 Questions/interview 5.3 Written test related to underpinning knowledge
6. Context of assessment	6.1 Competency assessment may occur in the workplace or in any appropriate simulated environment 6.2 Assessment shall be observed while task are being undertaken whether individually or in group 6.3 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

2.21 (4) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY: (4) SUPERVISE MENSURATION AND RELATED COMPUTATIONS.**

**UNIT CODE : CON311203**

**UNIT DESCRIPTOR :** This unit of Common Construction Industry Competency covers the knowledge, skills and attitudes on identifying and measuring objects based on the required performance standards.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variable Training Components
1. Select measuring instruments	1.1 Object or component to be measured is identified, classified and interpreted according to the appropriate regular <b>geometric shape</b> 1.2 Measuring tools are selected/identified as per object to be measured or job requirements 1.3 Correct specifications are obtained from relevant sources 1.4 Appropriate measuring instruments are selected according to job requirements 1.5 Alternative measuring tools are used without sacrificing cost and quality of work
2. Carry out measurements and calculations	2.1 Accurate <b>measurements</b> are obtained according to job requirements 2.3 Alternative measuring tools are used without sacrificing cost and quality of work 2.4 <b>Calculation</b> needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x) and division

	<p>(/) including but not limited to: trigonometric functions, algebraic computations</p> <p>2.5 Calculations involving fractions, percentages and mixed numbers are used to complete workplace tasks</p> <p>2.6 Numerical computation is self-checked and corrected for accuracy</p> <p>2.7 Instruments are read to the limit of accuracy of the tool</p> <p>2.8 Systems of measurement identified and converted according to job requirements/ISO</p> <p>2.9 Workpieces are measured according to job requirements</p>
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2.22 (4) Range of Variable Training Components

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

2.23 (4) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires that the candidate: <ol 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> </ol>
2. Underpinning knowledge	<b>2.1 TRADE MATHEMATICS / MENSURATION</b> <ul style="list-style-type: none"> <li>• Four fundamental operation</li> <li>• Linear measurement</li> <li>• Dimensions</li> <li>• Unit conversion</li> <li>• Ratio and proportion</li> <li>• Trigonometric functions</li> <li>• Algebraic equations</li> </ul>
3. Underpinning skills	<ol style="list-style-type: none"> <li>3.1 Performing calculation by addition, subtraction, multiplication and division; trigonometric functions and algebraic equations</li> <li>3.2 Visualizing objects and shapes</li> <li>3.3 Interpreting formulas for volume, areas, perimeters of plane and geometric figures</li> <li>3.4 Proper handling of measuring instruments</li> </ol>
4. Resource implications	The following resources should be provided: <ol style="list-style-type: none"> <li>4.1 Workplace location</li> <li>4.2 Problems to solve</li> <li>4.3 Measuring instrument appropriate to carry out tasks</li> <li>4.4 Instructional materials relevant to the propose activity</li> </ol> <p>Assessment of underpinning knowledge and practical skills may be combined</p>
5. Methods of assessment	Competency should be assessed through: <ol style="list-style-type: none"> <li>5.1 Actual demonstration</li> <li>5.2 Direct observation</li> <li>5.3 Written test/questioning related to underpinning knowledge</li> </ol>
6. Context of assessment	<ol style="list-style-type: none"> <li>6.1 Competency assessment may occur in workplace or any appropriate simulated environment</li> <li>6.2 Assessment shall be observed while task are being undertaken whether individually or in group</li> <li>6.3 Competency assessment must be undertaken in accordance with the TESDA assessment guidelines</li> </ol>

2.21 (5) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY: (5) SUPERVISE PROPER USE AND MAINTENANCE OF TOOLS AND EQUIPMENT**

**UNIT CODE : CON311204**

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

<b>ELEMENTS</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Check condition of tools and equipment	1.1 Materials, tools and equipment are identified according to classification and job requirements 1.2 Non-functional tools and equipment are segregated and labeled according to classification 1.3 Safety of tools and equipment are observed in accordance with manufacturer's instructions 1.4 Condition of PPE are checked in accordance with manufacturer's instructions
2. Perform basic preventive maintenance	2.1 Appropriate lubricants are identified according to types of equipment 2.2 Tools and equipment are lubricated according to preventive maintenance schedule or manufacturer's specifications 2.2 Measuring instruments are checked and calibrated in accordance with manufacturer's instructions 2.4 Tools are cleaned and lubricated according to standard procedures 2.4 Defective instruments, equipment and accessories are inspected and replaced according to manufacturer's specifications 2.6 Tools are inspected, repaired and replaced after use 2.7 Work place is cleaned and kept in safe state in line with OSHA regulations
3. Store tools and equipment	3.1 Inventory of tools, instruments and equipment are conducted and recorded as per company practices 3.3 Tools and equipment are stored safely in appropriate locations in accordance with manufacturer's specifications or company procedures

2.22 (5) Range of Variable Training Components

VARIABLES TRAINING COMPONENTS	RANGE OF VARIATION
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 4.4 Inspection Form 4.5 Procedures

**2.30 Core Electrical Competencies**

2.31 (1) Performance Criteria for Unit of Competency Elements - This section gives the details of Core Electrical Competencies including (1) Performance Criteria for Unit of Competency Elements; (2) Range of Variable Training Components; (3) Evidence Guide for Assessment required for ELECTRICAL INSTALLATION AND MAINTENANCE NC IV Qualification.

**UNIT OF COMPETENCY : (1) PREPARE ELECTRIC AND HYDRAULIC TOOLS**

**UNIT CODE : CON724308**

**UNIT DESCRIPTOR :** This unit of Core Electrical Competencies deals with the knowledge, skills and attitudes on identifying and preparing materials and maintenance of electric power and hydraulic tools.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Request materials, tools and equipment	1.1 Quantity, usage and <b>specifications</b> of materials, tools and equipment are verified according to job requirements 1.2 Requisition form is properly filled-up according to list of materials, tools and equipment prepared 1.3 Requisition forms are approved by immediate superior
2. Select electrical power and hydraulic tools	2.1 <b>Electrical power and hydraulic tools</b> are identified and selected in line with job specification 2.2 Tools are inspected for damage in line with enterprise requirements 2.3 <b>Damaged tools</b> are reported to supervisor and repaired according to manufacturer’s specifications
3. Maintain electrical power and hydraulic	3.1 Electrical power and hydraulic tools are lubricated in line with enterprise requirements 3.2 Auxiliary parts of power tools/hydraulic tools are inspected and replaced according to manufacturer’s specifications 3.3 Electrical power and hydraulic tools are safety stored in line with enterprise requirements

2.32 (1) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
<p>1. Specifications</p>	<p>1.1 Brand/Make                      - Classification/Type                      1.2 Rating                      - Voltage                      - Current                      - Power                      - Frequency                      - Temperature                      - Service factor                      - Degree of protection                      - Utilization category                      - Harmonics                      - RPM                      - Pressure                      1.3 Phase                      1.4 Pole                      1.5 Range (Tools must be specific)                      1.6 <b>Needed accessories</b></p>
<p>2. Electrical power and hydraulic tools</p>	<p>Including but not limited to:                      2.1 Electrical power tools                      - Power drills                      - Portable grinder                      - Power saw                      2.2 Hydraulic tools                      - Pipe bender                      - Jack hammer</p>
<p>3. Damaged tools</p>	<p>Including but not limited to:                      3.1 Faulty plugs and cords of power tools                      3.2 Damaged housing and accessories                      3.3 Defective bearing, gasket, bushing                      3.4 Centrifugal switch                      3.5 Capacitors                      3.6 Carbon brush</p>



2.33 (1) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ol style="list-style-type: none"> <li>1.1 Identified, selected electrical power and hydraulic tools in line with job specification/requirements</li> <li>1.2 Checked quality and ratings of tools and accessories in line with job requirements</li> <li>1.3 Inspected electrical tools for damages in line with enterprise requirements</li> <li>1.4 Reported and repaired damaged electrical materials and tools to supervisor</li> <li>1.5 Maintained and stored electrical materials, hand tools, electrical power tools and hydraulic tools in line with manufacturer's/ supplier's specifications and enterprise requirements</li> </ol>
2. Underpinning Knowledge	<ol style="list-style-type: none"> <li>2.1 Types of electrical power tools</li> <li>2.2 Common damage to tools</li> <li>2.3 Maintenance procedure for electrical power and hydraulic tools</li> </ol>
3. Underpinning Skills	<ol style="list-style-type: none"> <li>3.1 Preparing materials</li> <li>3.2 Cleaning and maintaining electrical power and hydraulic tools</li> </ol>
4. Resource Implications	The following resources <b>MUST</b> be provided: <ol style="list-style-type: none"> <li>4.1 Workplace location</li> <li>4.2 Tools appropriate for electrical installation</li> </ol>
5. Methods of Assessment	Competency must be assessed through: <ol style="list-style-type: none"> <li>5.1 Direct observation of candidate's application of knowledge to tasks.</li> <li>5.2 Questions related to underpinning knowledge (Written Test)</li> </ol>
6. Context for Assessment	<ol style="list-style-type: none"> <li>6.1 Competency may be assessed in the workplace or in a simulated workplace setting</li> </ol>

2.31 (2) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY :** (2) **PERFORM ROUGHING-IN ACTIVITIES FOR BUS AND UNDERFLOOR DUCTS**

**UNIT CODE :** **CON724309**

**UNIT DESCRIPTOR :** This unit of Core Electrical Competencies covers the knowledge and attitudes on installing bus ways or bus duct, fittings, boxes, and under floor duct under the required performance standard.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Select materials	1.1 Technical drawings are planned and made to determine job requirements 1.2 Correct type and quantity of <b>ducts</b> are identified in line with job requirements 1.2 <b>Tools and equipment</b> are selected in line with job requirements 1.3 Correct <b>PPE</b> are identified and selected in line with safety requirements
2. Install bus and underfloor ducts	2.1 <b>Safety procedures</b> are followed 2.2 Correct procedures <b>for installation of bus and underfloor ducts</b> are performed in line with job requirements 2.1 Schedule of work is monitored to ensure work is completed in an agreed time, to a quality standard and with a minimum of waste 2.2 Unplanned events or conditions occurred are responded to accordingly 2.3 On going checks of quality of work are undertaken in accordance with instructions and requirements
3. Complete work	3.1 Final checks are made to ensure that work conforms with instructions and to requirements 3.2 Tools, equipment and any surplus resources and materials are checked/monitored in accordance with established procedures 3.3 Work area is checked as to cleanliness and safety

2.32 (2) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Ducts	1.1 Bus 1.2 Underfloor
2. Tools and equipment	Including but not limited to: 2.1 Pliers 2.2 Screwdrivers 2.3 Wrenches 2.4 Wire splicers 2.5 Knives 2.6 Face shield
3. Personal protective equipment (PPE)	Including but not limited to: 3.1 Working gloves 3.2 Safety shoes 3.3 Hard hat
4. Safety procedures	4.1 Philippine Electrical Code 4.2 Industrial safety 4.3 Electrical safety
5. Installation of ducts	5.1 Bus ducts <ul style="list-style-type: none"> <li>- Joints between sections and fittings are accessible for maintenance purposes</li> <li>- Bus ducts shall be securely supported</li> <li>- Vertically and horizontally aligned</li> <li>- Dead end of busway shall be closed</li> </ul> 5.2 Underfloor ducts <ul style="list-style-type: none"> <li>- Properly supported, aligned and spaced</li> <li>- Measurements referred to center of insert holes</li> </ul>

2.33 (2) Evidence Guide for Assessments

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment required evidence that the candidate: <ul style="list-style-type: none"> <li>1.1 Planned and made technical drawings to determine job requirements</li> <li>1.2 Selected appropriate tools, equipment and materials for performing rough-in activities</li> <li>1.3 Selected and used correct personnel protective equipment</li> <li>1.4 Demonstrated correct procedures for performing rough-in activities such as installing bus ducts and underfloor ducts and raceways</li> <li>1.5 Followed safety procedures</li> <li>1.6 Made final checks to ensure work completion and conforms with the working plan</li> </ul>
2. Underpinning Knowledge	<ul style="list-style-type: none"> <li>2.1 Bus ducts                             <ul style="list-style-type: none"> <li>- Uses and specifications</li> </ul> </li> <li>2.2 Underfloor ducts                             <ul style="list-style-type: none"> <li>- Uses and specifications</li> </ul> </li> <li>2.3 Safe working habit</li> <li>2.4 Philippine Electrical Code (PEC) requirements</li> </ul>
3. Underpinning Skills	<ul style="list-style-type: none"> <li>3.1 Interpreting plan and details</li> <li>3.2 Preparing materials</li> <li>3.3 Proper use of hand tools</li> <li>3.4 Splicing</li> <li>3.5 Dressing of wires</li> <li>3.6 Terminating wires</li> </ul>
4. Resource Implications	The following resources should be provided: <ul style="list-style-type: none"> <li>2.1 Workplace location</li> <li>2.2 Tools and equipment appropriate to building wiring electrical installation</li> <li>2.3 Materials relevant to the proposed activity</li> <li>2.4 Drawings and specifications relevant to the task</li> </ul>
5. Methods of Assessment	Competency in this unit must be assessed: <ul style="list-style-type: none"> <li>5.1 Through direct observation of application of tasks.</li> <li>5.2 Questions related to underpinning knowledge (Written Test)</li> </ul>
6. Context for Assessment	<ul style="list-style-type: none"> <li>6.1 Competency may be assessed in the workplace or in a simulated workplace setting</li> <li>6.3 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision</li> </ul>

2.31 (3) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY :** (3) PERFORM INSTALLATION OF WIRING DEVICES FOR FLOOR AND GROUND FAULT CURRENT INTERRUPTING OUTLETS

**UNIT CODE :** CON724310

**UNIT DESCRIPTOR :** This unit of Core Electrical Competencies covers the knowledge and attitudes on installing, selecting and documenting for floor outlets and ground fault current interrupter.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Select wiring devices	1.1 Drawings are read and interpreted to determine job requirements 1.2 Correct type and quantity of wiring devices and other materials are identified in line with job requirements 1.3 <b>Tools and equipment</b> are selected in line with job requirements 1.4 Correct <b>PPE</b> are identified and selected in line with safety requirements
2. Install wiring devices	2.1 <b>Safety procedures</b> are followed based on safety regulations 2.2 <b>Correct procedures for installation</b> of wiring devices are performed in line with job requirements 2.3 Schedule of work is followed based on agreed time, quality standard and minimum wastage 2.4 Further instructions are sought if unplanned events or conditions occur 2.5 On-going checking of quality of work are done in accordance with instructions and requirements
3. Notify completion of work	3.1 Final checks are made to ensure that work conforms with instructions and to requirements 3.2 Supervisor is notified upon completion of work 3.3 Tools, equipment and any surplus resources and materials are, where appropriate, cleaned, checked and returned to storage in accordance with established procedures 3.4 Work area is cleaned and made safe

2.32 (3) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Wiring devices	1.1 Floor outlet 1.2 Ground fault current interrupting outlet
2. Tools and equipment	2.1 Pliers 2.2 Screwdrivers 2.3 Wrenches 2.4 Wire splicers 2.5 Knives
3. Personal protective equipment (PPE)	May include but not limited to: 3.1 Working gloves 3.2 Safety shoes 3.3 Hard hat
4. Safety procedures	4.1 Philippine Electrical Code 4.2 Industrial safety 4.3 Electrical safety
5. Installation	5.1 Horizontally and vertically aligned 5.2 No gap between plate cover and wall 5.3 Wire cut to requirement 5.4 All bolts tightened for rigid mounting

2.33 (3) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> <li>1.1 Correctly interpreted work instructions</li> <li>1.1 Selected appropriate tools, equipment and materials for building wiring installation</li> <li>1.3 Selected and used correct PPE</li> <li>1.4 Demonstrated correct procedures for installation of floor outlets and ground fault current interrupting outlets</li> <li>1.5 Followed safety procedures</li> <li>1.6 Cleaned worksite, tools and equipment</li> <li>1.7 Stored surplus materials</li> </ul>
2. Underpinning Knowledge	<ul style="list-style-type: none"> <li>2.1 Installation procedures for floor outlets and ground fault current interrupting outlets</li> <li>2.2 Use of ground fault current interrupting outlets</li> <li>2.3 Safe work practices</li> <li>2.4 PEC requirements</li> </ul>
3. Underpinning Skills	<ul style="list-style-type: none"> <li>3.1 Interpreting plan and details</li> <li>3.2 Preparing materials</li> <li>3.3 Proper use of hand tools</li> <li>3.4 Splicing</li> <li>3.5 Dressing of wires</li> <li>3.6 Terminating wires</li> </ul>
4. Resource Implications	The following resources <b>MUST</b> be provided: <ul style="list-style-type: none"> <li>4.1 Workplace location</li> <li>4.2 Tools and equipment appropriate for installation of wiring devices</li> <li>4.3 Materials relevant to the proposed activity</li> <li>4.4 Drawings and specifications relevant to the task</li> </ul>
5. Methods of Assessment	Competency must be assessed through: <ul style="list-style-type: none"> <li>5.1 Direct observation of application of tasks</li> <li>5.2 Questions related to underpinning knowledge (Written Test)</li> </ul>
6. Context for Assessment	<ul style="list-style-type: none"> <li>6.1 Competency may be assessed in the workplace or in a simulated workplace setting</li> <li>6.2 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervisions</li> </ul>

2.31 (4) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY** : (4) **PERFORM INSTALLATION OF STANDARD ELECTRICAL PROTECTION SYSTEM FOR LIGHTNING AND GROUNDING**

**UNIT CODE** : **CON724311**

**UNIT DESCRIPTOR** : This module of Core Electrical Competency covers the knowledge, skill and attitudes in the installation of electrical protection system, such as safety switch, fuse cut-out, low voltage switch gear, earth leakage circuit breaker, conventional atmospheric lightning protection and grounding system.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Plan and prepare work	1.1 Instructions for the preparation of the work activity are communicated and confirmed to ensure clear understanding 1.2 Tools, equipment and PPE needed to install electrical wiring are identified, checked to ensure they work correctly as intended and are safe to use in accordance with established procedures 1.3 Materials needed for work are obtained in accordance with established procedures
2. Install electrical protection system	2.1 <b>Safety procedures</b> are followed 2.2 <b>Correct procedures for installation</b> of electrical protection system are performed in line with job requirements and PEC 2.3 Schedule of work is followed to ensure work is completed in an agreed time, to a quality standard and with a minimum waste 2.4 Further instructions are sought from a supervisor if unplanned events or conditions occur 2.5 On-going checks of quality of work are done in accordance with instructions and Requirements



<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
3. Notify completion of work	3.1 Final checks are made to ensure the work conforms with instructions and requirements 3.2 Supervisor is notified upon completion of work 3.3 Tools, equipment and any surplus resources and materials are, where appropriate, cleaned, checked and returned to storage in accordance with established procedures 3.4 Work area is cleaned and made safe

**2.32 (4) Range of Variable Training Components**

<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
1. Electrical protect system component	1.1 Safety switch fuse cut-out 1.2 High/Low Voltage Switch Gear (HLVSG) 1.3 Earth Leakage Circuit Breaker (ELCB) 1.4 Conventional atmospheric lightning protection 1.5 Grounding system
2. Tools and equipment	Tools and equipment may include but not limited to: 2.1 Pliers 2.2 Screwdrivers 2.3 Wrenches 2.4 Wire splicers 2.5 Knives
3. Personal protective equipment (PPE)	3.1 Working gloves 3.2 Safety shoes 3.3 Hard hat
4. Safety procedures	4.1 Philippine Electrical Code 4.2 Industrial safety
5. Installation	5.1 Horizontally and vertically aligned 5.2 Rigidly anchored to wall 5.3 Installed with clearance to wall/other boxes for cover to open freely 5.4 Enough clearance for cover opening for flush mounted

2.33 (4) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ol style="list-style-type: none"> <li>1.1 Correctly interpreted work instructions</li> <li>1.2 Selected appropriate tools, equipment and materials for installation of electrical protection system</li> <li>1.3 Selected and used correct PPE</li> <li>1.4 Demonstrated correct procedures on installation of electrical protection systems including safety switch fuse cut-out, high/low voltage switch gear, earth leakage circuit breaker, conventional atmospheric lightning protection and grounding system</li> <li>1.5 Followed safety procedures</li> <li>1.6 Cleaned worksite, tools and equipment</li> <li>1.7 Stored surplus materials</li> </ol>
2. Underpinning Knowledge	<ol style="list-style-type: none"> <li>2.1 Philippine Electrical Code (PEC) requirements</li> <li>2.2 Electrical protection system components</li> <li>2.3 Use of electrical protection systems</li> <li>2.4 Use of different electrical protection system, including safety switch fuse cut-out, high/low voltage switch gear, earth leakage circuit breaker, conventional atmospheric lightning protection and grounding system</li> </ol>
3. Underpinning Skills	<ol style="list-style-type: none"> <li>3.1 Interpreting plan and details</li> <li>3.2 Preparing materials</li> <li>3.3 Proper use of hand tools</li> <li>3.4 Splicing</li> <li>3.5 Dressing of wires</li> <li>3.6 Terminating wires</li> <li>3.7 Interpreting product technical brochure</li> </ol>
4. Resource Implications	The following resources <b>MUST</b> be provided: <ol style="list-style-type: none"> <li>4.1 Workplace location</li> <li>4.2 Tools and equipment appropriate for installation of electrical protection systems</li> <li>4.3 Materials relevant to the proposed activity</li> <li>4.4 Drawings and specifications relevant to the task</li> </ol>
5. Methods of Assessment	Competency must be assessed through: <ol style="list-style-type: none"> <li>5.1 Direct observation of candidate's application of knowledge to tasks.</li> <li>5.2 Questions related to underpinning knowledge</li> </ol>
6. Context for Assessment	<ol style="list-style-type: none"> <li>6.1 Competency may be assessed in the workplace or in a simulated workplace setting</li> <li>6.2 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision</li> </ol>

2.31 (5) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY :** (5) PERFORM INSTALLATION OF ELECTRICAL LIGHTING SYSTEMS, AUXILIARY OUTLETS AND LIGHTING FIXTURES.

**UNIT CODE :** CON724312

**UNIT DESCRIPTOR :** This unit of Core Electrical Competency covers the knowledge and attitudes on installing, selecting of lighting fixture for the lighting outlets and auxiliary outlets.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Variables
1. Plan and prepare work	1.1 Instructions for the preparation of the work activity are communicated and confirmed to ensure clear understanding 1.2 <b>Tools, equipment and personnel protective equipment (PPE)</b> needed to install electrical wiring are identified, checked to ensure the work is done as intended and are safe to use in accordance with established procedures 1.3 <b>Materials</b> needed for work are obtained in accordance with established procedures 1.4 Materials needed to do the work are estimated according to job requirements
2. Install lighting fixtures	2.1 <b>Safety procedures</b> are followed 2.2 <b>Correct procedures for installation of lighting fixtures</b> are performed in line with job requirements 2.3 Schedule of work is followed to ensure work is completed in an agreed time, to a quality standard and with a minimum waste 2.4 Further instructions are sought from a supervisor if unplanned events or conditions occur 2.32 On-going checks of quality of work are Undertaken in accordance with instructions and Requirements
3. Notify completion of work	3.1 Final checks are made to ensure that work conforms with instructions and requirements 3.2 Supervisor is notified upon completion of work 3.3 Tools, equipment and any surplus resources and materials are, where appropriate, cleaned, checked and returned to storage in accordance with established procedures 3.4 Work area is cleaned and made safe

2.32 (5) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Tools and equipment	1.1 Electrical hand tools <ul style="list-style-type: none"> <li>- Pliers</li> <li>- Screwdrivers</li> <li>- Wrenches</li> <li>- Wire</li> <li>- Splicers</li> <li>- Knives</li> </ul>
2. Personal protective equipment (PPE)	2.1 Working gloves 2.2 Safety shoes 2.3 Hard hat
3. Lights fixtures	3.1 Flood lights/spotlights 3.2 Track lights 3.3 High/Low bay sodium vapor lamps 3.4 Halogen lamps 3.5 Perimeter lighting
4. Safety Procedure	4.1 Philippine Electrical Code (PEC)
5. Installation of lighting fixtures	5.1 Floodlights/Spotlights <ul style="list-style-type: none"> <li>- Horizontally aligned against wall</li> <li>- No gap between ceiling and lighting fixture base</li> <li>- Wiring at junction box cut to requirement as required</li> <li>- Floodlights/spotlights securely mounted</li> </ul> 5.2 Track Lights <ul style="list-style-type: none"> <li>- Wiring at junction box cut to requirement as required</li> <li>- Track light mounted securely</li> </ul> 5.3 High/Low Bay Sodium Vapor Lamps <ul style="list-style-type: none"> <li>- Wiring at junction box cut to requirement as required</li> <li>- High/Low sodium vapor lamps mounted securely</li> </ul> 5.4 Halogen Lamps <ul style="list-style-type: none"> <li>- Wiring at junction box cut to requirement</li> <li>- Halogen lamps mounted securely</li> </ul> 5.5 Perimeter Lighting <ul style="list-style-type: none"> <li>- Perimeter lighting installed as per plan/shop</li> <li>- Foundation constructed as per plan</li> <li>- Fixture wired and tested</li> <li>- Fixture mounted to pole</li> </ul>

2.33 (5) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> <li>1.1 Correctly interpreted work instructions</li> <li>1.4 Selected appropriate tools, equipment and materials for Installing lighting fixtures</li> <li>1.3 Selected and used correct personnel protective equipment</li> <li>1.4 Demonstrated correct procedures for installation of lighting fixtures including, floodlights/spotlights, track lights, high/low bay sodium vapor lamps, halogen lamps and perimeter lighting</li> <li>1.5 Followed safety procedures</li> <li>1.6 Cleaned worksite, tools and equipment</li> <li>1.7 Stored surplus materials</li> </ul>
2. Underpinning Knowledge	<ul style="list-style-type: none"> <li>2.1 Types of lighting fixtures and installation technique</li> <li>2.2 Proper use of hand tools</li> <li>2.3 Knowledge of Philippine Electrical Code (PEC) requirements</li> <li>2.4 Ratings of lighting fixture</li> <li>2.5 Principles of electric light</li> </ul>
3. Underpinning Skills	<ul style="list-style-type: none"> <li>3.1 Interpreting electrical drawings and plans</li> <li>3.2 Preparing materials</li> <li>3.3 Interpreting product technical brochure</li> <li>3.4 Proper use of hand tools</li> <li>3.5 Splicing</li> <li>3.6 Dressing of wires</li> <li>3.7 Terminating wires</li> </ul>
4. Resource Implications	The following resources <b>MUST</b> be provided: <ul style="list-style-type: none"> <li>4.1 Workplace location</li> <li>4.2 Tools and equipment appropriate to building wiring electrical installation</li> <li>4.3 Materials relevant to the proposed activity</li> <li>4.4 Drawings and specifications relevant to the task</li> </ul>
5. Methods of Assessment	Competency must be assessed through: <ul style="list-style-type: none"> <li>5.1 Direct observation of candidate's application of knowledge to tasks.</li> <li>5.2 Questions related to underpinning knowledge (Written Test)</li> </ul>
6. Context for Assessment	<ul style="list-style-type: none"> <li>6.1 Competency may be assessed in the workplace or in a simulated workplace setting</li> <li>6.3 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision</li> </ul>

2.31 (6) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY:** (6) PERFORM INSTALLATION OF DATA MEASUREMENT AND CONTROL SYSTEMS ON ELECTRICAL AND AUXILLIARY EQUIPMENT

**UNIT CODE** : CON724319

**UNIT DESCRIPTOR** : This unit of Core Electrical Competency covers the knowledge, skills and attitudes in installing wiring devices for power supply of data measurement system and auxiliary equipment such as UPS, drytype, transformer, capacitor bank AVR and rectifier based on required performance standard.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Variables
1. Plan and prepare work	1.1 Instructions for the preparation of work activity are communicated and confirmed to ensure clear understanding 1.2 <b>Tools, equipment</b> and <b>personnel protective equipment</b> needed to <b>electrical system and by auxiliary equipment</b> are identified, checked to ensure they work correctly as intended and are safe to use in accordance with established procedures 1.3 Materials needed to do the work are obtained and estimated in accordance with established procedures and plan
2. Install electrical system and auxiliary equipment	2.1 <b>Safety procedures</b> are followed 2.2 Correct procedures for <b>installation of electrical system and auxiliary equipment</b> are performed in line with job requirements 2.3 Schedule of work is followed to ensure work is completed in an agreed time, to a quality standard and with a minimum of waste 2.4 Unplanned events or conditions occurred are responded to accordingly 2.5 On going checks of quality of work are undertaken in accordance with instructions and requirements 2.5 Conductors/wires are terminated/splice in accordance with the existing electrical standards

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Variables
3. Complete work	3.1 Final checks are made to ensure that work conforms with instructions and to requirements 3.2 Completion report is prepared and submitted to appropriate officer 3.3 Tools, equipment and any surplus resources and materials are checked and monitored in accordance with established procedures 3.4 Work area is monitored as to cleanliness and safety

2.32 (6) Range of Variable Training Components

<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
1. Tools and equipment	1.1 Electrical power tools 1.2 Hydraulic tools 1.3 Multi-testers, mega-ohmmeter, clam ammeter
2. Personal protective equipment (PPE)	Includes but is not limited to: 2.1 Working gloves 2.2 Safety shoes 2.3 Hard hat 2.4 Goggles/face shield
3. Electrical and auxiliary equipment	3.1 UPS 3.2 Drytype 3.3 Transformer 3.4 Capacitor bank 3.5 AVR 3.6 Rectifier
4. Safety procedures	4.1 Philippine Electrical Code (PEC) 4.2 Industrial safety 4.3 Electrical safety
5. Installation of electrical system and auxiliary equipment	5.1 Installed and connected as per plan 5.2 Magnetic switches installed 5.3 Conducted preliminary testing prior to commissioning

2.33 (6) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> <li>1.1 Correctly followed work instructions</li> <li>1.2 Selected appropriate tools, equipment and materials for installing electrical system and auxiliary equipment</li> <li>1.3 Selected and used correct personal protective equipment</li> <li>1.4 Demonstrated correct procedures for installation of electrical system and auxiliary equipment such as UPS, Drytype, transformer, capacitor bank, AVR and rectifier</li> <li>1.5 Made final checks to ensure work conforms with the plan</li> <li>1.6 Followed safety procedures</li> <li>1.7 Communicated effectively to ensure safety and effective work operations</li> </ul>
2. Underpinning Knowledge	2.1 Types and use of: <ul style="list-style-type: none"> <li>- UPS</li> <li>- Drytype</li> <li>- Transformer</li> <li>- Capacitor bank</li> <li>- AVR</li> <li>- Rectifier</li> </ul> 2.2 Knowledge on PEC requirements
3. Underpinning Skills	3.1 Banking of transformer and capacitors 3.2 Installing AVR and UPS
4. Resource Implications	The following resources should be provided: <ul style="list-style-type: none"> <li>4.1 Workplace location</li> <li>4.2 Tools and equipment appropriate to building wiring installation</li> <li>4.3 Materials for building wiring installation</li> <li>4.4 Drawings and specifications for building wiring installation</li> </ul>
5. Methods of Assessment	Competency in this unit must be assessed through: <ul style="list-style-type: none"> <li>5.1 Direct observation of application of tasks.</li> <li>5.2 Questions related to underpinning knowledge</li> </ul>
6. Context for Assessment	6.1 Assessment should occur on the job or in a simulated workplace



2.31 (7) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY :** (7) **PERFORM ASSEMBLY AND INSTALL ELECTRICAL LIGHTING AND MOTOR CONTROL SYSTEMS**

**UNIT CODE :** 504724320

**UNIT DESCRIPTOR :** This unit of Core Electrical Competency covers the knowledge, skills and attitudes in performing assembly of electrical control system.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Check/Review type and purpose of electrical control system	1.1 <b>Wiring diagrams</b> and layout/shop drawings are obtained according to job requirements 1.2 Drawings are read and interpreted in accordance with job requirements 1.3 Estimated work schedule is verified with immediate superior 1.4 Correct rating, quantity, sizes and type of <b>control components &amp; wiring devices</b> and other materials are identified in line with job requirements 1.5 Correct size and <b>degree of protection</b> of enclosures are verified in line with job requirements 1.6 <b>Tools and testing instruments</b> are properly selected in line with job requirements 1.7 Correct <b>PPE</b> are identified and selected in line with safety requirements 1.8 Submit complete data on inspection report based on job requirements to immediate superior.
2. Request materials, tools and equipment	2.1 Quantity, usage and specifications of materials, tools and equipment are verified according to job requirements 2.2 Requisition form is properly filled-up according to list of materials, tools and equipment prepared 2.3 Requisition forms are approved by immediate superior
3. Inspect electrical materials and tools	3.1 Delivered materials are checked/inspected/ tested according to quantity, usage and specifications 3.2 Defective/Sub-standard electrical materials are identified according to physical damaged and quality are reported to immediate superior 3.3 Defective/sub-standard/wrong specification electrical materials are returned to warehouseman/stockman for replacement 3.4 Submit inspection reports on deliveries of electrical materials and tools to immediate superior.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
3. Inspect electrical materials and tools	<p>3.5 Defective/sub-standard/wrong specification electrical materials are returned to warehouseman/stockman for replacement</p> <p>3.6 Submit inspection reports on deliveries of electrical materials and tools to immediate superior.</p>
4. Assemble electrical control	<p>4.1 Safety procedures are followed according to enterprise and government regulations</p> <p>4.2 Electrical components and wiring devices are laid-out, mounted or installed according to drawings, plans, specifications and <b>PEC standards</b></p> <p>4.3 Electrical control components are wired correctly in accordance with wiring diagrams and PEC standards</p> <p>4.4 Work schedule is followed to ensure job is completed on time in accordance to a quality standard and minimum wastage.</p> <p>4.5 Further instructions are sought from the immediate superior in the event of unplanned events or conditions occurred.</p> <p>4.6 On going checks of quality of the work are undertaken with strict compliance in accordance with instructions and requirements.</p> <p>4.7 <b>Preliminary checks/tests</b> are conducted in line with job requirements.</p>
5. Notify completion of work	<p>5.1 Immediate superior is notified upon completion of work.</p> <p>5.2 <b>Performance tests</b> are made to ensure that work conforms to instructions and job requirements.</p> <p>5.3 Tools, equipment and any surplus materials are cleaned, checked and returned to storage in accordance with established procedures.</p> <p>5.4 Work area is cleaned up and made safe in accordance with OSHA requirements.</p>

2.32 (7) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Wiring diagrams	1.1 Power circuit 1.2 Control circuit <ul style="list-style-type: none"> <li>• Relay technology</li> <li>• PLC</li> </ul>
2. Control components & wiring devices	May include but are not limited to: <ul style="list-style-type: none"> <li>2.1 Circuit breakers/Fuses</li> <li>2.2 Magnetic Contactors</li> <li>2.3 Relays</li> <li>2.4 PLC</li> <li>2.5 Timers</li> <li>2.6 Terminal Blocks/Lugs</li> <li>2.7 Pilot lamps</li> <li>2.8 Actuators</li> <li>2.9 Push buttons</li> <li>2.10 Selector Switches</li> <li>2.11 Cable duct</li> <li>2.12 Din rail</li> <li>2.13 Wire Strap</li> <li>2.14 Wire Markers</li> <li>2.15 Cable Tie</li> <li>2.16 Tie Mount</li> <li>2.17 Cable Glands/Grommet</li> <li>2.18 Conductors</li> <li>2.19 Insulators</li> </ul>
3. Degree of Protection	<ul style="list-style-type: none"> <li>3.1 Nema Standards                             <ul style="list-style-type: none"> <li>- Nema 1</li> <li>- Nema 2</li> <li>- Nema 3/3R</li> <li>- Nema 4/4x</li> <li>- Nema 6</li> <li>- Nema 11</li> <li>- Nema 12</li> </ul> </li> <li>3.2 IEC Standards                             <ul style="list-style-type: none"> <li>- International Protection (IP)</li> </ul> </li> <li>3.3 Bureau of Product Standards (BPS)</li> </ul>

<p><b>VARIABLE TRAINING COMPONENTS</b></p>	<p><b>RANGE OF VARIATION</b></p>
<p>4. Tools &amp; Testing Instruments</p>	<p>May include but are not limited to:</p> <p>4.1 Tools</p> <ul style="list-style-type: none"> <li>- Pliers</li> <li>- Screw drivers</li> <li>- Wrenches</li> <li>- Wire splicers/strippers</li> <li>- Electrician knives</li> <li>- Electric Hand drill</li> <li>- Hand or electric taping/threading</li> <li>- Hack saw</li> <li>- File</li> <li>- Manual/Hydraulic puncher</li> <li>- Measuring tools (e.g. Push-pull meter)</li> <li>- Crimping tools</li> <li>- Soldering tools</li> <li>- Manual/Hydraulic pipe bender</li> <li>- Manual/Electrical Pipe Threader/Reamer</li> <li>- High-speed cutter</li> </ul> <p>4.2 Testing Instruments</p> <ul style="list-style-type: none"> <li>- Multi-tester</li> <li>- Clamp ammeter</li> <li>- Insulation resistance tester</li> <li>- Ground resistance tester</li> <li>- Earth leakage tester</li> <li>- Harmonic meter</li> </ul>
<p>5. Personal protective equipment (PPE)</p>	<p>May include but are not limited to:</p> <p>5.1 Proper working clothes</p> <p>5.2 Working gloves</p> <p>5.3 Safety shoes</p> <p>5.4 Gas/Dust mask</p> <p>5.5 Hard hat</p> <p>5.6 Safety goggles</p>

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
6. Specifications	6.1 Brand/Make - Classification/Type 6.2 Rating - Voltage - Current - Power - Frequency - Temperature Rise - Service factor - Degree of protection - Utilization category - Harmonics 6.3 Phase 6.4 Range (Tools must be specific) 6.5 Needed accessories
7. PEC standard and requirements	7.1 Splicing and joining of electrical conductor 7.2 Soldering electrical conductors 7.3 Solderless electrical connectors 7.4 Creepage distances 7.5 Clearances
8. Preliminary Check/Tests	May include but are not limited to: 8.1 Mechanical - Board/Panel properly leveled - Doors can be opened/closed with ease. Paint not easily scratched/removed - Tightness of bolts and nuts - Type of protection - Cleanliness - Cable trays 8.2 Electrical - Conductor size or Cross-section - Conductor Color Coding - Cables laid to avoid risk of short circuit - Grounding busbar conductor - Voltage Clearances/Creepage Distances - Control Voltage - High Voltage Test - Insulation Test - Continuity Test/Contact Resistance Test - Correct use of wire markers & terminals
9. Performance Tests	9.1 Simulation Test/No Load Test 9.2 Phase sequence 9.3 Actual Operation 9.4 Temperature rise

2.33 (7) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> <li>1.1 Demonstrated understanding/interpretation on diagrams, symbols and work instructions</li> <li>1.2 Demonstrated understanding of proper use of materials, tools and testing instruments for assembly of electrical control system</li> <li>1.3 Selected and used correct personal protective equipment</li> <li>1.4 Demonstrated correct procedures for installation and wiring of electrical control components</li> <li>1.5 Demonstrated understanding on proper testing procedures</li> <li>1.6 Followed work schedule</li> <li>1.7 Demonstrated good work attitude</li> </ul>
2. Underpinning Knowledge	<ul style="list-style-type: none"> <li>2.1 Materials use and specification</li> <li>2.2 Economic use of materials</li> <li>2.3 Safe working habits/Safety procedures</li> <li>2.4 Philippine Electrical Code (PEC) requirements</li> <li>2.5 Electrical control components and devices</li> <li>2.6 Correct procedures in assembling electrical control system</li> <li>2.7 Mensuration</li> <li>2.8 Cleaning of worksite, tools and equipment</li> </ul>
3. Underpinning Skills	<ul style="list-style-type: none"> <li>3.1 Reading &amp; interpreting different types of electrical diagrams and work instructions correctly</li> <li>3.2 Verifying materials, tools and testing instruments</li> <li>3.3 Following wiring diagrams</li> <li>3.4 Following safety procedures</li> <li>3.5 Proper handling of materials</li> <li>3.6 Proper using of handtools</li> <li>3.7 Splicing of conductors</li> <li>3.8 Dressing/harnessing of wires</li> <li>3.9 Terminating and insulating of wires</li> <li>3.10 Storing excess materials</li> <li>3.11 Checking quality of work</li> <li>3.12 Communicating skills (both written and oral)</li> <li>3.13 Measuring techniques/skills</li> <li>3.14 Estimating quantity/bill of materials</li> <li>3.15 Preparing request forms for supplies/materials/tools and equipment</li> </ul>

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
4. Resource Implications	The following resources should be provided: 4.1 Workplace location 4.2 Tools and equipment appropriate to assembly of electrical control system 4.3 Materials relevant to the activity 4.4 Wiring diagrams, layout/shop drawings and specifications relevant to the task
5. Methods of Assessment	Competency in this unit must be assessed through: 5.1 Direct observation of application of tasks 5.2 Questions or interview related to underpinning knowledge 5.3 Portfolio (credentials) 5.4 Written Test (about symbols)
6. Context for Assessment	6.1 Competency may be assessed in the workplace – to observe/check workmanship, correct function of work, length of time in doing the work 6.2 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision

2.31 (8) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY :** (8) **PERFORM MAINTENANCE AND TROUBLESHOOTING WORKS.**

**UNIT CODE :** 502724321

**UNIT DESCRIPTOR :** This unit of Core Electrical Competency covers the knowledge, skill and attitudes in performing maintenance, troubleshooting and repair works.

ELEMENT	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Plan, prepare and coordinate maintenance works	1.1 <b>Maintenance work</b> schedule is prepared in accordance with machine/equipment operating time/condition 1.2 Work instructions are prepared according to machine’s manual and established enterprise procedures 1.3 <b>Materials, tools, equipment, testing devices</b> and <b>PPE</b> needed to complete job requirements are identified and requested/obtained in line with prepared work instructions 1.4 <b>Potential hazards</b> are identified for prevention and

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
	<p>control measures are selected in accordance with the work plan and site procedures</p> <p>1.5 Safety permit/Hot work permit is secured in accordance with enterprise procedure.</p> <p>1.6 Concerned department/personnel are informed on the schedule of work according to standard operating procedure.</p>
2. Maintain electrical system or equipment	<p>2.1 Safety policies and procedures are followed in accordance with OSHA and enterprise procedure</p> <p>2.2 <b>Electrical system or equipment parts</b> are properly tested/cleaned/lubricated according to manufacturer or enterprise procedure.</p> <p>2.3 Worn-out/malfunctioning electrical system or equipment parts are identified and replaced in accordance with manufacturer's requirements or enterprise standards.</p> <p>2.5 Readings of <b>Electrical measuring instruments</b> are checked and identified defective instruments are referred for calibration/replacement in accordance with enterprise procedure.</p> <p>2.5 Connectors, bolts, nuts and screws are checked and tightened according to sizes and torque requirements.</p> <p>2.6 Routinary/visual/sensory inspection is regularly conducted in line with normal operation.</p>
	<p>2.7 Unforeseen events are responded in line with established procedures.</p> <p>2.8 Ongoing check of quality and progress of works are undertaken with strict compliance in line with established procedures.</p>
3. Troubleshoot faults in an Electrical System or equipment	<p>3.1 Safety policies and procedures are followed</p> <p>3.2 Availability of <b>maintenance records</b> are prepared in accordance with established procedure, or based on enterprise <b>Quality Management System (QMS)</b>.</p> <p>3.3 Circuit or equipment to be diagnosed is isolated (lockout/tagout) in accordance with established procedure or according to duly accepted standard practices.</p> <p>3.4 <b>Indicators/Symptoms</b> of fault or failure are identified.</p> <p>3.5 Necessary <b>electrical test</b> on the system or equipment is performed in accordance with established procedure or according to manufacturers guidelines.</p> <p>3.6 Extent of the fault to include the time to accomplish the job and the spare parts needed is estimated according to extent of damage.</p>



ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
	3.7 <b>Other works</b> associated with the problem are coordinated with other concerned group. 3.8 Details of fault, possible cause, corrective action, recommendation to eliminate the problem are recorded accordingly. 3.9 <b>Unforeseen events</b> are responded in line with established procedures
4. Notify completion of work	4.1 Immediate superior is notified upon completion of work. 4.2 <b>Performance tests</b> are made to ensure that work conforms to instructions and job requirements. 4.3 Tools, equipment and any surplus materials are cleaned, checked and returned to storage area in accordance with established procedures. 4.4 Work area is cleaned up and made safe in accordance with OSHA requirements. 4.5 Service report is prepared and submitted to appropriate officer

2.32 (8) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Maintenance work	1.1 Preventive 1.2 Corrective/Breakdown 1.3 Routine 1.4 Predictive 1.5 Condition based
3. Materials	May include but not limited to: 2.1 Contact cleaner 2.2 Insulating varnish/materials 2.3 Carbon brushes 2.4 Sand paper 2.5 Waste rags 2.6 Electrical tapes 2.7 Warning tags 2.8 Signages 2.9 Lockout/tagout 2.10 Lubricants 2.11 Motor cleaner 2.12 Insulating oil 2.13 Coolant

<p><b>VARIABLE TRAINING COMPONENTS</b></p>	<p><b>RANGE OF VARIATION</b></p>
<p>3. Tools, equipment and testing devices</p>	<p>Including but not limited to:</p> <p>3.1 Electrical hand tools</p> <ul style="list-style-type: none"> <li>- Pliers</li> <li>- Screwdrivers</li> <li>- Wrenches</li> <li>- Wire splicers</li> <li>- Knives</li> <li>- Bolt/Cable cutter</li> <li>- Knockout puncher</li> <li>- Torque wrench</li> </ul> <p>3.2 Testing instruments/devices</p> <ul style="list-style-type: none"> <li>- Multi-tester (VOM)</li> <li>- Insulation resistance tester (Megger)</li> <li>- High potential tester</li> <li>- Low resistance tester</li> <li>- Phase sequence meter</li> <li>- Ammeter</li> <li>- Torque meter</li> </ul> <p>3.3 Equipment</p> <ul style="list-style-type: none"> <li>- Labeling machine</li> <li>- Vacuum cleaner</li> <li>- Air blower</li> <li>- Dryer</li> <li>- Welding machine</li> <li>- Pressure washer</li> <li>- Vacuum pump</li> </ul>
<p>4. Personal protective equipment (PPE)</p>	<p>Including but not limited to:</p> <p>4.1 Working gloves</p> <p>4.2 Safety shoes</p> <p>4.3 Hard hat</p> <p>4.4 Face shield</p> <p>4.5 Insulating mat</p> <p>4.6 Lockout tags</p> <p>4.7 Safety goggles</p> <p>4.8 Safety belt</p> <p>4.9 Safety ladder</p>
<p>5. Potential hazards</p>	<p>Including but not limited to:</p> <p>5.1 Live wires</p> <p>5.2 Oil spill</p> <p>5.3 Chemical hazards</p> <p>5.4 Flammable materials</p> <p>5.5 Sources of energy</p> <p>5.6 Moving machine parts</p> <p>5.7 Sharp/pointed objects</p> <p>5.8 Noise hazards</p> <p>5.9 Confined space</p>

<p><b>VARIABLE TRAINING COMPONENTS</b></p>	<p><b>RANGE OF VARIATION</b></p>
<p>6. Electrical system or equipment parts</p>	<p>May include but not limited to:</p> <p>6.1 Electrical</p> <ul style="list-style-type: none"> <li>- Carbon brushes</li> <li>- Brush holders</li> <li>- Slip ring</li> <li>- Commutators</li> <li>- Contactors</li> <li>- Relays</li> <li>- Circuit breakers</li> <li>- Wires</li> <li>- Timers</li> <li>- Switches and push buttons</li> <li>- Indicating lamps</li> <li>- Terminal blocks</li> <li>- Sensors</li> </ul> <p>6.2 Mechanical</p> <ul style="list-style-type: none"> <li>- Bearings</li> <li>- Bushings</li> <li>- Shafting</li> <li>- Filters</li> <li>- Bolts and nuts</li> <li>- Belts</li> <li>- Pulley</li> <li>- Couplings</li> <li>- Gears</li> </ul>
<p>7. Electrical measuring instruments</p>	<p>May include but are not limited to:</p> <p>7.1 Multi-tester (VOM/DMM)</p> <p>7.2 Insulation resistance tester (Megger)</p> <p>7.3 High potential tester</p> <p>7.4 Low resistance tester</p> <p>7.5 Phase sequence meter</p> <p>7.6 Ammeter</p>
<p>8. Maintenance records</p>	<p>May include but are not limited to:</p> <p>8.1 Electrical plans</p> <p>8.2 Equipment electrical diagrams</p> <p>8.3 Historical records</p> <ul style="list-style-type: none"> <li>- Job orders</li> <li>- Commissioning test record</li> <li>- Preventive Maintenance schedules</li> <li>- Corrective Maintenance records</li> <li>- Manufacturer’s maintenance guides</li> <li>- Equipment breakdown records</li> <li>- Periodic monitoring data</li> <li>- Service reports</li> </ul> <p>8.4 Log book</p>

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
9. Quality Management System	9.1 ISO 9001 9.2 QS 9000 9.3 TS 16949 9.4 ISO 14000 9.5 ISO14001
10. Indicators / Symptoms	May include but not limited to: 10.1 Heating of parts 10.2 Loose connections 10.3 Burned or exposed parts 10.4 Malfunction of logic controls 10.5 Abnormal/Unusual Noise/Smell/vibration 10.6 Intermittent operation 10.7 High current reading 10.8 Tripping of breakers
11. Electrical test	May include but not limited to: 11.1 Continuity test 11.2 Electrical insulation test 11.3 High potential test (as the need arises) 11.4 Earth resistance test 11.5 Phase sequence test 11.6 Load test 11.7 Winding resistance test 11.8 Free running test
12. Other works	May include but not limited to: 12.1 Mechanical works 12.2 Computer programs 12.3 Communication systems
13. Unforeseen events	May include but not limited to: 13.1 Natural calamities 13.2 Emergency situations 13.3 Accidents
14. Performance Test	May include but not limited to: 14.1 Simulation Test/No Load Test 14.2 Phase sequence 14.3 Actual Operation 14.4 Temperature rise

2.33 (8) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> <li>1.1 Identified or determined faults and troubles</li> <li>1.2 Identified cause of troubles</li> <li>1.3 Performed/Followed maintenance and troubleshooting procedures</li> <li>1.4 Analyzed and interpreted electrical machine circuit diagram</li> <li>1.5 Interpreted and analyzed periodic monitoring data</li> <li>1.6 Demonstrated understanding on safety regulations applicable to worksite operations</li> <li>1.7 Demonstrated understanding on the use of electrical testing equipment</li> <li>1.8 Demonstrated understanding on final inspection procedures</li> <li>1.9 Accomplishment of service report forms</li> <li>1.10 Coordinated effectively with others to ensure safe and effective work operations</li> </ul>
4. Underpinning Knowledge	<ul style="list-style-type: none"> <li>2.1 Philippines Electrical Code (PEC) requirements</li> <li>2.2 Maintenance and troubleshooting procedures</li> <li>2.3 Standard operating procedure in energizing electrical system</li> <li>2.4 Mensuration</li> <li>2.5 Interpretation of electrical plans/shop drawings</li> <li>2.6 Interpretation of indicating instrument readings and test instruments</li> <li>2.7 Electrical Laws and principles</li> <li>2.8 Sensors/Actuators</li> <li>2.9 Computer Operations</li> <li>2.10 Pneumatics and Electro-Pneumatics</li> <li>2.11 Types of potential hazards</li> <li>1.12 Safety practices</li> </ul>

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
<p>3. Underpinning Skills</p>	<p>3.1 Interpreting plan and details                      3.2 Tracing circuits                      3.3 Performing basic first-aid                      3.4 Practicing safe working habits                      3.5 Using test instruments                      3.6 Troubleshooting skills                      3.7 Application of maintenance procedures                      3.8 Preparing/obtaining materials, PPE, tools, equipment and testing devices in line with established procedures                      3.9 Estimating the time required to accomplish the job (depending on extent of damage)                      3.10 Evaluating condition of damage                      3.11 Selecting prevention and/or control measures                      3.12 Proper handling of equipment, tools, materials and consumables                      3.13 Operating computers                      3.14 Communication skills</p>
<p>4. Resource Implications</p>	<p>The following resources should be provided:                      4.1 Workplace location                      4.2 Tools, equipment and materials appropriate to maintenance and troubleshooting relevant to the task                      4.3 Drawings and specifications relevant to the task                      4.4 Service report form</p>
<p>5. Methods of Assessment</p>	<p>Competency in this unit must be assessed through:                      5.1 Direct observation of application of tasks                      5.2 Written test or examination                      5.3 Questions related to underpinning knowledge                      5.4 Third party report (to include report on work attitude)                      5.5 Demonstration/Simulation</p>
<p>6. Context for Assessment</p>	<p>6.1 Competency may be assessed in the workplace or in a simulated workplace setting                      6.2 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision</p>

2.31 (9) Performance Criteria for Unit of Competency Elements

**UNIT OF COMPETENCY: (9) Supervise/Monitor installation and maintenance on electrical systems, auxiliary including control, lighting power and protection equipment**

**UNIT CODE : CON724322**

**UNIT DESCRIPTOR :** This module of Core Electrical Competency covers the knowledge, skill and attitudes in supervising/monitoring of electrical practitioner for the installation and wiring of electrical devices, auxiliary, lighting and protection system equipment.

ELEMENT	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Plan and prepare work	1.1 Instructions for the preparation of the work activity are communicated and confirmed to immediate superior to ensure clear understanding 1.2 <b>Drawings/diagrams</b> are read and interpreted in accordance with job requirements 1.3 Correct type, quantity, size and rating of <b>electrical devices, auxiliary</b> and <b>protection system equipment</b> and other materials are identified in line with job requirements. 1.4 <b>Tools, equipment</b> and <b>personnel protective equipment</b> needed are identified/selected in accordance with established procedures 1.5 Estimated time of work completion is determined in accordance with the job requirement.
2. Request materials, tools and equipment	2.1 Quantity, usage and <b>specifications</b> of materials, tools and equipment are verified according to job requirements 2.2 Requisition form is properly filled-up according to list of materials, tools and equipment prepared 2.3 Requisition forms are approved by immediate superior
3. Direct and monitor installation of electrical, auxiliary and protection system equipment through working teams	3.1 Safety procedures are followed according to enterprise and government regulations. 3.2 <b>Installation criteria</b> for electrical, auxiliary and protection system equipment are carried out in line with job requirements and PEC standards. 3.3 Work schedule is followed to ensure job is completed on time in accordance with a quality standard. 3.4 Further instructions are sought from the immediate superior in the event of unplanned events or conditions occurred. 3.5 On-going checks of quality of the work are undertaken with strict compliance in accordance with instructions and requirements.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
4. Direct and monitor installation of electrical wiring	<p>4.1 Safety procedures are followed according to enterprise and government regulations.</p> <p>4.2 <b><i>Electrical wiring criteria</i></b> are followed in line with job requirements and PEC standard.</p> <p>4.3 Work schedule is followed to ensure job is completed on time in accordance to a quality standard and with minimum wastage.</p> <p>4.4 Contingency measures are applied during occurrence of unplanned events or conditions.</p> <p>4.5 On-going checks of quality of the work are undertaken in accordance with instructions and requirements.</p> <p>4.6 Preliminary check / test are conducted in line with job requirements.</p>
5. Notify completion of work	<p>5.1 Final checks are made to ensure that work conforms with instructions and job requirements</p> <p>5.2 Immediate superior is notified upon completion of work</p> <p>5.3 Tools, equipment and any excess resources and materials are cleaned, checked and returned to storage area in accordance with enterprise procedures</p> <p>5.4 Work area is cleaned up and made safe in accordance with OHS requirements</p>



2.32 (9) Range Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
<p>1. Drawings/diagram</p>	<p>May include but are not limited to:</p> <ul style="list-style-type: none"> <li>1.1 Control and power circuit diagram</li> <li>1.2 Termination diagram</li> <li>1.3 Schematic diagram</li> <li>1.4 Logic diagram</li> <li>1.5 Process flow diagram</li> <li>1.6 Ladder diagram</li> <li>1.7 Block diagram</li> <li>1.8 Electrical plan</li> </ul>
<p>2. Electrical devices</p>	<p>May include but are not limited to:</p> <ul style="list-style-type: none"> <li>2.1 Receptacles</li> <li>2.2 Outlets</li> <li>2.3 Switches                             <ul style="list-style-type: none"> <li>- Push button</li> <li>- Selector switches</li> <li>- Step switches</li> <li>- Meter switches</li> <li>- Emergency switch</li> </ul> </li> <li>2.4 Terminal blocks</li> <li>2.5 Relays                             <ul style="list-style-type: none"> <li>- Timers</li> <li>- Counters</li> </ul> </li> <li>2.6 Contactors                             <ul style="list-style-type: none"> <li>- Sensors</li> <li>- Proximity switch</li> <li>- Limit switch</li> <li>- Smoke detector</li> <li>- Fire detector</li> <li>- Photo Electric switch</li> <li>- Thermo controller</li> <li>- Pressure switch</li> <li>- Float switch</li> <li>- Flow switch</li> </ul> </li> <li>2.8 Metering devices</li> </ul>

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
<p>3. Electrical /auxiliary equipment</p>	<p>May include but are not limited to:</p> <ul style="list-style-type: none"> <li>3.1 Power supply                             <ul style="list-style-type: none"> <li>- Automatic Voltage Regulator (AVR)</li> <li>- Uninterruptible power supply (UPS)</li> </ul> </li> <li>3.2 Generators and motors</li> <li>3.3 Transformer</li> <li>3.4 Capacitors</li> <li>3.5 Inverters/Rectifiers</li> <li>3.6 Controllers                             <ul style="list-style-type: none"> <li>- Motor controls</li> <li>- Electro-mechanical controllers (e.g. Solenoid)</li> <li>- Electro-Pneumatic controller</li> <li>- Electronic drives</li> <li>- Solid-state controls</li> </ul> </li> <li>3.7 Battery bank and battery charger</li> <li>3.8 Fire alarm system                             <ul style="list-style-type: none"> <li>- Distributed control system (DCS)</li> <li>- Combine PIC/PVC</li> </ul> </li> <li>3.9 Auxiliary outlets                             <ul style="list-style-type: none"> <li>- Telephone</li> <li>- Mass Antenna Television (MATV)</li> <li>- Closed-circuit Television (CCTV)</li> <li>- UTV Voice Data</li> </ul> </li> <li>3.10 Communication system</li> </ul>
<p>4. Protection system equipment</p>	<p>May include but are not limited to:</p> <ul style="list-style-type: none"> <li>4.1 Circuit breakers/Fuses                             <ul style="list-style-type: none"> <li>- Oil circuit breaker (OCB)</li> <li>- Vacuum circuit breaker (VCB)</li> <li>- Gas insulated circuit breaker (SF6)</li> <li>- Enclosed circuit breaker (ECB)</li> <li>- Earth leakage circuit breaker/RCCB</li> <li>- Cut-out fuse / Time delay fuses</li> <li>- Air circuit breaker (ACB)</li> </ul> </li> <li>4.2 Relays                             <ul style="list-style-type: none"> <li>- Over/Under voltage</li> <li>- Over/Under current</li> <li>- Phase Reversal/Failure</li> </ul> </li> <li>4.3 High and Low Voltage Switch Gears</li> <li>4.4 Motor Control Center (MCC)</li> <li>4.5 Motor Control Panel (MCP)</li> <li>4.6 Power /Lighting Panel</li> </ul>

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
	4.7 Power Mitigated Devices <ul style="list-style-type: none"> <li>- Transient Voltage Surge Suppressor (TVSS)</li> <li>- Power Conditioner</li> <li>- Harmonic Filter</li> <li>- Harmonic Reactor</li> </ul> 4.8 Motor Guard 4.9 Grounding system 4.10 Ground Fault Circuit Interrupter (GFCI) 4.11 Atmospheric/Conventional Lightning Protection System
5. Tools and equipment	May include but not limited to: <ul style="list-style-type: none"> <li>5.1 Electrical handtools (pliers, screwdrivers, wrenches, wires, splicer, knife, wire stripper)</li> <li>5.2 Multi-testers, mega-ohmmeter, clamp ammeter</li> <li>5.3 Tachometer</li> <li>5.4 Pressure gauge</li> <li>5.5 Industrial thermometer</li> <li>5.6 Frequency meter</li> <li>5.7 Flow meters</li> <li>5.8 Lux meters</li> </ul>
6. Personnel Protective Equipment (PPE)	May include but not limited to: <ul style="list-style-type: none"> <li>6.1 Working gloves</li> <li>6.2 Safety shoes</li> <li>6.3 Hard hat</li> <li>6.4 Safety goggles</li> <li>6.5 Gas mask</li> <li>6.7 Insulating mat</li> <li>6.8 Apron</li> <li>6.9 Safety belts</li> <li>6.10 Safety ladder</li> </ul>
7. Specifications	7.1 Brand/Make <ul style="list-style-type: none"> <li>- Classification/Type</li> </ul> 7.2 Rating <ul style="list-style-type: none"> <li>- Voltage</li> <li>- Current</li> <li>- Power</li> <li>- Frequency</li> <li>- Temperature</li> </ul>

VARIABLE TRAINING COMPOENTS	RANGE OF VARIATON
	<ul style="list-style-type: none"> <li>- Service factor</li> <li>- Degree of protection</li> <li>- Utilization category</li> <li>- Harmonics</li> <li>- RPM</li> <li>- Pressure</li> </ul> <p>7.3 Phase</p> <p>7.4 Pole</p> <p>7.5 Range (Tools must be specific)</p> <p>7.6 Needed accessories</p>
8. Installation criteria	<p>8.1 Installed as per plan/instruction, specifications and diagrams</p> <p>8.2 Mounted horizontally and vertically aligned and use shim as required</p> <p>8.3 Rigidly bolted/screwed in place (e.g. wall or ceiling, flooring)</p> <p>8.4 Wires are cut to requirement and arranged to prevent unnecessary mechanical pressure to device terminal</p> <p>8.5 Functional as per standard testing procedures</p>
9. Electrical wiring criteria	<p><u>9.1 Roughing-in works</u>                      Conduits are properly processed and laid out as per job requirements                      Pull, utility and junction boxes are mounted and installed as per job requirements                      Proper fittings are used, screwed and mounted                      Correct ratings of enclosed over current protection are used</p> <p><u>9.2 Installing guide wires</u>                      Guide wire sized to requirement with allowance of at least 150mm and hooked</p> <p><u>9.3 Pulling/laying electrical wires</u>                      Wires measured and cut to exact requirement                      Required color coding followed                      Cable puller firmly mounted                      Correct size of pull wires/ropes as to load requirement                      Pulling compound to be used on big wire sizes                      No damage on insulation                      Free conductor allowance as to field requirement</p>

VARIABLE TRAINING COMPONENTS	RANGE VARIATION
	<p><u>9.4 Splicing wire and cable (e.g. solderless connectors crimping type)</u>                      Spliced wire and cables using standard splicing method, tools, right connector and terminal lug for size of wire as per PEC requirement</p> <p><u>9.5 Dressing electrical wire</u>                      Free conductor allowance per PEC standard                      Wire dressed/arranged for easy accessibility to electrical component                      Bend to conductor per code requirement to prevent damage to insulation</p> <p><u>9.6 For cable glands</u>                      Cable gland sized to cable diameter                      Cable gland installed complete with fittings</p> <p><u>9.7 For Bus bar</u>                      Installed bus bar securely and rigidly supported to maintain distances between different phases per PEC standard.                      Mounted on the same surface not less than 51mm and clearance not less than 26mm in any metal surface                      Installed as per plan/shop drawing and PEC requirement</p> <p><b>Auxiliary Outlets and Lighting Fixtures:</b></p> <p><u>9.8 For porcelain receptacle</u>                      Re-checked wire splicing as per plan prior to installation                      Wire cut to requirement and arranged to prevent unnecessary mechanical pressure to receptacle terminal                      All bolt tightened for rigid mounting                      No gap between fixture base and ceiling</p> <p><u>9.9 For high/low bay sodium vapor</u>                      Support rigid enough to carry fixture load                      Conduit stem plumb/perpendicular to ground                      Mounting support to comply with plan details                      Fixture mounted as per product technical brochure                      Correct tapping at ballast terminal</p>

VARIABLE TRAINING COMPONENTS	RANGE VARIATION
<p>9. Electrical wiring criteria (cont.)</p>	<p><u>9.10 For fluorescent fixtures</u>                      Re-checked wire splicing as per plan prior to installation                      Junction box cleaned prior to installation                      Wire cut to requirement and arranged prior to closing with box cover                      Fluorescent fixture horizontally aligned against wall                      No gap between fixture base and ceiling                      Rigidly screwed to ceiling                      Ballet connection checked as to correct terminal tapping.</p> <p><u>9.11 For Flood light and spot light</u>                      Re-checked wire splicing as per plan prior to installation                      Boxes cleaned and wire arranged prior to closing with box cover                      Fixture rigidly mounted                      Ballast connection checked as to correct terminal tapping                      Installed as per plan/installation instruction</p> <p><u>9.12 For halogen lamp</u>                      Re-checked wire splicing as per plan prior to installation                      Hole centering and distances of fixture per reflected ceiling plan                      Hole diameter exact to fixture requirement                      Transformer firmly mounted on non-combustible support                      Bulb not to be touched by hand                      Cover properly mounted and sealed</p> <p><u>9.13 For perimeter lighting (e.g. wall type, fence, pole type)</u>                      Foundation constructed as per plan                      Pole plumb to ground upon erection, if required, shim to be provided                      Fixture wired and tested prior to erection                      Test wiring for insulation breakdown minimum resistance tolerance 1000ohms/v ± 1 meg.                      Installed as per product technical brochure</p>

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
<p>10. Installation of equipment protection system criteria</p>	<p><u>10.1 For Grounding system</u></p> <ul style="list-style-type: none"> <li>• Ground rod fully driven to earth per PEC std.</li> <li>• Grounding conductor to be buried according to PEC standard</li> <li>• No splicing on ground conductor</li> <li>• All connection to ground rod per specification (e.g. exothermic ground clamp, etc.)</li> <li>• Resistance to ground per design requirement</li> </ul> <p><u>10.2 For earth leakage circuit breaker</u></p> <ul style="list-style-type: none"> <li>• Horizontally and vertically aligned</li> <li>• Earthwire solidly connected</li> <li>• Rigidly bolted to enclosure</li> <li>• Installed as per electrical drawings/schematic diagrams and instructions</li> </ul> <p><u>10.3 For Atmospheric/conventional lightning protection system</u></p> <ul style="list-style-type: none"> <li>• Ground rod fully driven to earth per PEC stds.</li> <li>• Resistance to ground per design requirement</li> <li>• No splicing on ground conductor</li> <li>• Lightning counter rigidly mounted on walls &amp; fix to structure</li> <li>• Air terminal or ionizer are rigidly mounted at roof support or steel structure</li> <li>• Down conductor installed per plan</li> <li>• All connector at ground per specification as to exothermic ground clamp, etc.</li> <li>• Operational as per standard testing procedure</li> </ul> <p><u>10.4 For Power Circuit Breaker (PCB) and Vacuum Circuit Breaker (VCB)</u></p> <ul style="list-style-type: none"> <li>• Horizontally and vertically aligned</li> <li>• Circuit breaker (CB) housing rigidly bolted to mounting bracket and anchored to flooring</li> <li>• CB bus terminals solidly connected to bus bars</li> <li>• Minimized damage to paint</li> <li>• Installed as per electrical drawings/schematic diagrams and instructions</li> </ul>

2.33 (9) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> <li>1.1 Correctly interpreted work instructions</li> <li>1.2 Selected appropriate tools, testing instruments and materials for electrical wiring installation</li> <li>1.3 Selected and used correct personal protective equipment</li> <li>1.4 Followed criteria for installation and wiring of electrical devices, auxiliary and protection system equipment</li> <li>1.5 Followed safety procedures</li> <li>1.6 Undertaken checks of quality of the work in accordance with instructions and job requirements</li> <li>1.7 Followed PEC regulations</li> <li>1.8 Demonstrated good working attitudes</li> </ul>
2. Underpinning Knowledge	<ul style="list-style-type: none"> <li>2.1 Materials use and specification</li> <li>2.2 Understand economic use of material</li> <li>2.3 Safe working procedures (including works in hazardous locations)</li> <li>2.4 Philippine Electrical Code (PEC) requirements</li> <li>2.5 Correct procedures in installing electrical wiring</li> <li>2.6 Installation of communication/paging system</li> <li>2.7 Kinds of lighting fixtures and its application</li> <li>2.8 Basic Electronics</li> <li>2.9 Motor Controllers</li> <li>2.10 Motors and Generators</li> <li>2.11 Power Calculation</li> <li>2.12 Time Management</li> <li>2.13 Mensuration</li> <li>2.14 Pneumatics / electro-pneumatics</li> <li>2.15 Basic Computer operations</li> </ul>
3. Underpinning Skills	<ul style="list-style-type: none"> <li>3.1 Interpreting plan and details</li> <li>3.2 Planning and coordinating work scheduling</li> <li>3.3 Able in determining and classifying work environment</li> <li>3.4 Preparing materials</li> <li>3.5 Proper using of hand tools</li> <li>3.6 Splicing conductors</li> <li>3.7 Dressing/harnessing of wires</li> <li>3.8 Terminating wires</li> <li>3.9 Crimping/ Soldering wires and connectors</li> <li>3.10 Storing excess materials properly</li> <li>3.11 Cleaning worksite, tools and equipment</li> <li>3.12 Installing electrical wiring materials, equipment and accessories</li> <li>3.13 Operating computer</li> </ul>



ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
4. Resource Implications	The following resources should be provided: 4.1 Workplace location 4.2 Tools and equipment appropriate to installation of electrical wirings 4.3 Materials relevant to the proposed activity 4.4 Drawings and specifications relevant to the task
5. Methods of Assessment	Competency in this unit must be assessed: 5.1 Through direct observation of application of tasks. 5.2 Oral questioning related to underpinning knowledge 5.3 Written test or examination 5.4 Third party report 5.5 Demonstration (able to impart knowledge and skills)
6. Context for Assessment	6.1 Competency may be assessed in the workplace or in a simulated workplace setting 6.2 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision
<p>2.31 (10) <u>Performance Criteria for Unit of Competency Elements</u></p> <p><b>UNIT OF COMPETENCY : (10) PERFORM COMMISSIONING OF ELECTRICAL EQUIPMENT/SYSTEMS BELOW 600 VOLTS</b></p> <p><b>UNIT CODE : CON724323</b></p> <p><b>UNIT DESCRIPTOR :</b> This module of Core Electrical Competency covers the knowledge, skill and attitudes in commissioning electrical equipment and all auxiliary system used in industrial establishments based on the required performance standards.</p>	
ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
1. Plan and prepare commissioning activities	1.1 Work instructions are confirmed to immediate to ensure clear understanding of job requirements 1.2 <b>Commissioning procedures</b> are planned according to job requirements 1.3 Materials and <b>PPE</b> needed to complete job requirements are obtained in line with established procedures

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training Components
	<p>1.4 <b>Tools, equipment and testing devices</b> needed for commissioning procedures are obtained, estimated and inspected for compliance with the job specifications</p> <p>1.5 <b>Potential hazards</b> are identified and prevention and/or control measures are selected in accordance with the work plan and site procedures</p> <p>1.6 Commissioning activities are coordinated with the end-user or the department involved in accordance with the established procedures</p>
2. Commission electrical equipment/systems	<p>2.1 Safety policies and procedures are followed in accordance with duly accepted international safety standards</p> <p>2.2 Electrical testing criteria are followed in line with job requirements and established procedures</p> <p>2.2 Electrical equipment/systems are commissioned in line with established procedures</p>
	<p>commissioned in line with established procedures</p> <p>2.4 Unforeseen events are responded in line with established procedures and as per plans, draw</p> <p>2.5 Records, electrical plans and schematic diagrams are revised/updated according to changes incurred during commissioning</p> <p>2.6 Test data forms are filled-out and submitted to immediate superior for evaluation</p>
3. Turn-over electrical equipment/systems	<p>3.1 Final inspection is undertaken to ensure that commissioning of electrical system meets job requirements</p> <p>3.2 Tools, equipment and any excess resources and materials are cleaned, checked and returned to storage area in accordance with enterprise procedures</p> <p>3.3 Written report is prepared and submitted to immediate superior in accordance with enterprise procedures</p> <p>3.4 Monitoring data sheet for the newly installed system is accomplished based on the job requirements</p> <p>3.5 Orientation and technical assistance is provided to prospective operators based on company procedures.</p>

2.32 (10) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Commissioning procedures	1.1 Formulate checklist of machine and equipment parts 1.2 Check completeness of installation based on plans/diagrams 1.3 Perform electrical testing 1.4 Perform no-load and load testing 1.5 Perform monitoring of meters and gauges 1.6 Orient end-user regarding systems operations 1.7 Turn over electrical equipment to end-user
2. Personal protective equipment (PPE)	Including but not limited to: 2.1 Working gloves 2.2 Safety shoes 2.3 Hard hat 2.4 Face shield 2.5 Insulating mat 2.6 Ear plug
3. Tools, equipment and testing devices	Including but are not limited to: 3.1 Electrical hand tools <ul style="list-style-type: none"> <li>- Pliers</li> <li>- Screwdrivers</li> <li>- Wrenches</li> <li>- Wire splicers</li> <li>- Electrician knives</li> </ul> 3.2 Testing instruments <ul style="list-style-type: none"> <li>- Multi-tester (VOM)</li> <li>- Ammeter</li> <li>- Insulation resistance tester</li> <li>- Ground resistance tester</li> <li>- Lux meter</li> <li>- Thermal scanner</li> <li>- Flow meter</li> <li>- Pressure gauge</li> <li>- Pressure Analyzer/ Gauge manifold</li> <li>- Leak tester</li> </ul> 3.3 Labeling machine 3.4 Warning signages <ul style="list-style-type: none"> <li>- Lock-out/Tag-out</li> </ul> 3.5 Phase-sequence indicator 3.6 Thermometer 3.7 Tachometer 3.8 Telephone/telephone handset

<p>4. Potential hazards</p>	<p>Including but not limited to:</p> <ul style="list-style-type: none"> <li>4.1 Live wires</li> <li>4.2 Oil spill</li> <li>4.3 Chemical hazards</li> <li>4.4 Flammable materials</li> <li>4.5 Sources of energy</li> <li>4.6 Moving machine parts</li> <li>4.7 Sharp/pointed objects</li> <li>4.8 Noise hazards</li> <li>4.9 Confined space</li> </ul>
<p>5. Electrical testing criteria</p>	<p>May include but are not limited to:</p> <p><u>5.1 Continuity test</u>          Completely filled-up continuity test report          Instrument calibrated and certified annually          Used of appropriate test instrument (e.g. analog/digital, multi-meter or ohmmeter)          All tools, instrument, equipment and materials in proper place without unnecessary things within work perimeter</p> <p><u>5.2 Electrical insulation test</u>          Appropriate instrument is used in the testing          Megger test data sheet filled-up completely          Accuracy of test result obtained within tolerable limit (e.g. 2 meg ohm ± 2%)          Instrument calibrated and certified annually</p> <p><u>5.3 High potential test</u>          Appropriate instrument is used in the testing          Instrument calibrated and certified annually          Test Data Sheet completely filled-up          Reading accuracy of test result obtained at ± 2% (3.kvac)</p> <p><u>5.4 Earth resistance test</u>          Appropriate instrument is used in the testing          Instrument calibrated and certified annually          Test report completely filled-up          Test reading accuracy is obtained with tolerance limit (5 ohm) 3 point method</p> <p><u>5.5 Phase sequence test</u>          Appropriate instrument is used in the testing          Tagging power line in accordance of phase sequence results from the main distribution panel down to the load          Completely filled-up report in accordance with the test result</p>

5.6 Load test

Appropriate instrument is used in the testing  
Load test reading accuracy within tolerance  
limit (e.g.  $\pm 5\%$  220 VAC and full load  
current equal or below name plate rating  
Test Data Sheet completely filled-up

5.7 Voltage test

Appropriate instrument is used in the testing  
Accuracy of test result is obtained within  
tolerable limit (e.g.  $\pm 10\%$  220 VAC)  
Voltage Test Data Sheet properly filled-up

5.8 Winding resistance test

Appropriate instrument is used in the testing  
Instrument calibrated and certified annually  
Winding Resistance Test Data Sheet  
completely filled-up  
Accuracy of test result is obtained within  
tolerable limit (e.g. 358 ohms  $\pm 2\%$ )

5.9 Polarization index (P.I.) test

Appropriate instrument is used in the testing  
Polarization Index Test Data Sheet filled-up  
completely  
Followed Polarization Index Test procedures  
Instrument calibrated and certified annually

5.10 Lock rotor test

Appropriate instrument is used in the testing  
Test report completely filled-up  
Test reading accuracy is obtained within  
tolerable limit (e.g. 220 VAC,  $\pm 2\%$  12A,  $\pm$   
 $2\%$  25 watts)

5.11 Free running test

Appropriate instrument is used in the testing  
Test reading accuracy is obtained within  
tolerable limit (e.g. 220 VAC,  $\pm 2\%$  10A, 20  
W  $\pm 2\%$ )  
Test report complete filled-up

5.12 Open/short circuit test

Appropriate instrument is used in the testing  
Instrument calibrated and certified annually  
Test reading accuracy is obtained with  
tolerable limit (e.g. 220 VAC  $\pm 5\%$ , 15A  $\pm$   
 $2\%$  30 W  $\pm 2\%$ )  
Test report completely filled-up

5.13 Transformer turn ratio test

Appropriate instrument is used in the testing  
Instrument calibrated and certified annually  
Test reading accuracy is obtained with  
tolerable limit (e.g.  $1.82 \pm 5\%$ )  
Completely filled-up TTR portion of  
Transformer Test Data Sheet

5.14 Dielectric strength test

Appropriate instrument is used in the testing  
Test procedure for dielectric strength of oil  
followed  
Reading accuracy of test result is obtained  
(e.g.  $25\text{kv} \pm 2\%$ )  
Test Data Sheet completely filled-up

5.15 Voltage excitation test

Appropriate instrument is used in the testing  
Reading accuracy of test result is obtained  
within tolerable limit equal or below  
nameplate rating (e.g.  $\pm 2\%$  120 V)  
Test Data Sheet completely filled-up

5.16 Energizing electrical system

Appropriate instrument is used in the testing  
Final check for loose connection, wire  
arrangement, cleanliness, enclosure  
appearance insulation resistance  
measurement in the presence of  
commission's team as per client standard  
requirement  
Energize equipment one-by-one  
Voltage and current measurement within  
tolerable limit base on equipment  
nameplate (e.g.  $5\%$  220 VAC) in the  
presence of commissioning team  
Completely filled-up record form for all  
measurement

2.32 (10) Range of Variable Training Components

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
1. Commissioning procedures	1.1 Formulate checklist of machine and equipment parts 1.2 Check completeness of installation based on plans/diagrams 1.3 Perform electrical testing 1.4 Perform no-load and load testing 1.5 Perform monitoring of meters and gauges 1.6 Orient end-user regarding systems operations 1.7 Turn over electrical equipment to end-user
2. Personal protective equipment (PPE)	Including but not limited to: 2.1 Working gloves 2.2 Safety shoes 2.3 Hard hat 2.4 Face shield 2.5 Insulating mat 2.6 Ear plug
3. Tools, equipment and testing devices	Including but are not limited to: 3.1 Electrical hand tools <ul style="list-style-type: none"> <li>- Pliers</li> <li>- Screwdrivers</li> <li>- Wrenches</li> <li>- Wire splicers</li> <li>- Electrician knives</li> </ul> 3.2 Testing instruments <ul style="list-style-type: none"> <li>- Multi-tester (VOM)</li> <li>- Ammeter</li> <li>- Insulation resistance tester</li> <li>- Ground resistance tester</li> <li>- Lux meter</li> <li>- Thermal scanner</li> <li>- Flow meter</li> <li>- Pressure gauge</li> <li>- Pressure Analyzer/ Gauge manifold</li> <li>- Leak tester</li> </ul> 3.3 Labeling machine 3.4 Warning signages <ul style="list-style-type: none"> <li>- Lock-out/Tag-out</li> </ul> 3.5 Phase-sequence indicator 3.6 Thermometer 3.7 Tachometer 3.8 Telephone/telephone handset

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
<p>4. Potential hazards</p>	<p>Including but not limited to:</p> <ul style="list-style-type: none"> <li>4.1 Live wires</li> <li>4.2 Oil spill</li> <li>4.3 Chemical hazards</li> <li>4.4 Flammable materials</li> <li>4.5 Sources of energy</li> <li>4.6 Moving machine parts</li> <li>4.7 Sharp/pointed objects</li> <li>4.8 Noise hazards</li> <li>4.9 Confined space</li> </ul>
<p>5. Electrical testing criteria</p>	<p>May include but are not limited to:</p> <p><u>5.1 Continuity test</u>                      Completely filled-up continuity test report                      Instrument calibrated and certified annually                      Used of appropriate test instrument (e.g. analog/digital, multi-meter or ohmmeter)                      All tools, instrument, equipment and materials in proper place without unnecessary things within work perimeter</p> <p><u>5.2 Electrical insulation test</u>                      Appropriate instrument is used in the testing                      Megger test data sheet filled-up completely                      Accuracy of test result obtained within tolerable limit (e.g. 2 meg ohm ± 2%)                      Instrument calibrated and certified annually</p> <p><u>5.3 High potential test</u>                      Appropriate instrument is used in the testing                      Instrument calibrated and certified annually                      Test Data Sheet completely filled-up                      Reading accuracy of test result obtained at ± 2% (3.kvac)</p> <p><u>5.4 Earth resistance test</u>                      Appropriate instrument is used in the testing                      Instrument calibrated and certified annually                      Test report completely filled-up                      Test reading accuracy is obtained with tolerance limit (5 ohm) 3 point method</p>



VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
	<p><u>5.5 Phase sequence test</u>                      Appropriate instrument is used in the testing                      Tagging power line in accordance of phase sequence results                      from the main distribution panel down to the load                      Completely filled-up report in accordance with the test result</p> <p><u>5.6 Load test</u>                      Appropriate instrument is used in the testing                      Load test reading accuracy within tolerance limit                      (e.g. <math>\pm 5\%</math> 220 VAC and full load current equal or below name plate rating                      Test Data Sheet completely filled-up</p> <p><u>5.7 Voltage test</u>                      Appropriate instrument is used in the testing                      Accuracy of test result is obtained within tolerable limit (e.g. <math>\pm 10\%</math> 220 VAC)                      Voltage Test Data Sheet properly filled-up</p> <p><u>5.8 Winding resistance test</u>                      Appropriate instrument is used in the testing                      Instrument calibrated and certified annually                      Winding Resistance Test Data Sheet completely filled-up                      Accuracy of test result is obtained within tolerable limit (e.g. 358 ohms <math>\pm 2\%</math>)</p> <p><u>5.9 Polarization index (P.I.) test</u>                      Appropriate instrument is used in the testing                      Polarization Index Test Data Sheet filed-up completely                      Followed Polarization Index Test procedures                      Instrument calibrated and certified annually</p>

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
	<p><u>5.10 Lock rotor test</u>                      Appropriate instrument is used in the testing                      Test report completely filled-up                      Test reading accuracy is obtained within tolerable limit (e.g. 220 VAC, <math>\pm 2\%</math> 12A, <math>\pm 2\%</math> 25 watts)</p> <p><u>5.11 Free running test</u>                      Appropriate instrument is used in the testing                      Test reading accuracy is obtained within tolerable limit (e.g. 220 VAC, <math>\pm 2\%</math> 10A, 20 W <math>\pm 2\%</math>)                      Test report complete filled-up</p> <p><u>5.12 Open/short circuit test</u>                      Appropriate instrument is used in the testing                      Instrument calibrated and certified annually                      Test reading accuracy is obtained with tolerable limit (e.g. 220 VAC <math>\pm 5\%</math>, 15A <math>\pm 2\%</math> 30 W <math>\pm 2\%</math>)                      Test report completely filled-up</p> <p><u>5.13 Transformer turn ratio test</u>                      Appropriate instrument is used in the testing                      Instrument calibrated and certified annually                      Test reading accuracy is obtained with tolerable limit (e.g. 1.82 <math>\pm 5\%</math>)                      Completely filled-up TTR portion of Transformer Test Data Sheet</p> <p><u>5.14 Dielectric strength test</u>                      Appropriate instrument is used in the testing                      Test procedure for dielectric strength of oil followed                      Reading accuracy of test result is obtained (e.g. 25kv <math>\pm 2\%</math>)                      Test Data Sheet completely filled-up</p> <p><u>5.15 Voltage excitation test</u>                      Appropriate instrument is used in the testing                      Reading accuracy of test result is obtained within tolerable limit equal or below nameplate rating (e.g. <math>\pm 2\%</math> 120 V)                      Test Data Sheet completely filled-up</p>

VARIABLE TRAINING COMPONENTS	RANGE OF VARIATION
	<p><u>5.16 Energizing electrical system</u>                      Appropriate instrument is used in the testing                      Final check for loose connection, wire arrangement, cleanliness, enclosure appearance insulation resistance measurement in the presence of commission’s team as per client standard requirement                      Energize equipment one-by-one                      Voltage and current measurement within tolerable limit base on equipment nameplate (e.g. 5% 220 VAC) in the presence of commissioning team                      Completely filled-up record form for all measurement</p>

2.33 (10) Evidence Guide for Assessment

ASPECTS OF COMPETENCY	ASSESSMENT EVIDENCE REQUIREMENTS
<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Planned commissioning procedures in line with job requirements</li> <li>1.2 Prepared/obtained materials, PPE, tools, equipment and testing devices in line with established procedures and job specifications</li> <li>1.3 Demonstrated compliance with safety regulations applicable to worksite operations</li> <li>1.4 Performed commissioning activities in line with established procedures</li> <li>1.5 Undertaken final inspection to ensure commissioning electrical system meet job requirements</li> <li>1.6 Communicated effectively with others to ensure safe and effective work operations</li> <li>1.7 Prepared complete report of commissioned electrical equipment/ system</li> <li>1.8 Demonstrated good working attitudes</li> </ul>

<b>ASPECTS OF COMPETENCY</b>	<b>ASSESSMENT EVIDENCE REQUIREMENTS</b>
2. Underpinning Knowledge	2.1 Handling of equipment, tools, materials and consumables 2.2 Philippines Electrical Code (PEC) requirements 2.3 Standard operating procedure in energizing electrical system 2.4 Mensuration 2.5 Knowledge on how to operate the test instruments 2.6 Interpretation of electrical plans/shop drawings 2.7 Electrical Laws and Principles 2.8 Pneumatics and Electro-Pneumatics 2.9 Computer Operations 2.10 Environmental laws 2.11 Occupational Health & Safety procedures
3. Underpinning Skills	3.1 Interpreting plan and details 3.2 Tracing circuits 3.3 Performing electrical test 3.4 Using test instruments 3.5 Troubleshooting skills 3.6 Performing first-aid 3.7 Identifying potential hazards and selecting prevention and/or control measures 3.8 Practicing safe working habits 3.9 Operating computers 3.10 Communication skills
4. Resource Implications	The following resources should be provided: 4.1 Workplace location 4.2 Tools and equipment appropriate to commissioning electrical system 4.3 Materials relevant to the proposed activity 4.4 Drawings and specifications relevant to the task
5. Methods of Assessment	Competency in this unit must be assessed: 5.1 Through direct observation of application of tasks. 5.2 Oral questioning related to underpinning knowledge 5.3 Written test or examination 5.4 Third party report 5.5 Demonstration (able to impart knowledge and skills)
6. Context for Assessment	6.1 Competency may be assessed in the workplace or in a simulated workplace setting 6.3 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision

2.31 (11) Performance Criteria for Unit of Competency Elements

**UNIT TITLE** : (11) **PERFORM PROGRAMMING AND INSTALLATION OF BASIC PROGRAMMABLE LOGIC CONTROLLER (PLC) SYSTEMS.**

**UNIT CODE** : **CON724324**

**UNIT DESCRIPTOR** : This module of Core Electrical Competency covers the knowledge, skill and attitudes necessary to install and program a basic programmable logic control.

VARIABLE TRAINING COMPONENTS	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable Training
1. Plan and prepare for installation	1.1. Work instructions are read and interpreted to determine job requirements. 1.2. <b>Tools and testing devices</b> needed to carry out the installation work are selected in accordance with established procedures and checked for correct operation and safety. 1.3. <b>Materials and components</b> necessary to complete the work are obtained in accordance with job requirements.
2. Install/Test field and control devices	2.1. Appropriate <b>personal protective equipment</b> is worn in line with standard operating procedures. 2.2. <b>Occupational Health &amp; Safety policies and procedures</b> for installation are followed in line with the job requirements. 2.3. <b>Devices</b> are installed and tested in accordance with manufacturer’s instructions and requirements 2.4. Work site is cleaned and cleared of all debris and made safe in accordance with the company requirements 2.5. Report on installation and testing of equipment is prepared according to company’s procedures/policies. 2.6. Unplanned events or conditions are responded to in accordance with established procedures
3. Create/Modify, install and test basic PLC program	3.1. Appropriate <b>language</b> is used according to applications. 3.2. Created/modified PLC program is tested / run to ensure all syntax errors are corrected. 3.3. Test processes are reviewed to ensure defect-free PLC program. 3.4. External documentation and back-up programs required for users are created/prepared according to company standards.

2.32 (11) Range of Variable Training Components

<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
1. Tools	Includes the following but not limited to: 1.1 Pliers; assorted 1.2 Screwdrivers; assorted 1.3 Wrenches; assorted
2. Test equipment/instruments	Includes the following but not limited to: 2.1 Multi-tester (VOM) 2.2 Ammeter 2.3 Signal generator 2.4 Calibrators 2.5 Flow meters 2.6 Pressure meter 2.7 Thermometer 2.8 Low voltage power supply (DC) 2.9 Computers (PC/laptop)/Programming console
3. Materials and components	Includes the following but not limited to: 3.1 Wires 3.2 Terminal lugs 3.3 Terminal blocks 3.4 Terminal wire marker 3.5 Sensors 3.5.1 Heat/temperature 3.5.2 Pressure 3.5.3 Flow 3.5.4 Motion 3.5.5 Proximity 3.6 Limit switches 3.7 Relays
4. Personal protective equipment	May include but are not limited to: 4.1 Safety helmet (hard hat/bump hat) 4.2 Safety shoes 4.3 Ear muffs 4.4 Goggles/Face shield 4.5 Safety belt/Harness 4.6 Safety Gloves 4.7 Safety Mask (gas/fumes, dust) 4.8 Proper working clothes
5. Occupational Health & Safety (OH & S) policies and procedures	5.1 Philippine Electrical Code (PEC) 5.2 National Building Code 5.3 OH & S guidelines 5.4 Philippine environmental laws

<b>VARIABLE TRAINING COMPONENTS</b>	<b>RANGE OF VARIATION</b>
6. Field and control devices	Includes the following but not limited to: 6.1 Analogue devices 6.1.1 Actuators 6.1.2 Servo Motors 6.1.3 Frequency drives 6.1.4 Transducers 6.1.5 Transmitters 6.2 Digital devices 6.2.1 Actuators 6.2.2 Buzzers 6.2.3 Lamps 6.2.4 Limit switches 6.2.5 Magnetic contactors 6.2.6 Photo-sensors 6.2.7 Proximity sensors
7. Language	Includes but not limited to: 1.1. Standard Programming language 1.1.1. Ladder 1.1.2. Mnemonics 1.1.3. STL (Statement List) 1.1.4. Function chart 1.2. Procedure language

2.33 (11) Evidence Guide for Assessment

<b>ASPECTS OF COMPETENCY</b>	<b>ASSESSMENT EVIDENCE REQUIREMENTS</b>
1. Critical aspect of competency	Assessment must show that the candidate: 1.1 Interpreted work instructions according to job requirements 1.2 Checked installed devices to ensure safety 1.3 Tested installed field and control devices 1.4 Gathered and documented information needed for the creation/modification of the basic PLC program 1.5 Selected appropriate basic PLC programming language 1.6 Tested created/modified basic PLC program 1.7 Prepared a user-friendly documentation of the created/modified basic PLC program

<b>ASPECTS OF COMPETENCY</b>	<b>ASSESSMENT EVIDENCE REQUIREMENTS</b>
2. Underpinning knowledge	2.1 Occupational health and safety procedures 2.2 Electrical theories 2.3 Use of test equipment/instruments 2.4 Basic electronics 2.5 Drawing interpretation 2.6 Electromechanical technology 2.7 Pneumatics / Electro-Pneumatics 2.8 Hydraulics 2.9 Industrial motors 2.10 Process Automation and Calibration 2.11 Basic PLC Programming 2.12 Concepts of I/O drivers 2.13 Control applications and concepts 2.14 Circuit Analysis 2.15 Basic Microprocessor Applications 2.16 Operating Systems (Basic computer applications) 2.17 Sequence control
3. Underpinning skills	3.1 Reading skills required to interpret diagrams and work instructions 3.2 Communication skills needed to interpret and define work procedures 3.3 Problem solving in emergency situation 3.4 Programming skills
4. Method of assessment	4.1 The assessor may select two of the following assessment methods to objectively assess the candidate: 4.1.1 Direct Observation 4.1.2 Oral/Written Questioning 4.1.3 Third Party Report 4.1.4 Practical Demonstration 4.1.5 Portfolio
5. Resource Implication	5.1 Tools 5.2 Test equipment/instruments 5.3 Field and control devices 5.4 Materials 5.5 PPE 5.6 Technical manuals 5.7 PLC System 5.8 Appropriate equipment
6. Context of Assessment	6.1 Assessment may be conducted in the workplace or in a simulated work process and procedures



**ELECTRICAL INSTALLATION & MAINTENANCE NC IV COMPETENCY MAP**

**BASIC COMPETENCIES**

Receive and Respond to Workplace Communication	Work with Others	Demonstrate work values	Practice basic housekeeping procedures	Participate in Workplace Communication	Work in a Team Environment	Practice career professionalism
Practice occupational health and safety procedures	Lead Workplace Communication	Lead Small Working Teams	Develop and Practice Negotiating Skills With Team Members	Guide Effective Solutions to Problems Arising from Work Activities	Check and Develop the Use of Mathematical Concepts & Techniques	Use Relevant Technologies Applicable to Assigned Work
<b>Lead in Utilizing Specialized Communication Skills</b>	<b>Assist in Developing Team and Individuals</b>	<b>Apply Problem Solving Techniques in the Workplace</b>	<b>Collect, analyze and organize information</b>	<b>Plan and Organize Work for Several Working Teams</b>	<b>Promote Environmental Protection</b>	

**COMMON COMPETENCIES**

<b>Supervise Preparation Construction Materials, Tools &amp; Equipment for Assigned Tasks</b>	<b>Ensure Compliance with Standards Procedures, Specifications and Manuals of Instructions</b>	<b>Interpret and Follow Technical Drawings and Plans</b>	<b>Supervise Mensuration and Related Computations</b>	<b>Supervise Proper Use and Maintenance of Tools and Equipment</b>
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**CORE COMPETENCIES**

Prepare electrical materials and tools	Perform roughing-in activities for basic electrical lay-out	Perform installation of wiring devices for power, lights & auxiliary outlets	Perform installation of electrical wiring	Perform installation of basic electrical protection systems	Perform installation of basic auxiliary outlets and lighting fixtures	Perform commissioning on low voltage electrical systems
<b>Prepare electric and hydraulic tools</b>	Perform roughing-in activities for communication and distribution systems	Install wiring devices for floor and ground fault current interrupting outlets	Install electrical protection system for lightning and grounding	Install electrical lighting on auxiliary outlets and lighting fixtures	Install communication, signaling devices and remote control systems on auxiliary equipment	Commission installed electrical systems
<b>Perform roughing-in and wiring activities for bus and under-floor ducts</b>	<b>Perform installation of wiring devices for floor and ground fault current interrupting outlets</b>	<b>Perform installation of standard electrical protection system for lightning and grounding</b>	<b>Perform installation of electrical lighting systems, auxiliary outlets and lighting fixtures</b>	<b>Perform installation of data measurement and control system on electrical and auxiliary equipment</b>	<b>Assemble and install electrical lighting and motor control systems</b>	<b>Perform maintenance and troubleshooting works</b>
<b>Supervise/Monitor installation &amp; maintenance on electrical systems, auxiliary including control, lighting, power and protection equipment</b>	<b>Perform commissioning of electrical equipment/system</b>	<b>Perform programming and installation of basic PLC systems</b>				

**3.00 TRAINING STANDARDS**

3.10 **Curriculum Design** - These guidelines for Curriculum Design are set to provide technical and vocational education and training (TVET) providers with information and other important requirements to consider when designing training programs for Electrical Installation and Maintenance NC IV. This course is designed to develop knowledge, skills and attitudes of a worker qualified for Electrical Installation and Maintenance NC IV in accordance with TESDA standards level. It covers (1) Basic Worker Competencies; (2) Common Construction Industry Competencies; and (3) Core Electrical Competencies as enumerated in Section 1.30 (Page 2).

**Nominal Training Duration:**

Basic Worker Competencies - 20 Hours  
 Common Construction Industry Competencies - 32Hours  
 Core Electrical Competencies - 464 Hours  
**Total Course Hours 516 Hours**

3.11 **Basic Worker Competencies Development** - This course is designed to equip individual with operational skills required for Basic Worker Competencies of Electrical Installation & Maintenance IV with learning outcomes, methodology and assessment approach as listed herein.

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Lead workplace communication	1.1 Communicate information about workplace processes. 1.2 Lead workplace discussions. 1.3 Identify and communicate issues arising in the workplace	1.a. Group discussion 1.b. Role Play 1.c. Brain-storming	1.u. Observation 1.v. Interviews
2. Lead small teams	2.1 Provide team leadership. 2.2 Assign responsibilities among members. 2.3 Set performance expectation for team members 2.4 Supervise team performance	2.a. Lecture 2.b. Demonstration 2.c. Self-paced (modular)	2.u. Demonstration 2.v. Case studies

<b>Unit of Competency</b>	<b>Learning Outcomes</b>	<b>Methodology</b>	<b>Assessment Approach</b>
3. Develop and practice negotiation skills	3.1 Identify relevant information in planning negotiations 3.2 Participate in negotiations 3.3 Document areas for agreement	3.a. Direct observation 3.b. Simulation/role playing 3.c. Case studies	3.u. Written test 3.v. Practical/ performance test
4. Solve workplace problem related to work activities	4.1 Explain the analytical techniques. 4.2 Identify the problem. 4.3 Determine the possible cause/s of the problem.	4.a. Direct observation 4.b. Simulation/role playing 4.c. Case studies	4.u. Written test 4.v. Practical/ performance test
5. Use mathematical concepts and techniques	5.1 Identify mathematical tools and techniques to solve problem 5.2 Apply mathematical procedures/solution 5.3 Analyze results	5.a. Direct observation 5.b. Simulation/role playing 5.c. Case studies	5.u. Written test 5.v. Practical/ performance test
6. Use relevant technologies	6.1 Identify appropriate technology 6.2 Apply relevant technology 6.3 Maintain/enhance relevant technology	6.a. Direct observation 6.b. Simulation/role playing 6.c. Case studies	6.u. Written test 6.v. Practical/ performance test

3.12 Common Construction Industry Competencies Development - This course is designed to equip individual with operational skills required for Common Construction Industry Competencies of Electrical Installation & Maintenance IV with learning outcomes, methodology and assessment approach as listed herein.

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1.Prepare construction materials and tools	1.1 Identify Materials 1.2 Requisition Materials 1.3 Receive and inspect materials	1.a. Audio Visual 1.b. Simulation 1.c. Discussion 1.d. Practical Exercise 1.e. Demonstration	1.u. Direct observation 1.v. Questions or interview 1.w. Portfolio (credentials) 1.x. Written / Oral Test 1.y. Demonstration
2.Observe procedures, Specifications and Manuals of Instructions	2.1 Identify and access specification/ manuals	2.a. Audio Visual 2.b. Simulation 2.c. Discussion Practical Lab 2.d. Demonstration	2.u. Direct observation 2.v. Oral questioning 2.w. Written test or examination 2.x. Third party report 2.y. Demonstration (able to impart knowledge & skills)
3.Interpret Technical Drawing	3.1 Analyze sign, symbols & data 3.2 Interpret technical drawing & plans 3.3 Apply freehand sketching	3.a. Audio Visual 3.b. Simulation 3.c. Discussion Practical Lab 3.d. Demonstration	3.u. Direct observation 3.v. Oral questioning 3.w. Written test or examination 3.x. Third party report 3.y. Demonstration (able to impart knowledge and skills)
4.Perform mensurations and calculation	4.1 Select measuring instruments 4.2 Carry out measurements and calculations	4.a. Audio Visual 4.b. Simulation 4.c. Discussion Practical Lab 4.d. Demonstration	4.u. Direct observation 4.v. Oral questioning 4.w. Written test or examination 4.x. Third party report 4.y. Demonstration (able to impart knowledge and skills)

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
5. Maintain tools and equipment	5.1 Check condition of tools and equipment 5.2 Perform basic preventive maintenance 5.3 Sharpen edge and tooth cutting tools 5.4 Store tools and equipment	5.a. Audio Visual 5.b. Simulation 5.c. Discussion Practical Lab 5.d. Demonstration	5.u. Direct observation of application of tasks. 5.v. Oral questioning 5.w. Written test or examination 5.x. Third party report 5.y. Demonstration

3.13 Core Electrical Competencies Development - This course is designed to equip individual with operational skills required for Core Electrical Competencies of Electrical Installation & Maintenance IV with learning outcomes, methodology and assessment approach as listed herein.

*Note: Units 1 to 5 of the core units are the same as those for Electrical Installation and Maintenance NC II. Units 1 to 8 are the same as those for Electrical Installation and Maintenance NC III. Hence those who have completed training in one or both of the above qualifications or who are valid holders of one or both of these qualifications need not undergo training in the corresponding competencies.*

<b>Unit of Competency</b>	<b>Learning Outcomes</b>	<b>Methodology</b>	<b>Assessment Approach</b>
1. Prepare Electric and Hydraulic Tools	1.1. Select and identify of electric power and hydraulic tools. 1.2. Maintain electrical power and hydraulic tools.	1.a. Demonstration 1.b. Modular (self-paced) 1.c. Lecture 1.d. Audio Visual 1.e. Practical Laboratory	1.u. Direct observation 1.v. Oral questioning 1.w. Written Test 1.x. Demonstration
2. Perform roughing-in activities for bus ducts and underfloor ducts.	2.1 Install bus way or bus duct and fittings. 2.2 Install under floor duct and fittings.	3.y. Demonstration 3.z. Modular (self-paced) 3.aa. Lecture 3.bb. Audio Visual 3.cc. Practical Laboratory	2.u. Direct observation 2.v. Oral questioning 2.w. Written Test 2.x. Demonstration
3. Perform installation of wiring devices for floor and ground fault current interrupting outlets	3.1 Select the wiring devices used for floor and ground fault current interrupter. 3.2 Install the wiring devices for floor and ground fault current interrupter based on standard 3.3 Notify the completion of work in accordance with the requirement.	3.a. Demonstration 3.b. Modular (self-paced) 3.c. Lecture 3.d. Audio Visual 3.e. Practical Laboratory	3.u. Direct observation 3.v. Oral questioning 3.w. Written Test 3.x. Demonstration

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
4. Perform installation of electrical protection system for lightning and grounding.	4.1 Plan and prepare work. 4.2 Install electrical protection system. 4.3 Notify completion of work.	4.a. Demonstration 4.b. Modular (self-paced) 4.c. Lecture 4.d. Audio Visual 4.e. Practical Laboratory	4.u. Direct Observation 4.v. Written or Oral demonstration 4.w. Oral questioning 4.x. Written Test 4.y. Demonstration
5. Perform installation of electrical lighting systems, auxiliary outlets and lighting fixtures.	5.1 Plan and prepare work. 5.2 Install lighting fixtures. 5.3 Notify the completion or work in accordance with the requirement.	5.a. Demonstration 5.b. Modular (self-paced) 5.c. Lecture 5.d. Audio Visual 5.e. Practical Laboratory	5.u. Direct Observation 5.v. Written or Oral Demonstration 5.w. Oral questioning 5.x. Written Test 5.y. Demonstration
6. Perform installation of data measurement and control systems on electrical and auxiliary equipment.	1.1 Plan and prepare work. 1.2 Request materials, tools and equipment needed. 1.3 Install electrical, auxiliary and protection system of an equipment. 1.4 Install electrical wiring. 1.5 Notify completion of work.	6.a. Demonstration 6.b. Modular (self-paced) 6.c. Lecture 6.d. Audio Visual 6.e. Practical Laboratory	6.u. Direct observation 6.v. Oral questioning 6.w. Written Test 6.x. Demonstration

<b>Unit of Competency</b>	<b>Learning Outcomes</b>	<b>Methodology</b>	<b>Assessment Approach</b>
<p>7. Assemble and install electrical lighting and motor control systems.</p>	<p>7.1 Check/Review type and purpose of electrical control system.</p> <p>7.2 Request the needs of materials, tools and equipment.</p> <p>7.3 Inspect electrical materials and tools.</p> <p>7.4 Assemble electrical control system.</p> <p>7.5 Notify completion of work.</p>	<p>7.a. Demonstration</p> <p>7.b. Modular (self-paced)</p> <p>7.c. Lecture</p> <p>7.d. Audio Visual</p> <p>7.e. Practical Laboratory</p>	<p>7.u. Direct observation</p> <p>7.v. Oral questioning</p> <p>7.w. Written Test</p> <p>7.x. Demonstration</p>
<p>8. Perform maintenance and troubleshooting works.</p>	<p>8.1 Plan, prepare and coordinate maintenance works.</p> <p>8.2 Maintain electrical system or equipment</p> <p>8.3 Troubleshoot faults in an electrical system or equipment</p> <p>8.4 Notify completion of work.</p>	<p>8.a. Demonstration</p> <p>8.b. Modular (self-paced)</p> <p>8.c. Lecture</p> <p>8.d. Audio Visual</p> <p>8.e. Practical Laboratory</p>	<p>8.u. Direct observation</p> <p>8.v. Oral questioning</p> <p>8.w. Written Test</p> <p>8.x. Demonstration</p>



Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
<p>9. Supervise /monitor installation and maintenance on electrical systems, including auxiliary, control, lighting, power and protection equipment.</p>	<p>9.1 Conduct Planning and preparation of work.                      9.2 Evaluate request materials, tools and equipment needed.                      9.3 Supervise the installation of electrical, auxiliary and protection system of equipment prepared.                      9.4 Supervise the installation of electrical wiring.                      9.5 Notify completion of work</p>	<p>9.a. Demonstration                      9.b. Modular (self-paced)                      9.c. Lecture                      9.d. Audio Visual                      9.e. Practical Laboratory</p>	<p>9.u. Direct observation                      9.v. Written and oral demonstration                      9.w. Written Test                      9.x. Demonstration</p>
<p>10 .Perform commissioning of electrical equipment/systems below 600 Volts.</p>	<p>10.1 Plan and prepare commissioning activities.                      10.2 Conduct commissioning on electrical equipment/ system.                      10.3 Turn over electrical equipment/ systems below 600 volts.</p>	<p>10.a.Demonstration                      10.b.Modular (self-paced)                      10.c.Lecture                      10.d.Audio Visual                      10.e.Practical Laboratory</p>	<p>10.u. Direct Observation                      10.v. Written or oral demonstration                      10.w. Written Test                      10.x. Demonstration</p>

<p>11. Perform programming and installation of basic Programmable Logic Controller (PLC) system.</p>	<p>11.1 Plan and prepare for installation.                  11.2 Identify materials, components tools and testing instrument.                  11.3 Install/Test field and control devices.                  11.4 Create/Modify, install and test basic PLC program.</p>	<p>11.a.Demonstration                  11.b.Modular (self-paced)                  11.c.Lecture                  11.d.Audio Visual                  11.e.Practical Laboratory</p>	<p>11.u. Direct Observation                  11.v.Written or oral demonstration                  11.w. Written Test                  11.x.Demonstration</p>
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**3.20 Training Delivery** - The delivery of training should adhere to the design of the curriculum.

3.21 Basic Principles of Competency – Based TVET- Delivery shall be guided by the 10 basic principles of competency-based TVET:

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

3.22 Training Modalities Programs -The competency-based TVET system recognizes various types of delivery modes, both on and off-the-job as long as the learning is driven by the competency standards specified by the industry. The following training modalities may be adopted when designing training programs:

- (1) The dualized mode of training delivery is preferred and recommended. Thus programs would contain both in-school and in-industry training or fieldwork components. Details can be referred to the Dual Training system (DTS) Implementing Rules and Regulations.
- (2) Modular/self-paced is a competency-based training modality wherein the trainee is allowed to progress at his/her own pace. The trainer only facilitates the training delivery.
- (3) Peer teaching/mentoring is a training modality wherein fast learners are given the opportunity to assist the slow learners.
- (4) Supervised Industry Training or On-the-Job Training is an approach in training designed to enhance the knowledge and skills of the trainee through actual experience in the workplace to acquire specific competencies prescribed in the training regulations.
- (5) Distance learning is a formal education process in which majority of the instruction occurs when the students and instructor are not in the same place. Distance learning may employ correspondence study, or audio, video or computer technologies.
- (6) Project-based instruction is an authentic instructional model or strategy in which students plan, implement and evaluate projects that have real world applications.

**3.30 Trainee Entry Requirements** - To qualify as trainee for Electrical Installation & Maintenance NC IV, a candidate must be:

- (1) a holder of Electrical Installation & Maintenance NC III or equivalent experience and training.
- (2) can communicate both oral and in written
- (3) physically and mentally fit
- (4) with good moral character
- (5) 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.

### 3.40 Tools, Equipment and Materials

Recommended list of tools, equipment and materials for the training of 25 trainees for ELECTRICAL INSTALLATION & MAINTENANCE NC IV are as follows:

TOOLS		MATERIALS	
Qty.	Description	Qty.	Description
5 pcs.	Crimping tools	5 pcs.	Circuit breakers/Fuses (Din rail type)
		5 pcs.	PLC materials
5 pcs.	Pliers	5 pcs.	Relays (Din rail type)
5 sets	Screw drivers	5 pcs.	Timers (Din rail type)
5 sets	Wrenches (box & open)	5 pcs.	Terminal Blocks/Lugs (Din rail type)
5 pcs.	Wire splicers/strippers	5 pcs.	Pilot lamps
5 pcs.	Measuring tools (e.g. Pull-push meter)	5 pcs.	Actuators
		20 pcs.	Push buttons (panel type)
EQUIPMENT		20 pcs.	Selector Switches (panel type)
Qty.	Description	5 lengths	Cable duct
5 units	Power supply	4 lengths	Din rail
	- Automatic Voltage Regulator (AVR)	3 packs	Wire Strap
	- Un-interruptible power supply (UPS)	20 pcs.	Wire Markers
5 units	Generators and motors	5 pack	Cable Tie
5 units	Transformer	20 meters	Cable (Royal cord)
5 units	Capacitors	10 pcs.	Glands/Grommet
5 units	Inverters/Rectifiers	2 boxes	Conductors
5 units	Controllers	5 rolls	Insulators
10 sets	- Motor controls	20 pcs.	Proper working clothes
	- Electro-mechanical controllers (e.g. Solenoid)		
1 set	- Electro-Pneumatic controller	Forms/Manuals	
5 pcs.	Pressure gauge		PLC plan and specification
5 pcs.	Pressure Analyzer/Gauge manifold		Requisition form(s)
5 pcs.	Leak tester		Industry/Institution Quality Manual
10 units	Micro PLC		User's guide
25 lic.	PLC Simulator Software		Drawings/diagrams

**3.50 Training Facilities**

Based on a class intake of 25 students/trainees, below are the space requirement & their sizes:

<b>Space Requirement</b>	<b>Size in Meters</b>	<b>Area in Sq. Meters</b>	<b>Total Area in Sq. Meters</b>
1. Student/Trainee Working Space	2.50 x 2.50 per student/trainee	6.25 per student	156.25
2. Contextual Learning Laboratory/ Lecture Room	4 x 5	20	20
3. Learning Resource Center	4 x 5	20	20
4. Facilities/Equipment/ Circulation area	10 x 6	60	60
<b>TOTAL AREA</b>			<b>256.25</b>

**3.60 Trainer's Qualifications** - The trainer who will handle the course must have the following qualifications:

- (1) Be a graduate of BS in Industrial Education, Major in Electrical Technology or its equivalent
- (2) Must have undergone training on Training Methodology I (TM I)
- (3) He must be a holder of at least Electrical Installation & Maintenance NC IV
- (4) Good moral character
- (5) Must be computer literate
- (6) Must be physically and mentally fit
- (7) Minimum of three (3) years relevant job/industry experience \*

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

#### 4.00 NATIONAL ASSESSMENT AND CERTIFICATION

**4.10 National Assessment** - To attain the National Qualification of Electrical Installation Maintenance NC IV, the candidate must demonstrate competence in all the units of Basic Worker Competencies, Common Construction Industry Competencies and Core Electrical Competencies as listed in Section 1.30, on page 2.

**4.20 Certification**- The qualification of Electrical Installation and Maintenance NC IV may be attained by candidates who have acquired Certificates of Competency (COCs) in all the required units of competency. Successful candidates shall be awarded the National Certificate for Electrical Installation & Maintenance NC IV. *If the candidate holds a National Certificate in Electrical Installation and Maintenance NC II, he/she will be required to acquire COCs only for Units of Competency Nos. 6 to 11. If the candidate holds a National Certificate for Electrical Installation & Maintenance NC III, he will be required to acquire COC's only for Units of Competency Nos. 9, 10 and 11 in order to acquire a National Certificate for Electrical Installation & Maintenance NC IV.* The guidelines on assessment and certification are discussed in more detail in the “Procedures Manual on Assessment and Certification” and “Guidelines on the Implementation of the Philippine TVET Qualification and Certification System (PTQCS)”.

4.20.1 *Accumulation of certificates of competency (COCs) in al the following areas*

4.20.1.1 *Performing roughing-in activities*

- *Prepare electrical power and hydraulic tools*
- *Perform roughing-in activities for communication and distribution systems*

4.20.1.2 *Installing wiring*

- *Prepare electrical power and hydraulic tools*
- *Install wiring devices for floor and GFCI outlets*

4.20.1.3 *Installing electrical protection systems*

- *Prepare electrical power and hydraulic tools*
- *Installing electrical protection systems for lighting and grounding*

4.20.1.4 *Installing lighting systems*

- *Prepare electrical power and hydraulic tools*
- *Install electrical lighting systems on auxiliary outlets and lighting fixtures*

*Note: Those who have unexpired Building-Wiring Installation NC II or Electrical Installation and Maintenance NC II qualifications will not need to accumulate the above COCs.*

*4.20.1.5 Install metering and control systems on electrical and auxiliary equipment*

*4.20.1.6 Assemble and install electrical lighting and motor control systems*

*4.20.1.7 Perform electrical maintenance and troubleshooting work*

*4.20.1.8 Supervise/Monitor installation and maintenance of electrical systems and auxiliaries including control, lighting, power and protection equipment*

*4.20.1.9 Commission electrical equipment/systems*

*4.20.1.10 Program and install basic PLC systems*

*Note: Those who have unexpired Electrical Installation and Maintenance NC III qualifications will not need to accumulate the above COCs.*

*4.20.2 Demonstration of competence through project-type assessment covering all the required units of the qualification*

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

4.22. The following are qualified to apply for assessment and certification:

(1) Graduates of formal, non-formal and informal including enterprise-based training programs

(2) Experienced Workers (wage-employed or self-employed)

**5.00 ACKNOWLEDGEMENTS**

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