

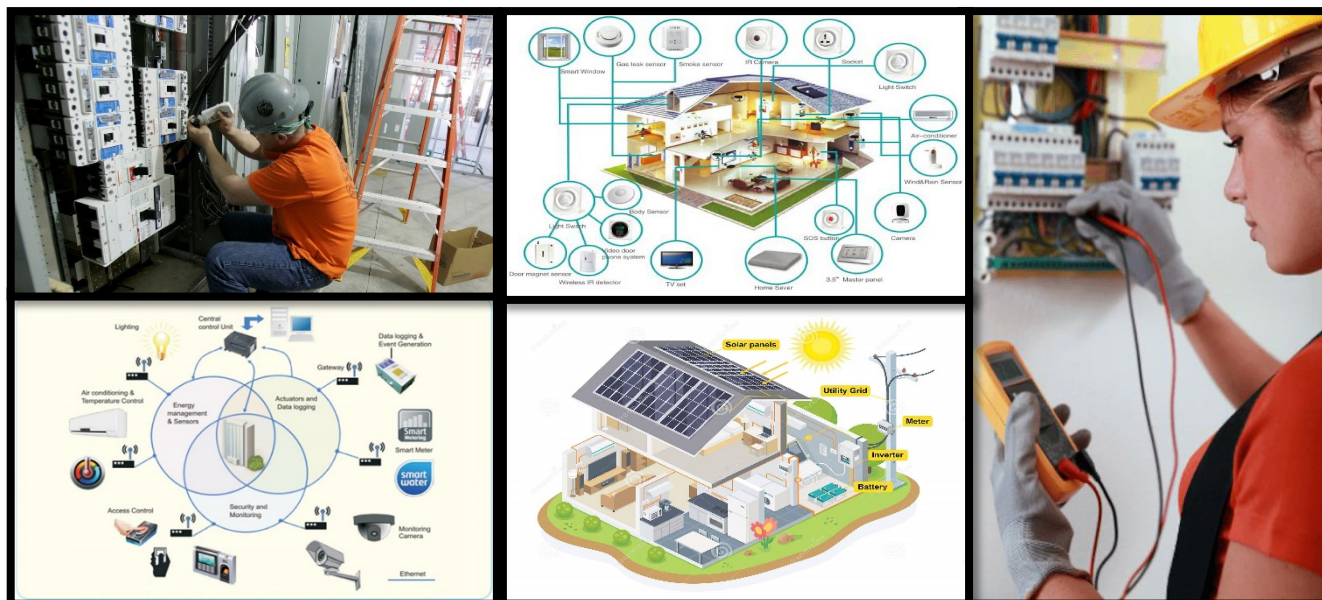


Kingdom of Cambodia
Nation Religion King



National Training Board
Ministry of Labour and Vocational Training

Competency Standard Installation and Maintenance Power and Control System in Building, Level 5 Code: POWE 622



Department of Standard and Curriculum

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1. INTRODUCTION

Cambodia has embarked on a process of reforming its Technical and Vocational Education and Training (TVET) System in response to industry needs for trained and educated manpower and directed to the achievement of effectiveness, efficiency, relevance, performance, flexibility and transparency of education and training. TVET is given an important role regarding technology transfer. The new paradigm in the outcome based TVET system is the orientation at the current and anticipated future demand of the economy and the labour market. Within the policies and strategies of the Cambodian Government, national competency standards have been developed using regional standards and international best practices as the basis, and, adopting, adapting and verifying them in the Cambodian context.

The National Competency Standards are an essential element of the Cambodian National TVET Strategy and an important factor within the context of the Cambodian National Qualification Framework (CQF) which provide for the granting of nationally recognized qualifications. The National Competency Standards are developed in consultation with the concerned expert workers and industry advisory groups and are written using prescribed format to maintain uniformity of formats amongst occupations.

This competency standard details the mandatory format, sequencing, wording and layout for the Cambodian National Competency Standard comprised of Units of Competency. A unit of competency describes a distinct work activity that would normally be undertaken by one person in accordance with industry standards. Units of Competence are documented in a standard format that comprises:

- Reference to Industry Sector, Occupational title, CQF level
- Unit code
- Unit title
- Unit descriptor
- Unit of competency
- Elements and performance criteria
- Variables and range statement
- Evidence guides

Competency Standards describe the skills, knowledge and attitude needed to perform effectively in the workplace. Competency Standards acknowledge that people can achieve vocational and technical competency in many ways by emphasizing what the learner can do, not how or where they learned to do it. The National Competency Standards focus on what is expected of a worker in the workplace and adhere to the following:

- emphasis is upon outcomes and the application of knowledge, skills and attitude;
- stress upon the ability to transfer and apply knowledge, skills and attitude to new situations and environment;
- concerned with what individuals can do and the ability to do a task in a range of contexts; and
- include all aspects of workplace performance and not only narrow task skills.

2. OVERVIEW

A **Competency Standard** is a written specification of the knowledge, skills and attitudes required for the performance of a job or occupation or trade corresponding to the standard of performance required in the workplace.

Competency Standard:

- provides a consistent and reliable set of components for training, recognizing and assessing skills of individuals, and may also have optional support materials
- enables nationally recognized qualifications to be awarded through direct assessment of workplace competencies
- encourages the development and delivery of flexible training which suits individual and industry requirements
- Encourages learning and assessment in a work-related environment which leads to verifiable workplace outcomes.

The Cambodian National Quality Framework applies nationally, is endorsed by the National Training Board (NTB) for Technical and Vocational Education and Training and comprises the National Qualification Framework and Competency Standards.

Competency Standards are developed by a Technical Working Group comprised of selected TVET teachers with the participation of worker-experts from the industry to meet the identified training needs of specific industries or industry sector. To gain national endorsement of competency standards, developers must provide consultation and support within the industry sector or enterprise through the Industry Advisory Group.

With Competency Standards, training and assessment may be conducted at the workplace, off-the-job, at a training organization, during regular work, or through work experience, work placement, work simulation or any combination of these methods.

3. QUALIFICATION

Installation and Maintenance Power and Control System in Building Level 5 (High Diploma):

The **Installation and Maintenance Power and Control System in Building Level 5** qualification consists of competencies that a person must achieve that will enable him/her to select, install, set up, test, fault find, repair, and maintain electrical systems and equipment in domestic and industrial building and premises.

The units of competency comprising this qualification include the following:

BASIC COMPETENCIES	CODE NO.
Supervise application of key communication skills in the workplace	POWE 0501
Supervise development of teams & individuals	POWE 0502
Supervise on problem solving techniques in the workplace	POWE 0503
Supervise data collection and analysis in the workplace	POWE 0504
Plan & organize work for several work teams	POWE 0505
Supervise environmental protection implementation	POWE 0506
Supervise OHS work issues in the Construction Industry	POWE 0507
Apply gender & social equity principles & policies	POWE 0508
Supervise works to comply compliance with procedures, specifications, and manuals	POWE 0509
Supervise preparation, use and maintenance of tools and equipment	POWE 0510
Supervise interpretations of technical drawings, plans and mathematic Calculations	POWE 0511
CORE COMPETENCIES	CODE NO.
Install and Test Electrical in Residential Building	POWE 6501
Install and Test Electrical in Commercial and Industrial Building	POWE 6502
Maintain Electrical Machines and Applications	POWE 6503
Maintain Power System and Switchboard	POWE 6504

Maintain Electrical Auxiliary Systems	POWE 6505
Program Intelligent Building Control Systems	POWE 6506
Maintain Solar Photovoltaic Systems	POWE 6507

4. COMPETENCY STANDARDS

Installation and Maintenance Power and Control System in Building, Level 5

This section gives the details of the contents of the basic and core units of competencies required in **Installation and Maintenance Power and Control System in Building, Level 5**.

BASIC COMPETENCIES

UNIT OF COMPETENCY: SUPERVISE APPLICATION OF KEY COMMUNICATION SKILLS IN THE WORKPLACE	UNIT CODE: POWE 0501
UNIT DESCRIPTOR: This unit covers the knowledge, skills and attitudes required to supervise the application of key communication skills in the workplace.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
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	2.1 Strategies for internal and external dissemination of information are developed, promoted, implemented, and reviewed as required 2.2 Channels of communication are established and reviewed regularly 2.3 Coaching in effective communication is provided 2.4 Work related network and relationship are maintained as necessary 2.5 Negotiation and conflict resolution <u>strategies</u> are used where required 2.6 Communication with clients and colleagues is appropriate to individual needs and organizational objectives
3. Represent the organization	3.1 When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization 3.2 Presentation is clear and sequential and delivered within a predetermined time 3.3 Utilize appropriate media to enhance presentation 3.4 Differences in views are respected 3.5 Written communication is consistent with organizational standards 3.6 Inquiries are responded in a manner consistent with organizational standard
4. Facilitate group discussion	4.1 Mechanisms which enhance <u>effective group interaction</u> is defined and implemented 4.2 Strategies which encourage all group members to participate are used routinely 4.3 Objectives and agenda for meetings and discussions are routinely set and followed 4.4 Relevant information is provided to group to facilitate outcomes 4.5 Evaluation of group communication strategies is undertaken to promote participation of all parties 4.6 Specific communication needs of individuals are identified and addressed
5. Conduct interviews	5.1 <u>Types of interviews</u> are employed in <u>interview situations</u>

	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 the required message is communicated.

RANGE OF VARIABLES

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
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 Interviews	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

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Demonstrated effective communication skills with clients accessing service and work colleagues 1.2 Supervised use of relevant communication techniques and strategies to meet client needs and difficulties
2. Underpinning knowledge	2.1 Communication process 2.2 Dynamics of groups and different styles of group leadership 2.3 Communication skills relevant to client groups
3. Underpinning Skills	3.1 Full range of communication techniques including: 3.1.1 Full range of communication 3.1.2 Active listening 3.1.3 Feedback 3.1.4 Interpretation 3.1.5 Role boundaries setting 3.1.6 Negotiation 3.1.7 Establishing empathy 3.2 Communication skills required to fulfill job roles as specified by the organization
4. Resource Implications	The following resources MUST be provided: 4.1 Variety of Information 4.2 Communication tools 4.3 Simulated workplace
5. Methods of Assessment	Competency may be assessed through: -

	5.1. Demonstration with oral questioning 5.2. Observation 5.3. Interview Test 5.4. Written Test 5.5. Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: SUPERVISE DEVELOPMENT OF TEAMS & INDIVIDUALS	UNIT CODE: POWE 0502
This Unit covers the Skills Knowledge & Attitudes required to supervise the planning of individual and team development needs and facilitate the development of workgroups	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Supervise team leadership development	1.1 Supervise <u>Learning and development needs</u> implementation in line with <u>organizational requirements</u> 1.2 Learning plan to meet team leadership developmental needs is collaboratively developed and implemented 1.3 Team leaders are encouraged to self-evaluate performance and identify areas for improvement 1.4 <u>Feedback on performance</u> of team leaders & members is collected & evaluated against planned outcomes.
2. Foster individual and organizational growth	2.1 Learning and development program goals and objectives are identified to match the needs. 2.2 <u>Learning delivery methods</u> are appropriate to the learning goals, the learning style of participants & availability of equipment and resources 2.3 Supervise workplace learning and coaching/ mentoring 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, teams is used to identify and implement improvements in future learning arrangements 3.2 Supervised outcomes and performance of individuals/teams are assessed and recorded to determine the effectiveness of development programs and the extent of additional support 3.3 Modifications to learning plans are negotiated to improve the efficiency and effectiveness of learning 3.4 Records and reports of competency are maintained in line with SOP & QMS
4. Develop team commitment and cooperation	4.1 Open communication processes to obtain and share information is used by team 4.2 Decisions are reached by consensus in accordance with the teams agreed roles and responsibilities 4.3 Mutual concern and support are developed within the team
5. Facilitate accomplishment of organizational goals	5.1. Team members actively participated in team activities and communication processes 5.2. Teams members developed individual and joint responsibility for their actions 5.3. Collaborative efforts are sustained to attain organizational goals

RANGE OF VARIABLES

1. Learning & development needs	1.1 Supervision, Coaching, mentoring. 1.2 Formal/informal learning program 1.3 Internal/external training provision 1.4 Work experience/exchange/opportunities 1.5 Personal study 1.6 Career planning/development 1.7 Performance appraisals 1.8 Workplace skills assessment 1.9 Recognition of prior learning
2. Monitor performance	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
3. Feedback	Formal/informal performance appraisals 3.1 Obtaining feedback from supervisors & Colleagues. 3.2 Obtaining feedback from clients 3.3 Personal and reflective behavior strategies 3.4 Routine and organizational methods for monitoring service delivery
4. Learning delivery methods	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

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Identified and supervised learning opportunities for team members 1.2 Gave and received feedback constructively 1.3 Supervised participation of individuals in teamwork 1.4 Negotiated learning plans to improve the effectiveness of learning 1.5 Prepared learning plans to match skill needs
2. Underpinning Knowledge	2.1 Supervision, Coaching and mentoring principles 2.2 How to work effectively with team members with diverse work styles, aspirations, cultures and perspective 2.3 How to facilitate team development and improvement 2.4 Learning theory 2.5 Methods and techniques for extracting and interpreting feedback 2.6 Methods for identifying and prioritizing personal development opportunities and options 2.7 Career paths and competency standards in the industry

3. Underpinning Skills	3.1 Listening Skills. 3.2 Planning Skills 3.3 Learning methods/domains (Blooms taxonomy etc.) 3.4 Communication skills including receiving feedback and reporting, maintaining effective relationships and conflict management 3.5 Coaching and mentoring skills 3.6 Monitoring & evaluation skills 3.7 Reporting skills to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes 3.8 Facilitation skills to conduct small group training sessions 3.9 Interpersonal skills
4. Resource Implications	The following resources should be provided: 4.1 Materials relevant to the proposed activity or tasks
5. Methods of Assessment	Competency may be assessed through: 5.1 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test 5.5 Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: SUPERVISE ON PROBLEM SOLVING TECHNIQUES IN THE WORKPLACE	UNIT CODE: POWE 0503
UNIT DESCRIPTOR: This Unit covers the Skills Knowledge & Attitudes required to supervise the problem-solving techniques in the workplace.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Analyze the problem	1.1 Supervise evaluation and reporting techniques & reports 1.2 Supervise development of possible cause & solution statements based on findings within the <u>areas of responsibilities</u>
2. Identify the possible solution	2.1 Supervise resolution decision making process in accordance with relevant procedures and <u>safety</u> 2.2 Strengths and weaknesses of possible options are considered
3. Recommend solution to teams or higher management	3.1 reports/ <u>communication</u> or <u>documentations</u> are prepared 3.2 Recommendations are presented to appropriate personnel in line with <u>SOP QMS & OHS</u> 3.3 Recommendations are followed-up if required
4. Implement & Supervise Solution	4.1 Measurable objectives are identified 4.2 Resource needs are identified 4.3 Timelines are identified in accordance with plan 4.4 Corrective actions process is supervised 4.5 Recommendations are actioned & recorded
5. Monitor outcomes	5.1 Recommendations are prepared and submitted to line with procedures. 5.2 Supervised implementation of processes and improvements.

RANGE OF VARIABLES

1. Area of responsibility	Variables may include but are not limited to: 1.1 Work environment 1.2 Problem solution processes 1.3 Monitoring & evaluation 1.4 Preventative maintenance and diagnostic policy 1.5 Roles and technical responsibilities
2. Communication	Variables may include but are not limited to: 2.1 Listening 2.2 Handwritten and printed material 2.3 Electronic mail. 2.4 Verbal communication 2.5 Sign language 2.6 Display units/environments
3. Documentation	3.1 Audit trails 3.2 Quality Assurance Procedures 3.3 Technical & Operating standards 3.4 Cause & solution records 3.5 Corrective action records.
4. SoP, QMS, OHS	4.1 As per company, statutory and vendor requirements (SoP & QMS) 4.2 Ergonomic and environmental regulations/factors must be considered during the demonstration of this competency

	4.3 Cause & solution statements.
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EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate is able to:</p> <ul style="list-style-type: none"> 1.1 Analyzed the problem 1.2 Identified possible solutions 1.3 Implemented solutions 1.4 Recommended solutions to higher management 1.5 Outcome evaluated/monitored
2. Underpinning Knowledge	<ul style="list-style-type: none"> 2.1 QMS organizational systems and functions 2.2 Maintenance practices & data management 2.3 Data management hardware and software 2.4 Knowledge of the client business domain 2.5 Broad knowledge base of diagnostic tools 2.6 General principles of OHS 2.7 Divisional/unit responsibilities
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Supervise decision making by individuals & teams 3.2 Communication skills applied 3.3 Supervise Teamwork in reference to personal responsibility 3.4 Time management as applied to self-management. 3.5 Analytical skills in relation to routine malfunctions. 3.6 General customer service skills displayed. 3.7 Consistently & effectively applying questioning and active listening skills
4. Resource Implications	<ul style="list-style-type: none"> 4.1 Assessment may 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. 4.2 A bank of scenarios/case studies/what ifs. 4.3 A bank of questions to determine the reasoning behind the observable actions
5. Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 5.1 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test 5.5 Portfolio
6. Context for Assessment	<ul style="list-style-type: none"> 6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: SUPERVISE DATA COLLECTION AND ANALYSIS IN THE WORKPLACE	UNIT CODE: POWE 0504
UNIT DESCRIPTOR: This Unit covers the Skills Knowledge & Attitudes required to supervise the collection & processing of data in the workplace.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Study information requirements	1.1 Needs are identified using established <u>research procedures</u> 1.2 Relevant <u>forms</u> 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 collected	2.1 <u>Data & Information</u> 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. Analyse, interpret and organize information gathered	3.1 Data are analyzed using relevant <u>methodologies</u> 3.2 Where applicable, <u>statistical analysis/methods</u> 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 Report on recommendations are prepared in line with procedures 4.2 Recommendations are presented to appropriate personnel. 4.3 Recommendations are followed-up & monitored as appropriate.

RANGE OF VARIABLES

1. Research procedures	1.1 Front-end analysis 1.2 Surveys 1.3 Interviews 1.4 Functional analysis
2. Forms	May include but not be 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. Data & Information	3.1 Raw data 3.2 Processed & packaged data 3.3 Papers/Research etc.
4. Methodologies	4.1 Qualitative methods 4.2 Quantitative methods
5. Statistical analysis/methods	5.1 Averages (Mean, Median, Mode) 5.2 Percentage 5.3 Ranks 5.4 Frequency Distribution 5.5 Statistical test

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 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. Analysed and organised information gathered 1.6. Submitted/Disseminated technical reports to concerned personnel
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. Spread sheets 2.4.2. Presentation graphics 2.4.3. Work processor 2.4.4. Statistical package
3. Underpinning Skills	3.1. Communication is clear, precise and varies according to the type of audience Research & Analysis techniques & processes 3.2. Data reading & interpretation 3.3. Problem solving 3.4. Analytical skills in relation to routine malfunctions 3.5. General customer service skills displayed 3.6. Time management as applied to self-management 3.7. Decision making within a limited range of options.
4. Resource Implications	4.1. Workplace or assessment location 4.2. Access to office equipment and facilities relevant to the unit 4.3. Case studies/scenarios/questions
5. Methods of Assessment	Competency may be assessed through: 5.1 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test 5.5 Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: PLAN & ORGANIZE WORK FOR SEVERAL WORK TEAMS	UNIT CODE: POWE 0505
UNIT DESCRIPTOR: This Unit covers the Skills Knowledge & Attitudes required to plan & organize work for several work teams.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Set objectives	1.1 <u>Work Objectives</u> set 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
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 agreed set time frames 2.3 <u>Resources</u> are allocated as per requirements of the activity 2.4 <u>Schedule of work activities</u> is coordinated with personnel concerned
3. Implement work plans	3.1 <u>Work methods and practices</u> are identified in consultation with personnel concerned 3.2 <u>Work plans</u> are implemented in accordance with set time frames, resources & standards 3.3 Appropriate actions are always implemented
4. Monitor work activities	4.1 Work activities & performances are monitored and compared with set objectives 4.2 Deviations from work activities are reported and recommendations are in accordance with set <u>standards</u> 4.3 Reporting requirements are compiled in accordance with SoP's & QMS 4.4 Reports are and maintained in accordance with standard operating procedures
5. Evaluate works plans & activities	5.1 Plans, strategies & implementation outcomes are evaluated with teams in line with SoP's & QMS 5.2 Evaluation outcomes are recorded and actioned as required. 5.3 All evaluation data is recorded and used to provide team & supervisor <u>feedback</u> .

RANGE OF VARIABLES

1. Objectives	1.1 Specific 1.2 General
2. Resources	2.1 Personnel 2.2 Equipment & technology 2.3 Services 2.4 Supplies & 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
4. Work methods and practices	4.1 Legislated regulations & codes of practices 4.2 Standard Operating Procedures 4.3 Quality Management Systems 4.4 OHS regulations
5. Work Plans	5.1 Daily work plans 5.2 Project plans 5.3 Programmed plans 5.4 Organization strategic and restructuring plans 5.5 Resources 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. Feedback	7.1 Reports 7.2 Verbal feedback 7.3 Formal feedback 7.4 Informal feedback 7.5 Questionnaire 7.6 Survey 7.7 Group discussion

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Set objectives 1.2 Planned & scheduled activities 1.3 Implemented work plans 1.4 Monitored work activities 1.5 Reported on work plans & activities 1.6 Evaluated & provided feedback on work plans & activities
2. Underpinning Knowledge	2.1 Organization strategic plan 2.2 SOP's 2.3 QMS 2.4 OHS 2.5 Teamwork & consultation strategies

3. Underpinning Skills	3.1 Planning 3.2 Organizing 3.3 Coordinating 3.4 Communication 3.5 Interpersonal/intra-person 3.6 Motivation 3.7 Presentation 3.8 Reporting
4. Resource Implications	4.1 Tools, equipment, materials & facilities appropriate to planned activities 4.2 Work plans & schedules 4.3 Relevant supporting documents (drawings etc.)
5. Methods of Assessment	Competency may be assessed through: 5.1 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test 5.5 Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: SUPERVISE ENVIRONMENTAL PROTECTION IMPLEMENTATION	UNIT CODE: POWE 0506
UNIT DESCRIPTOR: This Unit covers the Skills Knowledge & Attitudes required to supervise environmental protection implementation in the workplace	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Adopt environmental protection policy & principles.	1.1 Environmental <u>legislations/conventions</u> and local regulations are identified & adopted 1.2 <u>Industrial standard/environmental practices</u> are identified according to various <u>environmental concerns & impact</u> . 1.3 Environmental management support systems are established & operational
2. Implement specific environmental programs.	2.1 <u>Programs/Activities</u> are identified according to organizations policies and guidelines 2.2 Individual roles/responsibilities are determined and performed based on the activities identified 2.3 Environmental issues are identified & resolved in accordance with organizations' policies and guidelines 2.4 Environmental stakeholders are consulted based on company environmental guidelines.
3. Monitor activities on environmental protection /programs	3.1 Activities are <u>periodically</u> monitored and evaluated according to the objectives of the environmental programmed. 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 within <u>environmental auditing</u> . 3.4 Environmental protection recommendations are made & submitted based on the findings. 3.5 Environmental non-compliance issues are reported, monitored and managed.

RANGE OF VARIABLES

1. Legislations/conventions	1.1 Clean air act/law 1.2 Clean water act/law 1.3 Solid waste management 1.4 Montreal protocol 1.5 Kyoto protocol
2. Industrial standard/environmental practices	2.1 ISO Standards (14001:2015 & 14004:2016) 2.2 ECC standards 2.3 Company environmental management system (EMS) 2.4 ISO Internal & External auditor standards
3. Environmental concerns & impact	3.1 Air, water, noise & light pollution 3.2 Solid waste management 3.3 Deforestation & soil erosion 3.4 Radiation, radio frequency, microwaves, chemical 3.5 Electrical materials & components safe recycling & storage 3.6 Flood control

	3.7 Situation
	3.8 Coral reef/marine life protection
4. Programs/Activities	4.1 Waste disposal (on-site and off-site) 4.2 Repair and maintenance of equipment 4.3 Treatment and disposal operations 4.4 Clean-up activities 4.5 Laboratory and analytical test 4.6 Monitoring and evaluation 4.7 Environmental advocacy programs
5. Environmental auditing	5.1 Time structured 5.2 Individual & team 5.3 Auditing data reports.
6. Periodically	6.1 Hourly 6.2 Daily 6.3 Weekly 6.4 Monthly 6.5 Annually/yearly
7. Activities	7.1 Waste disposal (on-site and off-site) 7.2 Repair and maintenance of equipment. 7.3 Treatment, disposal & clean-up operations. 7.4 Laboratory and analytical test. 7.5 Supervision, Auditing, Monitoring and evaluation 7.6 Environmental advocacy programmed. 7.7 Reporting and compliance enforcement

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Application of environmental legislation policy & procedures relating to a range of environmental issues 1.2 Experienced in standard industrial environmental practices covering a range of environmental issues. 1.3 Implemented, monitored & audited environmental practices based on EMS 1.4 Resolved & reported on environmental problems and non-compliances based on EMS & existing legislation
2. Underpinning Knowledge	2.1 ISO 14001:2015, 14004:2016 2.2 Company EMS, policy & procedures 2.3 Environmental protocols 2.4 Supervisory principles 2.5 Internal & external auditor (EMS) 2.6 Compliance & noncompliance
3. Underpinning Skills	3.1 Supervisory skills 3.2 Management of ISO 14001:2015, 14004:2016 3.3 EMS Auditing skills 3.4 Research & analysis. 3.5 Fault finding & solution planning 3.6 Report writing
4. Resource Implications	4.1 Assessment location 4.2 Assessment package, including case studies. 4.3 Legislation & Standards 4.4 EMS policy & procedures
5. Methods of Assessment	Competency may be assessed through: 5.1 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test

	5.5 Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: SUPERVISE OHS WORK ISSUES IN THE CONSTRUCTION INDUSTRY	UNIT CODE: POWE 0507
UNIT DESCRIPTOR: This Unit of Common Competency covers the knowledge, skills, and attitudes to supervise OHS work issues within any sector of the Construction Industry	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Risk identification	1.1 OHS Risk <u>Hazards</u> in the work area are identified, assessed and reported to a supervisor/designated person. 1.2 Supervisor compiles an OHS risk report in line with SOP, QMS & OHS procedures 1.3 Hazardous materials on a work site are correctly identified and used according to company and legislated procedures.
2. Risk assessment	2.1 Supervisor & team assess the OHS risk hazards identified. 2.2 Supervisor implements & manages OHS risk assessment plan.
3. Risk prevention & supervision	3.1 Supervisor ensures that Safe work practices, duty of care requirements and safe work instructions are implemented & maintained. 3.2 OHS, hazard, accident or incident reports contribute to updating workplace procedures & National OHS legislation. 3.3 Correct personal protective equipment (<u>PPE</u>) and clothing for each area of construction work are identified, worn, correctly fitted, used, and stored according to SOP. 3.4 Measures for controlling risks and construction hazards are applied including training & multimedia signage. 3.5 Lists of designated OHS personnel names and contact data are visually available throughout the workplace in a range of media.
4. Emergency procedures	4.1 Response and evacuation procedures are known, practised and carried out effectively when required 4.2 Designated personnel are contacted in the event of an emergency. 4.3 First aid treatment of minor injuries is carried out correctly and details recorded for use by OHS Supervisor.

RANGE OF VARIABLES

1. Hazards	1.1 People 1.2 Chemical spills 1.3 Work in confined spaces 1.4 Trenches, excavations 1.5 Falling objects 1.6 Gasses, fires 1.7 Hazardous materials 1.8 Extreme temperatures 1.9 Infectious diseases 1.10 Handling & moving equipment
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	1.11 Overhanging, protruding, sharp objects 1.12 Noise, dust, vapors 1.13 Uncontrolled site traffic 1.14 Working at heights
2. PPE	2.1 Aprons 2.2 Arm guards 2.3 Caps 2.4 Dust masks 2.5 Respirators 2.6 Earmuffs 2.7 Gloves hard hats 2.8 Reflective vests 2.9 Overalls safety glasses 2.10 Boots
3. Risk identification & Assessment	3.1 Risk analysis models 3.2 OHS regulations 3.3 SOP 3.4 QMS 3.5 Risk reports 3.6 Incident reports
4. Risk prevention and supervision	4.1 Safe work practices 4.2 Safety training & competency 4.3 Duty of care 4.4 Designated persons 4.5 Risk control plans 4.6 Multi-media signage
5. Emergency procedures	5.1 Response procedures 5.2 Evacuation procedures 5.3 First Aid treatment 5.4 External agency support (Fire, Ambulance, Hospitals).

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Supervise the use of risk information, standards & specifications 1.2 Comply with a safety site plan & National & organizational OHS policy/procedures 1.3 Supervise the effective implementation of required safety actions relevant to a range of situations & in line with OHS policy and procedures.
2. Underpinning Knowledge	2.1 What makes a risk/hazard situation? 2.2 Identifying types of risks/hazards 2.3 OHS & Construction terminology 2.4 Safe work practices 2.5 Emergency response procedure 2.6 Evacuation procedures 2.7 First Aid procedures
3. Underpinning Skills	3.1 Identifying/assessing potential hazards 3.2 Hazard response management & teamwork 3.3 Communication skills 3.4 Hazard management skills 3.5 Crisis management
4. Resource Implications	4.1 Assessment location 4.2 Workplace or simulated work area 4.3 OHS data & records 4.4 SOP 4.5 QMS

	4.6 Relevant resources 4.7 Reporting logs
5. Methods of Assessment	Competency may be assessed through: 5.1 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test 5.5 Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: APPLY GENDER & SOCIAL EQUITY PRINCIPLES & POLICIES	UNIT CODE: POWE 0508
UNIT DESCRIPTOR: This unit covers the knowledge, skills, and attitudes to apply principles and policies on gender and social equity contributing to positive and productive work environment.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Follow guidelines or rules of conduct related to gender and social equity in the workplace	1.1 <u>Workplace practices and work instructions</u> relating to interacting with different social groups based on gender, ethnicity and disability are recognized and followed, and clarification is sought where necessary 1.2 Relevant <u>legislation, codes and national standards</u> that impact on gender and social equity are recognized and followed 1.3 Introduction of and amendments to guidelines in the work conduct related to gender and social fairness practices are responded to positively and promptly in accordance with organizational requirements.
2. Contribute to improve workplace guidelines in promoting gender and social equity	2.1 <u>Suggestions</u> are made to <u>designated personnel</u> on how to improve social interaction and communication in the workplace to better promote gender and social equity 2.2 Information is gathered and improvements are suggested to help improve <u>workplace guidelines and policies in promoting observing gender and social fairness.</u> 2.3 <u>Gender and social equity issues</u> in the workplace practices are discussed in the workplace with colleagues and designated personnel. 2.4 Contributions to the review of workplace guidelines and policies gender and social equity guidelines and policies are made within limits of responsibility.
3. Recognize and report suspected cases of gender and other forms of social inequity	3.1 <u>Signs and manifestations</u> of gender and social inequities and its impact in the workplace are recognized. 3.2 Information about or observations of a suspected problem related to gender and social inequity are <u>reported</u> to supervisors and appropriate authorities. 3.3 Location and extent of suspected gender and social inequities is accurately <u>recorded.</u> 3.4 Reports on the effect of gender and social inequities are completed according to organizational guidelines.

RANGE OF VARIABLES

1. Workplace practices and work instructions	1.1 Social diversity awareness, recognition and analysis in the workplace 1.2 Use of gender fair and socially inclusive language in dealing with co-workers and students 1.3 Sexual harassment and bullying incident recording and reporting procedures
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	1.4 Verbal instructions from persons with responsibility related to gender and social equity awareness and sensitivity
2. Legislation, codes and national standards	2.1 Code of Teacher Ethics under MoEYS 2.2 National Strategy for Neary Ratanak 2.3 National Strategic Plan for Gender Equity and Women 2.4 National Action Plan for Violence Against Women, 2.5 Gender relations and Attitudes 2.6 Cambodia Labor Law (Articles ----) 2.7 Cambodia Constitution (Articles --) 2.8 National obligations to international human rights conventions (Convention on the Elimination of all Forms of Discrimination against Women (CEDAW), 1981; Convention on the Rights of the Child (CRC), 1990
3. Suggestions	3.1 Be sensitive in terms of gender, ethnicity and disability in verbal and non-verbal communication 3.2 Stop the repetition of sexist and discriminatory sex jokes 3.3 Create and share jokes that are not told at the expense of different social groups 3.4 Recognize the rights of different social groups i.e. women, different ethnic groups, the disabled to equal access to training and skills development, respectful treatment, etc.
4. Designated personnel	4.1 TVET Institution Administrator 4.2 Head Instructors 4.3 Instructor and institution staff designated as gender and social equity focal point 4.4 Workplace supervisor or another designated person
5. Workplace guidelines and policies in promoting observing gender and social fairness	5.1 Guiding workplace conduct against committing and reporting sexual harassment 5.2 Using language that is sensitive in terms of gender, ethnicity and disability 5.3 Information on personnel policies that are aligned with national and official policies and guidelines that uphold the rights of women, ethnic groups and the disabled 5.4 Provision of separate and secure accommodations, toilets wash and resting areas for women, ethnic groups and disabled people 5.5 The designation of a gender focal point among teachers, non-teaching staff and among student population.
6. Gender and social equity issues	6.1 Sexual harassment 6.2 Bullying 6.3 Voyeurism 6.4 Different forms of gender-based violence 6.5 Inappropriate and discriminatory language 6.6 Sex jokes that are discriminatory against women, ethnic groups, disabled people 6.7 Discrimination in the workplace
7. Signs or manifestations	7.1 Sub-standard performance, social withdrawal of affected group or individual

	7.2 Lack of motivation to advance or excel 7.3 Absenteeism, intention to resign without reason 7.4 Display of fear, nervous and seemingly irrational behavior of affected group in the presence of perpetrator
8. Reported	8.1 Verbally (face-to-face or through communication equipment) 8.2 In writing (memo, notes, faxes, email, or electronic messages) 8.3 Witness or third-party accounts
9. Recorded	9.1 Incident report 9.2 Public petitions 9.3 CCTV in the workplace

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Demonstrated knowledge of workplace practices and work instructions. 1.2 Described relevant legislations, codes and national standards related to gender and social equity issues in the workplace 1.3 Followed workplace practices, policies and guidelines related to gender and social equity 1.4 Contributed to improve workplace guidelines in promoting gender and social equity 1.5 Recognized and reported on suspected cases of gender and other forms of social inequity 1.6 Reported, recorded or became aware of the need to report and document lack of compliance with guidelines and policies on gender and social fairness in the workplace
2. Underpinning Knowledge	2.1 Relevant legislation from all levels of government on gender and other social equity issues involving ethnic groups and disability 2.2 Relevant gender and social equity official legislation, policies and workplace practices and procedures 2.3 Good practice approaches relevant to work area particularly regarding observance of and compliance with guidelines and policies that uphold and promote gender and social equity. 2.4 Gender and other social equity issues, especially in regard to sexual harassment and gender and other discrimination in the workplace 2.5 Gender issues in TVET areas traditionally not associated with women 2.6 General workplace practices and their potential impact on the gender and other dimensions of social equity
3. Underpinning Skills	3.1 Discuss and explain gender and other social equity issues in TVET 3.2 Communicate with co-workers and students in an inclusive manner that respects the rights of the different groups that constitute the workplace and the classroom 3.3 Recognize signs and manifestations of sexual harassment and other forms of gender-based violence in the workplace and in the classroom

	3.4 Follow workplace directions and instructions 3.5 Ability to report and document cases of sexual harassment and other forms of gender-based violence and violence directed at other disadvantaged groups
4. Resource Implications	4.1 Induction procedures 4.2 Realistic or simulated tasks covering mandatory OHS requirements 4.3 Relevant specifications & work instructions 4.4 Tools & equipment appropriate to applying safe work practices 4.5 Support materials appropriate to activity 4.6 Workplace instructions relating to safe work practices 4.7 Material safety data sheets 4.8 Research resources
5. Methods of Assessment	Competency may be assessed through: 5.1 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test 5.5 Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: SUPERVISE WORKS TO COMPLY COMPLIANCE WITH PROCEDURES, SPECIFICATIONS, AND MANUALS	UNIT CODE: POWE 0509
UNIT DESCRIPTOR: This Unit covers the Skills Knowledge & Attitudes required to supervise compliance with operating procedures, supporting specifications & manuals.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Review Standard Operating Procedure (SOP's), specifications & manuals.	1.1 Supervise status review of SOP's for approved reports and compliance records in line with Quality Management System (<i>QMS</i>) <i>requirements</i> . 1.2 Existing specifications & manuals are reviewed as fit for use as per job requirements, in line with SOP & QMS.
2. Interpret compliance of SOP, manuals & specifications	2.1 Relevant documents are applied to work processes 2.2 <i>Compliance requirements</i> are interpreted & applied to a range of work processes.
3. Recording & reporting	3.1 <i>Compliance data</i> is recorded for a range of work activities according to job & SOP requirements 3.2 Supervise the process of recording all non-compliance data & actions. 3.3 Ensure that all correct work processes are interpreted in accordance with information contained on the manual or specifications. 3.4 Supervise storage/processing of documents and reports.

RANGE OF VARIABLES

1. Standard Operating Procedure (SOP's)	1.1 Manufacturer's Specification Manual 1.2 Repair Manual 1.3 Maintenance Procedure Manual 1.4 Periodic Maintenance Manual.
2. Quality Management System (<i>QMS</i>)	2.1 ISO 9002 (Quality Management System) 2.2 ISO 14000 (Environment) 2.3 ISO 19011 Auditing (Internal & external)

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 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 Electric Installation 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 2.5 Compliance documents & records
3. Underpinning Skills	3.1 Supervisory processes 3.2 Interpretation of construction manuals and specifications 3.3 Accessing information and data

	3.4 Monitoring & evaluation 3.5 Reporting
4. Resource Implications	4.1 Technical manuals/catalogues relevant to construction sector/Electrical Installation 4.2 Relevant Quality & Environmental standards
5. Methods of Assessment	Competency may be assessed through: 5.1. Demonstration with oral questioning 5.2. Observation 5.3. Interview Test 5.4. Written Test 5.5. Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: SUPERVISE PREPARATION, USE AND MAINTENANCE OF TOOLS AND EQUIPMENT	UNIT CODE: POWE 0510
UNIT DESCRIPTOR: This unit of Common Competency covers the knowledge, skills and attitudes required in supervising the preparation of construction materials, tools & equipment for assigned tasks.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Supervise planning of resource requirements	1.1 <i>Resource requirements are planned for</i> as per job requirements 1.2 Quantity and <i>description of materials</i> conform with the job requirements 1.3 Resource planning list approved by supervisor in line with <i>Standard Operating Procedures (SOP)</i> .
2. Supervise requisition & acceptance of resources	2.1 Supervisor approves request for materials, equipment, and tools according to the SOP. 2.2 Resource acceptance and fit for use check is supervised and recorded in line with SOP.

RANGE OF VARIABLES

1. Materials, Tools, Equipment	Including but not limited to; - 1.1 Electrical supplies 1.2 Structural 1.3 Plumbing 1.4 Welding/pipefitting 1.5 Carpentry 1.6 Masonry
2. Description of Materials Tools, equipment	Requisition & Specification to include 2.1 Brand name 2.2 Size 2.3 Capacity 2.4 Application scope & range 2.5 Supervisor sign off
3. Standard Operating Procedures/Quality Management Systems	SOP & QMS covering, but not limited to; - 3.1 Job orders 3.2 Requisition orders 3.3 Borrower slips 3.4 Non-compliance records 3.5 Acceptance records 3.6 Resource management reports

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Supervised the identification & planning of resource materials according to quantity and job requirements 1.2 Supervised the acceptance of materials, equipment and tools according to the list prepared and as per company SOP. 1.3 Supervised the inspection of materials, tools & equipment as per quantity and job specifications 1.4 Approved the equipment, tools & equipment as being in conformance as per SOP/QMS
2. Underpinning Knowledge	2.1 Functions & types of construction equipment, tools & materials.

	2.2 Application & management of forms and data records. 2.3 Procedure implementation processes
3. Underpinning Skills	3.1 Supervising preparation of tools, equipment & materials 3.2 Supervising management of tools, equipment & materials. 3.3 Supervising implementation of various procedures
4. Resource Implications	4.1 Workplace location 4.2 Required relevant materials, tools & equipment 4.3 Relevant plans, drawings, procedures & specifications
5. Methods of Assessment	Competency may be assessed through: 5.1. Demonstration with oral questioning 5.2. Observation 5.3. Interview Test 5.4. Written Test 5.5. Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: SUPERVISE INTERPRETATIONS OF TECHNICAL DRAWINGS, PLANS AND MATHEMATIC CALCULATIONS	UNIT CODE: POWE 0511
UNIT DESCRIPTOR: This Unit covers the Skills Knowledge & Attitudes required when supervising the interpretation of drawings, data, and work plans by team members.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Analyze signs, symbols and data	1.1 <i>Technical plans</i> are obtained according to job requirements 1.2 Drawings and data are clarified according to job specifications 1.3 Signs symbols and data are determined according to <i>classification</i> or as appropriate in <i>drawings</i> .
2. Interpret technical drawings and work plans	2.1 Resources are identified & listed according to the <i>drawing & work plan</i> 2.2 Drawing & plan defects identified & recorded as required 2.3 Supervisor & team match existing/available resources to job requirements 2.4 Work plan is finalized following the interpretation.
3. Approve drawings & plans	3.1 Supervisor approves any/all drawing/plan changes. 3.2 Non compliances listed and feedback provided to issuing source (drawings & plans).

RANGE OF VARIABLES

1. Technical plans	Including but not limited to: 1.1 Electrical plans 1.2 Construction plans 1.3 Architectural plans 1.4 Plumbing plans 1.5 Job requirements 1.6 Installation instructions 1.7 Components instruction
2. Work Plans	2.1. Milestones 2.2. Gantt Charts 2.3. Bar Charts 2.4. Timelines 2.5. PERT 2.6. Resources 2.7. Budgets
3. Classification	3.1. Electrical 3.2. Mechanical 3.3. Plumbing 3.4. Construction
4. Drawings	Technical & Construction Drawings including: 4.1. Orthographic views (Front, R&L side view, Top, Pictorial) 4.2. Schematic diagram 4.3. Electrical Installation 4.4. Plumbing Installation 4.5. Welding 4.6. Drawing symbols & lines
5. Drawing resources	5.1. Computer hardware & relevant software

	5.2. Technical Drawing tools & equipment & related resources
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EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate is able to:</p> <ol style="list-style-type: none"> 1.1 Supervised interpretations of technical drawings according to work plan, job requirements and classifications 1.2 Supervised the identification of supporting resources 1.3 Supervised the development of the work plan to approval stage. 1.4 Determined job specifications based on working/ technical drawing
2. Underpinning Knowledge	<ol style="list-style-type: none"> 2.1 Mathematics <ul style="list-style-type: none"> • Linear measurement • Dimension • Unit conversion 2.2 Drawings & Plan specifications <ul style="list-style-type: none"> • Electrical, mechanical plan, symbols, and abbreviations • Drawing standard symbols
3. Underpinning Skills	<ol style="list-style-type: none"> 3.1 Interpreting technical plans 3.2 Matching specification details with existing resources 3.3 Completion of range of drawings/orthographic drawings
4. Resource Implications	<ol style="list-style-type: none"> 4.1 Workplace 4.2 Computer hardware & software 4.3 Drawings and specification relevant to task 4.4 Materials and instrument relevant to proposed activity
5. Methods of Assessment	<p>Competency may be assessed through:</p> <ol style="list-style-type: none"> 5.1 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test 5.5 Portfolio
6. Context for Assessment	<ol style="list-style-type: none"> 6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

CORE COMPETENCIES

UNIT OF COMPETENCY: INSTALL AND TEST ELECTRICAL IN RESIDENTIAL BUILDING	UNIT CODE: POWE 6501
UNIT DESCRIPTOR: This Competency Standard identifies the knowledge, skills and attitudes required to design, install, test, and maintain single phase electrical installation and wiring systems in residential premises in compliance with relevant local standards, regulations, and codes of practice.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Maintain safety and electrical standards	1.1 Assess the risk involved in electrical works. 1.2 Carry out <u>risk prevention and supervision</u> . 1.3 Maintain electrical installation in accordance with requirements and regulations. 1.4 Access to relevant code of practice for electrical installation correctly. 1.5 Observe and adhere to safety rules and precautions at work area.
2. Prepare electrical drawings of electrical installation / equipment	2.1 Interpret electrical <u>drawings and diagrams</u> for electrical installation, systems, and equipment correctly. 2.2 Electrical symbols for devices are correctly selected. 2.3 Establish correct current/ load demands based on requirements. 2.4 Establish size of main and sub-main protective device in accordance with requirements. 2.5 Establish size of main and sub-main cables in accordance with requirements. 2.6 Produce the electrical drawing and diagrams in accordance with specifications and relevant standards and code of practice. 2.7 Update electrical drawings as required arising from changes or modifications in requirements in accordance with specifications and relevant standards and code of practice using <u>CAD software</u> .
3. Install and maintain electrical final residential circuits and wiring systems	3.1 Relevant codes of practices, <u>regulations and standards</u> are interpreted correctly. 3.2 Interpret electrical drawings for electrical wiring in accordance with requirements and regulations. 3.3 Draw detailed wiring diagram from layout drawing correctly. 3.4 Locations of the electrical points and installation methods are identified and fixed according to layout plan. 3.5 <u>Equipment, protection devices and metering</u> are connected in the correct sequence of control. 3.6 Install lighting and power final circuits in accordance with electrical drawings and in compliance with relevant regulations and specifications. 3.7 All items are securely fixed with no loose items. 3.8 Appropriate inspections and tests are carried out in compliance with regulations and specifications. 3.9 Test circuits for correct operation. 3.10 Apply appropriate techniques and procedures to diagnose and rectify faults.

	<p>3.11 Test results and description of actions taken are documented in accordance with requirements.</p> <p>3.12 Electrical installations are maintained in compliance with the NSC regulations and code of practice.</p> <p>3.13 Safety rules and precautions are observed and followed.</p>
4. Install and maintain AC incoming supply system	<p>4.1 Interpret electrical drawing from supply system to consumer installation.</p> <p>4.2 Draw wiring diagram for a single-phase incoming system correctly.</p> <p>4.3 Install AC incoming system including meter board and consumer unit according to requirements and regulations.</p> <p>4.4 Read energy meter correctly.</p> <p>4.5 Interpret energy bill correctly.</p> <p>4.6 Observe and adhere to safety rules and precautions during site visits, in workplaces and/or industry attachment.</p>
5. Inspect and test electrical installations	<p>5.1 Select required tools and test equipment for testing of electrical installation.</p> <p>5.2 Carry out inspection of completed installation to ensure compliance with specifications and relevant regulations.</p> <p>5.3 Conduct tests on completed installation in accordance with relevant regulations.</p> <p>5.4 Interpret and analyze test results.</p> <p>5.5 Perform rectification of faults.</p> <p>5.6 Document test results and actions in accordance with regulations.</p> <p>5.7 Observe and adhere to safety rules and precautions.</p>

RANGE OF VARIABLES

1. Risk prevention and supervision	<p>Risk prevention and supervision including but not limited to:</p> <p>1.1 Safe work practices</p> <p>1.2 Safety training & competency</p> <p>1.3 Duty of care</p> <p>1.4 Designated persons</p> <p>1.5 Risk control plans</p> <p>1.6 Multi-media signage</p>
2. Drawings and diagrams	<p>Drawings and diagrams including but not limited to:</p> <p>2.1 Site Layout</p> <p>2.2 Block Layout</p> <p>2.3 Detailed Layout</p> <p>2.4 Workstation Layout</p> <p>2.5 Wiring devices</p> <p>2.6 Wiring a wall section</p>
3. CAD software	<p>CAD software including but not limited to:</p> <p>3.1 AUTO Cad</p> <p>3.2 CAD SIMU</p> <p>3.3 Festo</p> <p>3.4 Dailux</p>
4. Regulations and standards	<p>Regulations and standards including but not limited to:</p> <p>4.1 International Electrotechnical Commission (IEC)</p> <p>4.2 International Standards Organization (ISO)</p> <p>4.3 National Standard Council (NSC)</p>
5. Equipment, protection devices and metering	<p>Equipment, protection devices and metering including but not limited to:</p> <p>5.1 Equipments</p> <ul style="list-style-type: none"> • Light bulbs • Fan • Refrigerate Air-Condition

	<ul style="list-style-type: none"> • Heating 5.2 Protection devices <ul style="list-style-type: none"> • Circuit Breaker • Fuse • Protection Relay • Surge arrestor or Surge Protection Device (SPD) 5.3 Metering <ul style="list-style-type: none"> • Analog metering • Digital metering
6. Test equipment	Test equipment including but not limited to: <ul style="list-style-type: none"> 6.1 Multimeter 6.2 Ampere meter 6.3 Voltmeter 6.4 Watt meter 6.5 Frequency meter 6.6 Megger 6.7 Tachometer 6.8 Phase rotation meter 6.9 Earth Tester
7. Faults	Faults including but not limited to: <ul style="list-style-type: none"> 7.1 Bolted fault 7.2 Ground fault (earth fault) 7.3 Realistic faults 7.4 Arcing fault 7.5 Open circuit 7.6 Short circuit 7.7 Grounded circuit 7.8 Unbalance phase 7.9 Connection

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: <ul style="list-style-type: none"> 1.1 Implemented occupational safety protection and inspection. 1.2 Interpreted layout drawings and electrical diagrams according to technical standards. 1.3 Calculated the load current, use of protective equipment and size of cables in accordance with the work requirements. 1.4 Installed and maintained electrical equipment according to the design drawings. 1.5 Installed and maintained one-phase AC power supply system according to work requirements. 1.6 Inspected and tested the electrical installation operation in accordance with standard procedures.
2. Underpinning Knowledge	<ul style="list-style-type: none"> 2.1 Explain the need to comply with Local OSH and NSC standards, and Code of Practices. 2.2 Explain the importance of risk assessment. 2.3 Outline the basic/generic steps of risk assessment. 2.4 Recognize risks at workplace. 2.5 Describe the types of risk level. 2.6 Describe the various types of risk control. 2.7 Describe the general requirements to comply with the Code of Practice for electrical installation, maintenance, inspection, and testing. 2.8 Explain the difference between Alternating Current (AC) and Direct Current (DC). 2.9 Explain the functions of electricity generation,

	transmission, and distribution systems.
2.10	Explain the 3-phase, 4-wire supply system to consumers and their internal distribution.
2.11	Describe cable color codes for electrical installations.
2.12	Explain the single-phase incoming supply installation to residential homes, inclusive of meter boards and consumer units.
2.13	Describe the basic parameters and their unit of measurement in electric circuit.
2.14	Explain the relationship between current, voltage and resistance / impedance, power, and energy.
2.15	Determine the power of various loads in the installation.
2.16	Determine the energy consumption of electrical installation.
2.17	Perform calculation to obtain the electrical bill.
2.18	Explain the importance of observing safety rules and regulations when performing electrical work.
2.19	Describe the various types of common industrial electrical accessories used in residential installation.
2.20	Explain the protective safety measures in the context.
2.21	Explain the construction and operation of the protective devices use for overcurrent and earth leakage protection.
2.22	Describe the construction and application of common types of low voltage electric cables and the relevant electrical requirements.
2.23	Explain the features and requirements of the common types of cabling and wiring systems.
2.24	Explain the importance of earthing.
2.25	Describe the parts of an earthing system including bonding, earth electrodes and their electrical requirements.
2.26	Describe the common types of electric lamp.
2.27	Compare the performance of conventional lighting and LED lighting.
2.28	Explain the relationship between current, voltage and resistance in an electric circuit.
2.29	Relate the relationship to various lighting and power final circuit connections.
2.30	Describe the requirements for lighting final circuits in according to relevant regulations and code of practice.
2.31	Explain the characteristics of the various types of lighting circuit connections.
2.32	Calculate current drawn and power consumed for the various lighting circuit connections.
2.33	Explain the 2 types of socket-outlet (power) final circuit connections.
2.34	Describe the requirements for power final circuits in according to relevant regulations and code of practice.
2.35	Calculate the power demand in power final circuit.
2.36	Explain the need for inspection and testing of an

	<p>electrical installation.</p> <p>2.37 Explain the various types of tests that are required to be conducted on a completed electrical installation to ensure that it complies with the electrical requirements.</p> <p>2.38 Describe the test equipment and instruments used for testing electrical installations.</p> <p>2.39 Describe the procedure for inspection and testing of electrical installation.</p> <p>2.40 Explain and analyze values and readings of test.</p> <p>2.41 Describe the corrective action to rectify aspects of electrical installation that do not meet requirements of test.</p> <p>2.42 Explain the various types of electrical drawing.</p> <p>2.43 Describe the common graphical symbols for Electrical installation drawing.</p> <p>2.44 Describe the application of as-built drawings.</p> <p>2.45 Explain the design procedures to determine maximum demand for a given set of electrical loads.</p> <p>2.46 Explain the method to determine the size and rating of cables and overcurrent protective devices required for electrical installations.</p> <p>2.47 Describe the application and requirements of the relevant code of practice relating to electrical drawings.</p> <p>2.48 Explain the CAD features used in the editing and modification of electrical drawings.</p>
3. Underpinning Skills	<p>3.1 Followed OHS regulations for the required job</p> <p>3.2 Interpret drawings and specifications as per requirement</p> <p>3.3 Identify appropriate manuals to be used</p> <p>3.4 Identify drawings and specifications for the job task allocated</p> <p>3.5 interpret drawings and specifications as per requirement</p> <p>3.6 Interpret the relevant code of practice correctly</p> <p>3.7 Organize and plan the installation</p> <p>3.8 Inspect all electrical equipment, installation works and accessories are installed correctly</p> <p>3.9 Carry out the electrical tests and measurement per standard procedure safely</p> <p>3.10 Tested the performance of electrical installation system as per standard procedure</p> <p>3.11 Use proper and correct tools and testing instruments for the work</p>
4. Resource Implications	<p>4.1 Workplace (simulated or actual)</p> <p>4.2 Tools and equipment required for the job</p> <p>4.3 Materials required</p> <p>4.4 Job Sheets</p> <p>4.5 Diagram and manual</p> <p>4.6 Require computer for AUTOCAD drawing</p>
5. Methods of Assessment	<p>Competency may be assessed through:</p> <p>5.1 Written test</p> <p>5.2 Demonstration</p> <p>5.3 Oral questioning</p>

6. Context for Assessment	<p>6.1 Competency may be assessed in an accredited assessment center</p> <p>6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations</p>
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UNIT OF COMPETENCY: INSTALL AND TEST ELECTRICAL IN COMMERCIAL AND INDUSTRIAL BUILDING	UNIT CODE: POWE 6502
UNIT DESCRIPTOR: This Competency Standard identifies the knowledge, skills and attitudes required to design, install, test, and maintain three phase electrical installation and wiring systems in industrial and commercial premises in compliance with relevant local standards, regulations, and codes of practice.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Maintain electrical installations	1.1 Interpret electrical drawing of electrical installation. 1.2 Interpret code of practice for electrical installation correctly. 1.3 Interpret information on cabling and wiring systems in electrical installation. 1.4 Maintain electrical installation in accordance with requirements and regulations.
2. Prepare electrical drawings of electrical installation / equipment	2.1 Interpret information and requirements of electrical installation from <u>drawings</u> and specifications. 2.2 Apply the correct electrical symbols as required. 2.3 Establish correct current/load demand. 2.4 Establish correct size of main and sub-main protective devices. 2.5 Select the appropriate rating for main and sub-main cables. 2.6 Select appropriate luminaires for electrical installations based on requirements. 2.7 Allocate loads to phases of supply system in accordance with regulations. 2.8 Produce electrical drawings and diagrams in accordance with specifications and relevant standards and code of practice.
3. Install and maintain industrial electrical final circuits and wiring systems	3.1 Obtain and interpret the relevant information and requirements for installation. 3.2 Install <u>accessories</u> in accordance with design requirements. 3.3 Install wiring system for installation in accordance with design requirements. 3.4 Install cables of correct size and color. 3.5 Install <u>earthing system</u> in accordance with requirements. 3.6 Inspect and test the installations for correct operation. 3.7 Apply appropriate technique to rectify the <u>faults</u> in installation.
4. Install and maintain emergency lighting systems	4.1 Obtain and interpret the relevant information on emergency lighting system drawings correctly. 4.2 Check equipment and components condition for safe use prior installation. 4.3 Select appropriate tools according to the installation requirements. 4.4 Wire-up the emergency lighting system in accordance with requirements. 4.5 Perform inspection and testing of the installed emergency lighting. 4.6 Troubleshoot the faulty emergency lighting installation. 4.7 Update the relevant document accurately according to the given format.

5. Install and maintain 3-phase AC incoming supply system	<p>5.1 Interpret electrical drawing from supply system to consumer installation.</p> <p>5.2 Install 3-phase AC incoming system including <u>meter board</u> and consumer unit according to requirements and regulations.</p> <p>5.3 Install cables with correct size and color for the installation.</p> <p>5.4 Prepare and use the correct wiring system in accordance with requirement.</p> <p>5.5 Select the correct conductors for earthing system.</p>
6. Inspect and test electrical installations	<p>6.1 Select correct tools and <u>test equipment</u> for testing of electrical installation.</p> <p>6.2 Carry out inspection of completed installation to ensure compliance with specifications and relevant regulations.</p> <p>6.3 Conduct tests on completed installation in accordance with regulations.</p> <p>6.4 Troubleshoot and rectify faults.</p> <p>6.5 Document test results and actions in accordance with regulations.</p>

RANGE OF VARIABLES

1. Drawings	<p>Drawings including but not limited to:</p> <p>1.1 Site Layout</p> <p>1.2 Block Layout</p> <p>1.3 Detailed Layout</p> <p>1.4 Workstation Layout</p> <p>1.5 Wiring devices</p> <p>1.6 Wiring a wall section</p>
2. Accessories	<p>Accessories including but not limited to:</p> <p>2.1 Receptacles</p> <p>2.2 Outlets</p> <p>2.3 Switches</p> <ul style="list-style-type: none"> • Push button • Selector switches • Step switches • Meter switches • Emergency switch <p>2.4 Terminal blocks</p> <p>2.5 Relays</p> <ul style="list-style-type: none"> • Timers • Voltage • Current • Counters <p>2.6 Contactors</p> <p>2.7 Automation Device</p> <ul style="list-style-type: none"> • Sensors • Proximity switch • Limit switch • Smoke detector • Fire detector • Photo Electric switch • Thermo controller • Pressure switch • Float switch • Flow switch <p>2.8 Meter</p>
3. Earthing system	<p>Earthing system including but not limited to:</p>

	3.1 TN 3.2 TT 3.3 IT
4. Faults	Faults including but not limited to: 4.1 Bolted fault 4.2 Ground fault (earth fault) 4.3 Realistic faults 4.4 Arcing fault 4.5 Open circuit 4.6 Short circuit 4.7 Grounded circuit 4.8 Unbalance phase 4.9 Connection
5. Meter board	Meter board including but not limited to: 5.1 3-Phase Analog metering 5.2 3-Phase Digital metering
6. Test equipment	Test equipment including but not limited to: 6.1 Multimeter 6.2 Ampere meter 6.3 Voltmeter 6.4 Watt meter 6.5 Frequency meter 6.6 Megger 6.7 Tachometer 6.8 Phase rotation meter 6.9 Earth Tester

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Implemented occupational safety protection and inspection. 1.2 Interpreted layout drawings and electrical diagrams according to technical standards. 1.3 Calculated the load current, use of protective equipment and size of cables in accordance with the work requirements. 1.4 Installed and maintained electrical equipment according to the design drawings. 1.5 Installed and maintained one-phase AC power supply system according to work requirements. 1.6 Inspected and tested the electrical installation operation in accordance with standard procedures.
2. Underpinning Knowledge	2.1 Explain the need to comply with local standards, regulations, and code of practices (CP). 2.2 Describe the various types of common electrical installation methods used in industry and commercial premises. 2.3 Describe the general requirements of Code of Practice as applied for electrical installation, maintenance, inspection, and testing. 2.4 Explain the functions of electricity generation, transmission, and distribution systems. 2.5 Explain the 3-phase, 4-wire supply system to consumers and their internal distribution. 2.6 Explain the incoming supply arrangement for electrical installations in industrial and commercial premises, including meter boards, consumer unit and distribution board.

	<p>2.7 Describe the procedures in installing a 3-phase meter board to a 3-phase distribution board according to a given layout.</p> <p>2.8 Explain the relationship between current, voltage and resistance / impedance, power and energy for a 3-phase system installation.</p> <p>2.9 Describe the fundamentals of a 3-phase system.</p> <p>2.10 Describe the advantages of using a 3-phase supply system as compared to a single-phase supply system.</p> <p>2.11 Interpret the circuit diagrams of Star-connected system and Delta-connected system.</p> <p>2.12 Describe methods of protection against overcurrent and electric shock.</p> <p>2.13 Explain the types of earthing system used in TT and TNS system.</p> <p>2.14 Explain the requirements for an earthing system.</p> <p>2.15 Explain the construction and operation of a single-phase / 3-phase residual current circuit breaker.</p> <p>2.16 Explain the Rating of RCCB and MCB.</p> <p>2.17 Explain the operating curve of various type of MCBs.</p> <p>2.18 Determine the current and power of various loads in a 3-phase installation.</p> <p>2.19 Determine the energy consumption of electrical installation.</p> <p>2.20 Explain the importance of observing safety rules and regulations when performing electrical work.</p> <p>2.21 Describe the common accessories use in installation in industrial premises.</p> <p>2.22 Explain the various wiring system in the industrial installation.</p> <p>2.23 Select the appropriate wiring system to be used for the installation.</p> <p>2.24 Explain the construction and application of common types of low voltage electric cables.</p> <p>2.25 Explain the cable color code for electrical installations.</p> <p>2.26 Explain the requirements on the types of cabling and wiring systems for indoor and outdoor installations.</p> <p>2.27 Explain the relevant information on the final lighting and power circuits that is obtained from single-line and circuit diagrams for 3-phase system.</p> <p>2.28 Explain the method to install the power circuit for a 3-phase electrical equipment.</p> <p>2.29 Explain the common type of lighting use for industries premises, sodium vapor lamp luminaires and high power, LED light.</p> <p>2.30 Explain the importance of earthing system in installation.</p> <p>2.31 Explain the use of surge protection devices for lightning protection system in electrical installation.</p> <p>2.32 Explain the difference between maintained and non-maintained lighting system.</p> <p>2.33 Explain the need for inspection and testing of an electrical installation.</p> <p>2.34 Explain the various types of tests that are required to be conducted on a completed electrical installation to ensure that it complies with the electrical requirements.</p> <p>2.35 Describe the test equipment and instruments used for testing electrical installations.</p>
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	<p>2.36 Describe the procedures for carryout the inspection and testing of electrical installation.</p> <p>2.37 Explain and analyze values and readings of test.</p> <p>2.38 Describe the corrective measures to rectify aspects of electrical installation that do not meet requirements of test.</p> <p>2.39 Describe the various elements and basic requirements of different types of building drawings and electrical drawings.</p> <p>2.40 Describe the common graphical symbols for Electrical installation drawing.</p> <p>2.41 Explain the design procedures to determine maximum demand for a given set of electrical loads.</p> <p>2.42 Explain the method to determine the size and rating of cables and overcurrent protective devices required for electrical installations.</p> <p>2.43 Explain the selection criteria and procedures for switchgears with suitable interrupting capacity for an electrical installation, including short circuit calculations.</p> <p>2.44 Explain the necessity of distributing single-phase loads in the 3-phase system.</p> <p>2.45 Describe the application and requirements of the relevant code of practice relating to electrical drawings.</p> <p>2.46 Describe the application of as-built drawings.</p> <p>2.47 Describe the technique for plotting of CAD drawings.</p> <p>2.48 Identify and list the types of electrical loads in a multiple-storey building.</p>
3. Underpinning Skills	<p>3.1 Followed OHS regulations for the required job</p> <p>3.2 Interpret drawings and specifications as per requirement</p> <p>3.3 Identify appropriate manuals to be used</p> <p>3.4 Identify drawings and specifications for the job task allocated</p> <p>3.5 Interpret drawings and specifications as per requirement</p> <p>3.6 Interpret the relevant code of practice correctly</p> <p>3.7 Organize and plan the installation</p> <p>3.8 Inspect all electrical equipment, installation works and accessories are installed correctly</p> <p>3.9 Carry out the electrical tests and measurement per standard procedure safely</p> <p>3.10 Test the functional performance of industrial electrical installation system as per standard procedure</p> <p>3.11 Use proper and correct tools and testing instruments for the work</p> <p>3.12 Complete inspection and test report</p> <p>3.13 Use a range of appropriate tools and instrument for the fitting and fixtures installation</p>
4. Resource Implications	<p>4.1 Workplace (simulated or actual)</p> <p>4.2 Range of tools and equipment required for the job</p> <p>4.3 Materials required</p> <p>4.4 Job Sheets</p> <p>4.5 Diagram and manual</p> <p>4.6 Require computer for AUTOCAD drawing</p>
5. Methods of Assessment	<p>Competency should be assessed through:</p> <p>5.1 Written test</p> <p>5.2 Demonstration</p> <p>5.3 Oral questioning</p>

6. Context for Assessment	<p>6.1 Competency may be assessed in the workplace or in a simulated workplace environment</p> <p>6.2 Competency assessment must be undertaken in accordance with the promulgated National Competency Standards and the approved MLVT competency assessment guidelines</p>
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UNIT OF COMPETENCY: MAINTAIN ELECTRICAL MACHINES AND APPLICATIONS	UNIT CODE: POWE 6503
UNIT DESCRIPTOR: This Competency Standard identifies the knowledge, skills and attitudes required to maintain electrical motor installations including their associated conventional, digital and advanced control systems for various industrial motor applications in compliance with relevant local standards, regulations and codes of practice.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Maintain DC machines (motors)	1.1 Interpret relevant information on <u>motor</u> from technical specifications and <u>diagrams</u> correctly. 1.2 Perform inspection and tests on motor in compliance with safety rules, procedures, and requirements. 1.3 Maintain motor in compliance with <u>safety rules, procedures,</u> and requirements.
2. Maintain AC machines (motors)	2.1 Interpret relevant information on motor from technical specifications and diagrams correctly. 2.2 Perform inspection and tests on motor in compliance with safety rules, procedures, and requirements. 2.3 Maintain motor in compliance with safety rules, procedures, and requirements.
3. Maintain motor control circuits and equipment	3.1 Interpret relevant information on motor circuits and equipment from <u>manual</u> , specification sheet and circuit diagrams correctly. 3.2 Wire up motor control circuits in accordance with circuit diagram (power and control circuits, labelling of wiring). 3.3 Perform insulation resistance tests and continuity tests according to requirements. 3.4 Perform tests to verify operation of <u>motor control circuit</u> . 3.5 Rectify <u>faults</u> and malfunctions in motor control circuit. 3.6 Program and test motor drive system in accordance with control <u>application</u> and requirements.
4. Evaluate motor performance	4.1 Interpret relevant information on engineering requirements of motor and applications. 4.2 Plan work in compliance with standard safety norms related with AC motors. 4.3 Use appropriate <u>test equipment</u> and set up to evaluate the induction motor performance by no load test/ blocked rotor test and brake test. 4.4 Measure the slip of 3-phase squirrel cage induction motor by tachometer for different output. 4.5 Draw slip/ load characteristics of the motor. 4.6 Plot the speed torque (Slip/Torque) characteristics of slip ring. 4.7 Analyze performance data of motor correctly to determine maintenance and/or rectification where appropriate.

5. Perform synchronization of generators to busbar	<p>5.1 Interpret relevant information on engineering requirements of generators to be synchronized to existing busbars in switchboard.</p> <p>5.2 Check to see that appropriate monitoring instruments are set up for proper synchronization.</p> <p>5.3 Perform synchronization of alternator to infinite busbars in accordance with correct <u>procedures using synchro</u> scope.</p> <p>5.4 Record and analyze performance of generators in the synchronization.</p>
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RANGE OF VARIABLES

1. Motor	<p>Drawings including but not limited to:</p> <p>1.1 DC Motor</p> <ul style="list-style-type: none"> • Stepper Motor • Servo Motor <p>1.2 AC Motor</p> <ul style="list-style-type: none"> • ODP (Open Drip-Proof) • TENV (Totally Enclosed Non-Ventilated) • TEFC (Totally Enclosed Fan-Cooled) • TEBS (Totally Enclosed Blower-Cooled)
2. Diagrams	<p>Diagrams including but not limited to:</p> <p>2.1 Star-Delta connection</p> <p>2.2 Delta-Star connection</p> <p>2.3 Star-Star connection</p> <p>2.4 Delta-Delta connection</p> <p>2.5 Serie-Serie connection</p>
3. Safety rules, procedures	<p>Safety rules, procedures including but not limited to:</p> <p>3.1 International Electrotechnical Commission (IEC)</p> <p>3.2 International Standards Organization (ISO)</p> <p>3.3 National Standard Council (NSC)</p>
4. Manual	<p>Manual including but not limited to:</p> <p>4.1 Motor Manual</p> <p>4.2 Control circuit manual</p>
5. Motor control circuit	<p>Motor control circuit including but not limited to:</p> <p>5.1 Power circuit</p> <p>5.2 Control circuit</p>
6. Faults	<p>Faults including but not limited to:</p> <p>6.1 Power circuit</p> <ul style="list-style-type: none"> • Contactor • Overload Relay • Circuit Breaker • Wiring • Fuse • Connection <p>6.2 Control circuit</p> <ul style="list-style-type: none"> • Auxiliary Relay • Timer Relay • Push button • Wiring • Contactor • Circuit Breaker • Fuse • Connection
7. Application	<p>Application including but not limited to:</p> <p>7.1 Cade Simu</p> <p>7.2 Festo</p>

8. Test equipment	<p>Test equipment including but not limited to:</p> <p>8.1 Multi-tester (VOM)</p> <p>8.2 Insulation resistance tester (Megger)</p> <p>8.3 Low resistance tester</p> <p>8.4 Ammeter</p> <p>8.5 Torque meter</p> <p>8.6 Dynamometers</p> <p>8.7 Simulation Test/No Load Test</p> <p>8.8 Phase sequence meter</p> <p>8.9 Actual Operation</p> <p>8.10 Temperature Tester</p> <p>8.11 Connection tester</p> <p>8.12 High potential tester</p> <p>8.13 Earth tester</p> <p>8.14 Load tester</p> <p>8.15 Coil tester</p>
9. Procedures using synchro	<p>Procedures using synchro including but not limited to:</p> <p>9.1 1-Phase</p> <ul style="list-style-type: none"> • Frequency • Voltage <p>9.2 3-Phase</p> <ul style="list-style-type: none"> • Frequency • Voltage • Phase rotation

EVIDENCE GUIDE

1. Critical aspects of competency	<p>Assessment requires evidence that the candidate is able to:</p> <p>1.1 Maintained DC machines and AC machines</p> <p>1.2 Maintained motor control circuits and equipment</p> <p>1.3 Evaluated motor performance</p> <p>1.4 Performed synchronization of generators to busbar</p>
2. Underpinning Knowledge	<p>2.1 Describe the characteristics of a simple magnet.</p> <p>2.2 Describe the characteristics and operation of an electro-magnetic induction circuit.</p> <p>2.3 Define the following terms related to electrical machines.</p> <p>2.4 Describe the general construction, principles of operation, applications of DC motors.</p> <p>2.5 Describe the type of maintenance to be carried out a DC motor.</p> <p>2.6 Describe how speed control is achieved in DC motors.</p> <p>2.7 Explain how the DC motor works in the following electrical system and the key technical specifications required.</p> <p>2.8 Describe the basic operation and application of transformers.</p> <p>2.9 Describe the construction and principles of operation of single-phase induction motors.</p> <p>2.10 Explain the function of the following components of a single-phase induction motor.</p> <p>2.11 Explain selection of circuit breakers for motor protection and operation.</p> <p>2.12 Describe the difference in construction and principles of operation of three-phase induction and synchronous motors.</p> <p>2.13 Describe how the direction of 3-phase motor can be changed.</p> <p>2.14 Describe the types of AC motors for single-phase and</p>

	<p>three-phase applications.</p> <p>2.15 Calculate the following for a 3-phase induction motor given the number of poles, frequency, and slip.</p> <p>2.16 Outline the factors governing the magnitude of the torque of a 3-phase induction motor.</p> <p>2.17 Describe the inspection and testing procedures on a motor.</p> <p>2.18 Describe the methods for controlling the speed of three-phase motor.</p> <p>2.19 Describe how the AC motor is being applied to the following electrical systems and explain how it works.</p> <p>2.20 Describe the general construction and principles of operation of a 3-phase AC generator.</p> <p>2.21 Outline the requirements for the control of motors.</p> <p>2.22 Describe the common types and applications of motor control circuits and starters used in industry.</p> <p>2.23 Describe the common type of faults in induction motors and motor control circuits.</p> <p>2.24 Explain how speed control is achieved by drives.</p> <p>2.25 Describe the difference between a soft starter and Variable frequency drive.</p> <p>2.26 Describe selection of soft starter and VFD for different motor applications.</p> <p>2.27 Describe the benefits of using soft starter and VFD in motor control.</p> <p>2.28 Describe the program settings to run the motor application for the required load performance in terms of speed, torque, scheduling.</p> <p>2.29 Outline the methods for braking of AC motors.</p> <p>2.30 Explain the criteria in selecting type of motors for different applications.</p> <p>2.31 Determine the factors that affect the motor performance with reference to machine data being monitored.</p> <p>2.32 Determine the efficiency of 3-phase squirrel cage induction motor by no load test/ blocked rotor test and brake test.</p> <p>2.33 Explain the need to synchronize the alternator to busbar.</p> <p>2.34 Explain the construction and operation of a 3-phase alternator.</p> <p>2.35 Explain the conditions compulsory for synchronization the alternator to busbars.</p> <p>2.36 Explain follow up rectification work required after data analysis on motors.</p> <p>2.37 Explain on Direct Online (DOL)</p> <p>2.38 Explain on Star to Delta</p>
3. Underpinning Skills	<p>3.1 Record data on machine correctly</p> <p>3.2 Carrying out of maintenance to be carried out a DC motor</p> <p>3.3 Completing inspection and test report</p> <p>3.4 Drawing out the single-phase AC motor starting circuit</p> <p>3.5 Record data on ac motors</p> <p>3.6 Perform reversing of direction in a three-phase ac motor</p> <p>3.7 Test AC motor operation</p>

	3.8 Wire up the motor control panel operating 3.9 Applying proper test method to ensure safe operation of motor before live supply is connected 3.10 Operating the different starter methods 3.11 Testing and troubleshooting the motor circuits 3.12 Record the motor data that affects the motor performance 3.13 Demonstrating the operation of the VSD drive 3.14 Determining the efficiency of 3 phase squirrel cage induction motor by no load test/ blocked rotor test and brake test 3.15 Recommending rectification work required after data analysis on motors 3.16 Articulating the conditions for generator synchronization 3.17 Connect the generator synchronization method 3.18 Perform the synchronization of the generator
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 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test 5.5 Portfolio
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

UNIT OF COMPETENCY: MAINTAIN POWER SYSTEM AND SWITCHBOARDS	UNIT CODE: POWE 6504
UNIT DESCRIPTOR: This Competency Standard identifies the knowledge, skills and attitudes required to perform proper isolation, lockout tag out procedures as well as maintain low voltage electrical switchboards and power improvement and monitoring system in compliance with relevant local standards, regulations and codes of practice.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Maintain incoming supply connected to switchboard and equipment	1.1 Interpret relevant information of electrical switchboard and equipment from drawings, diagrams and/or manuals correctly. 1.2 Maintain <u>incoming and outgoing indicating lamps</u> in accordance with requirements. 1.3 Carry out insulation test on incoming and outgoing busbars of switchboard in accordance with requirements.
2. Maintain electrical switchboard	2.1 Wire the voltmeter and ammeter circuit. 2.2 Current <u>Transformer</u> 's secondaries are checked for earthing. 2.3 Wire up the overcurrent protection <u>relay</u> circuit correctly. 2.4 Wire up the <u>earth fault</u> relay circuit correctly. 2.5 Perform injection test and calibrate the overcurrent and earth fault relays circuits.
3. Perform isolation, lockout and tag out procedures	3.1 Interpret relevant information of <u>low voltage circuit breaker</u> and busbar system from diagrams and/or manuals correctly. 3.2 Perform lockout and tag out procedures according to requirements. 3.3 Perform insulation resistance test for outgoing busbars.
4. Maintain electrical power monitoring system	4.1 Obtain and interpret relevant information of low voltage smart switchboard system from diagrams and/or manuals correctly. 4.2 Configure smart switchboard via intelligent devices for remote energy/power monitoring of 3-phase outgoing loads.

RANGE OF VARIABLES

1. Indicating lamps	Indicating lamps including but not limited to: 1.1 Neon 1.2 LED
2. Incoming and outgoing	Incoming and outgoing including but not limited to: 2.1 Single Phase 2.2 Three Phase
3. Transformer	Transformer including but not limited to: 3.1 Power Transformer 3.2 Measurement Transformer
4. Relay	Relay including but not limited to: 4.1 Auxiliary Relay 4.2 Heating Relay 4.3 Timer Relay 4.4 Protection Relay
5. Earth fault	Earth fault including but not limited to: 5.1 Ground connection fault 5.2 Fault from cable or equipment to ground 5.3 Ground Resistance Fault
6. Low voltage circuit breaker	Low voltage circuit breaker including but not limited

	to: 6.1 Miniature Circuit Breaker (MCB) 6.2 Molded Case Circuit Breaker (MCCB) 6.3 Motor Protection Circuit Breaker (MPCB) 6.4 Earth leakage circuit breaker/RCCB 6.5 Air circuit breaker (ACB)
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EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Maintained incoming supply connected to switchboard and equipment 1.2 Maintained electrical switchboard 1.3 Performed isolation, lockout and tag out procedures 1.4 Maintained electrical power monitoring system
2. Underpinning knowledge	2.1. Explain the need of safe work procedures for electrical installation work environment. 2.2. Explain the functions of electricity generation, transmission and distribution systems. 2.3. Explain the 3-phase, 4-wire supply system to consumers and their internal distribution. 2.4. Describe the fundamentals of a 3-phase system. 2.5. Describe the phase relationship between the various phase and line values of voltage and current in a 3-phase star/delta supply system. 2.6. Describe the phase relationship between the various phase and line values of voltage and current in a 3-phase star/delta-connected load/equipment. 2.7. Describe the construction and operation of low voltage switchboards. 2.8. Explain the measuring and protection requirement for a LV consumer installation. 2.9. Describe the different types and design of switchboards. 2.10. Explain the types of protective switchgear used in switchboards. 2.11. Explain the function. 2.12. Explain the operation of trip circuit under overcurrent, earth fault and earth leakage conditions. 2.13. Describe the method in conducting the standard tests for a low voltage switchboard. 2.14. Describe the construction and safety features incorporated in the low voltage busbar system. 2.15. Explain the need for Lock Up Tag out (LOTO). 2.16. Explain the correct sequence of lockout and tagout perform on the switchboard during maintenance of a faulty motor repair. 2.17. Explain the sequence of releasing from lockout and tagout. 2.18. Describe the construction and features of a low voltage smart switchboard incorporated with ACB and outgoing MCCBs. 2.19. Explain the benefits of remote monitoring for electrical power system. 2.20. Explain power factor mean in the AC system. 2.21. Explain the need for and methods of power factor correction for electrical distribution system. 2.22. Explain the procedures of checking and maintaining power factor correction equipment.

	2.23. Calculate the power factor in the circuit and the reactive power produced.
3. Underpinning Skills	<p>3.1 Draw the 3-phase incoming supply from substation transformer to LV switchboard in switchroom</p> <p>3.2 Connect the transformer's secondary in star configuration</p> <p>3.3 Measure the incoming supply for the switchboard in term of phase and line value as shown in panel voltmeter</p> <p>3.4 Completing the identification of components in switchboards</p> <p>3.5 Drawing the voltmeter and indicating circuit protected by fuses</p> <p>3.6 Completing the ammeter and energy meter circuit with emphasis given to the earthing f secondary side of CTs.</p> <p>3.7 Completing the overcurrent and earth fault circuits</p> <p>3.8 Performing Primary injection test on switchboard overcurrent and earth fault relays</p> <p>3.9 Conducting the standard tests for a low voltage switchboard</p> <p>3.10 Performing periodic maintenance of switchboard and completing the maintenance checklist</p> <p>3.11 Identifying the different lock out devices for different tasks</p> <p>3.12 Interpret the power flow sequence from single line diagram so that the correct MCB is locked out appropriately</p> <p>3.13 Articulate the correct sequence of lock out tag out to perform maintenance on a fault motor</p> <p>3.14 Drawing the power factor control circuit</p> <p>3.15 Demonstrating how the power factor back is used to correct the power factor to the required power factor values</p> <p>3.16 Performing inspection on condition of the capacitor banks safely</p>
4. Resource Implications	<p>The following resources MUST be provided:</p> <p>4.1 Access to the workplace</p> <p>4.2 Tools and equipment appropriate to joint and connection process</p> <p>4.3 Availability of materials</p>
5. Methods of Assessment	<p>Competency may be assessed through: -</p> <p>5.1 Demonstration with oral questioning</p> <p>5.2 Observation</p> <p>5.3 Interview Test</p> <p>5.4 Written Test</p> <p>5.5 Portfolio</p>
6. Context for Assessment	<p>6.1 Competency may be assessed in an accredited assessment center</p> <p>6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations</p>

UNIT OF COMPETENCY: MAINTAIN ELECTRICAL AUXILIARY SYSTEMS	UNIT CODE: POWE 6505
UNIT DESCRIPTOR: This Competency Standard identifies the knowledge, skills and attitudes required to maintain temporary installation, Security and Fire Alarm System with related digital and data cabling and carry out PAT testing in compliance with relevant local standards, regulations and codes of practice.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Maintain temporary electrical supply connection	1.1 Obtain and interpret relevant information of low voltage socket outlet assembly (SOA) from <u>diagrams</u> and/or manuals. 1.2 Install <u>3-phase 5-pin plug and socket</u> (Red) assembly, the outgoing 3-phase 5-pin plug and socket (Red) assemblies, and <u>1-phase 3-pin plug & socket</u> (Blue) assemblies in accordance with requirements. 1.3 Perform correct <u>lock out and tag out</u> (LOTO) and isolation procedure correctly when performing a motor maintenance. 1.4 Perform correct LOTO procedure to disconnect the SOA from <u>AC control panel board</u> .
2. Maintain data cabling and equipment in Security system	2.1 Obtain relevant information on wiring system/cables/components from specification sheet/circuit diagrams/vendor's technical manuals and brochures. 2.2 Use appropriate tools and techniques to cut and prepare cables for termination to system network components. 2.3 Connect cables to system network components in accordance with specifications, standards and code of practice. 2.4 Verify signal performance of cable is within acceptable limits and relevant standards. 2.5 Use appropriate techniques and tests to identify, locate and rectify faults in wiring system/cables. 2.6 Document test results and description of actions taken in accordance with requirements. 2.7 Observe and follow safety rules at all times.
3. Install and maintain fire alarm system	3.1 Interpret technical references such as layout diagram of <u>fire alarm system</u> correctly. 3.2 Identify correct <u>equipment and components</u> for installation according to the given specifications. 3.3 Check equipment and components condition for safe use prior to installation. 3.4 Select appropriate tools according to the installation requirements. 3.5 Wire-up call-points to fire alarm in accordance with drawings and requirements. 3.6 Inspect and test fire alarm system in accordance with requirements. 3.7 Troubleshoot and rectify <u>faults</u> in fire alarm installation. 3.8 Update the relevant document accurately according to the given format.

RANGE OF VARIABLES

1. Diagrams	Diagrams including but not limited to: 1.1 Fire alarm system diagram 1.2 AC control panel board diagram 1.3 1-phase and 3-phase current diagrams
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2. 3-phase 5-pin plug and socket	3-phase 5-pin plug and socket including but not limited to: 2.1 380Volt 5-pin 2.2 Color code (Red Black Brown Blue Yellow/Green) IEC
3. 1-phase 3-pin plug & socket	1-phase 3-pin plug & socket including but not limited to: 3.1 220Volt 3-pin 3.2 Color code (Brown Blue Yellow/Green) IEC
4. Lock out and tag out	Lock out and tag out including but not limited to: 4.1 Occupational Safety Law
5. AC control panel board	AC control panel board including but not limited to: 5.1 AC control panel board Installation Technical Manual 5.2 AC control panel board diagram 5.3 Instruction Manual
6. Fire alarm system	Fire alarm system including but not limited to: 6.1 Fire alarm Installation Technical Manual 6.2 Fire alarm system diagram 6.3 Instruction Manual
7. Equipment and components	Equipment and components including but not limited to: 7.1 Fire Alarm Panel 7.2 Detector (Gas Detector, Smoke Detector, Heat Detector, Flame Detector) 7.3 Bell 7.4 Call-Point 7.5 Dual sensing 7.6 Alarm 7.7 Relay 7.8 Switch holding 7.9 Resistance 7.10 Smoke and Heat Testing Equipment
8. Faults	Faults including but not limited to: 8.1 Bolted fault 8.2 Ground fault (earth fault) 8.3 Realistic faults 8.4 Arcing fault 8.5 Open circuit 8.6 Short circuit 8.7 Grounded circuit 8.8 Unbalance phase 8.9 Connection

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Maintained temporary electrical supply connection 1.2 Maintained data cabling and equipment in Security system 1.3 Installed and maintained fire alarm system
2. Underpinning knowledge	2.1 Explain the need for the code of practice for typical temporary electrical installations. 2.2 Explain the requirements for temporary electrical installations in terms. 2.3 Explain the technical requirements for the setting up and operation of mobile generator set at construction work sites according to the requirements of relevant code of practice. 2.4 Describe the construction and features of a socket outlet assembly (SOA). 2.5 Explain the benefits of using SOA in a temporary electrical supply system. 2.6 Describe the electrical tests to check the safety and operation of a newly assembled SOA.

	<p>2.7 Explain the proper LOTO and isolation procedures for connection and disconnection of SOA.</p> <p>2.8 Explain requirements for temporary installations.</p> <p>2.9 Describe the requirements of structured cabling systems.</p> <p>2.10 Describe the general layout and requirements of network cabling systems.</p> <p>2.11 Describe basic guidelines for cables and equipment for communication wiring installations.</p> <p>2.12 Explain the use of tools and techniques for cable termination.</p> <p>2.13 Describe different types of copper network cables.</p> <p>2.14 Describe the color-coding system for copper media cables.</p> <p>2.15 Describe the techniques for field termination, testing and troubleshooting of copper network cabling system.</p> <p>2.16 Explain the requirements under the Administration Standards for the Telecommunication Infrastructure of Commercial Building.</p> <p>2.17 Describe the application of power over LAN.</p> <p>2.18 Describe the basic working principles of the fiber-optic cable systems.</p> <p>2.19 Describe different types of optical fiber cable.</p> <p>2.20 Describe the color-coding system for optical fiber cables.</p> <p>2.21 Explain the use of tools for fiber termination.</p> <p>2.22 Explain the required safety procedures when performing optical fiber network termination.</p> <p>2.23 Describe the procedure of terminating fiber-optic cables.</p> <p>2.24 Explain the basics of fiber to the home/premises/desk.</p> <p>2.25 Describe the testing procedures for fiber cabling system.</p> <p>2.26 Explain the procedures for cable management and labelling.</p> <p>2.27 Describe the procedures for grounding and bonding.</p> <p>2.28 Describe the importance and applications of security systems.</p> <p>2.29 Describe the major components and working principles of video surveillance systems.</p> <p>2.30 Describe the different types of cabling systems and accessories used in video surveillance systems.</p> <p>2.31 Explain the requirements of a fire alarm system in terms of detection of a fire or fire condition and the sounding of alarm.</p> <p>2.32 Explain the general requirements in the installation of electrical fire alarm systems and their associated components in buildings.</p> <p>2.33 Describe the component parts of the fire alarm system and explain their functions.</p> <p>2.34 Explain the procedure to restore an activated alarm.</p> <p>2.35 Explain the safety precautions to be observed when installing and maintaining a fire alarm system.</p>
3. Underpinning Skills	<p>3.1 Interpreting relevant information of low voltage socket outlet assembly (SOA) from diagrams and/or manuals</p> <p>3.2 Installing 3-phase 5-pin plug and socket (Red) assembly, the outgoing 3-phase 5-pin plug and socket (Red) assemblies, and 1-phase 3-pin plug & socket (Blue) assemblies in accordance with requirements</p> <p>3.3 Performing lock out and tag out (LOTO) and isolation</p>

	<p>procedure correctly when performing a motor maintenance with reference to Single line Diagram</p> <p>3.4 Performing correct LOTO procedure to disconnect the SOA from AC control panel board</p> <p>3.5 Obtaining relevant information on wiring system/cables/components from specification sheet/circuit diagrams/vendor's technical manuals and brochures</p> <p>3.6 Using appropriate tools and techniques to cut and prepare cables for termination to system network components</p> <p>3.7 Connecting cables to system network components in accordance with specifications, standards, and code of practice</p> <p>3.8 Verifying signal performance of cable is within acceptable limits and relevant standards</p> <p>3.9 Using appropriate techniques and tests to identify, locate and rectify faults in wiring system/cables</p> <p>3.10 Drawing the layout diagram of fire alarm system correctly</p> <p>3.11 Labelling the correct equipment and components for installation according to the given specifications</p> <p>3.12 Checking equipment and components condition for safe use prior to installation</p> <p>3.13 Selecting appropriate tools according to the installation requirements</p> <p>3.14 Wiring-up call-points to fire alarm in accordance with drawings and requirements</p> <p>3.15 Inspecting and testing fire alarm system in accordance with requirements</p> <p>3.16 Troubleshooting and rectifying faults in fire alarm installation</p>
4. Resource Implications	<p>The following resources MUST be provided:</p> <p>4.1 Relevant workplace procedures</p> <p>4.2 Relevant product and manufacturing specifications</p> <p>4.3 Layout plans/wiring diagrams</p> <p>4.4 Relevant drawings, manuals, codes, standards, and reference material</p>
5. Methods of Assessment	<p>Competency may be assessed through: -</p> <p>5.1 Demonstration with oral questioning</p> <p>5.2 Observation</p> <p>5.3 Interview Test</p> <p>5.4 Written Test</p> <p>5.5 Portfolio</p>
6. Context for Assessment	<p>6.1 Competency may be assessed in an accredited assessment center</p> <p>6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations</p>

UNIT OF COMPETENCY: PROGRAME INTELLIGENT BUILDING CONTROL SYSTEM	UNIT CODE: POWE 6506
UNIT DESCRIPTOR: This Competency Standard identifies the knowledge, skills and attitudes required to program, test, and maintain PLC system and Intelligent Building Control System to deliver smart home control solutions in compliance with relevant local standards, regulations and codes of practice.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Program PLC system	1.1 Interpret essential information pertaining to <u>PLC system</u> and electrical installation correctly. 1.2 Program and install PLC system in accordance with control application. 1.3 Install energy meter correctly. 1.4 Access and monitor energy meter from PLC system. 1.5 Apply appropriate techniques and procedures to diagnose and rectify <u>faults</u> in system. 1.6 Observe and follow safety rules at all times.
2. Install smart home system	2.1 Interpret essential information pertaining to <u>smart home</u> and electrical installation correctly. 2.2 Install smart home system in accordance with control requirements. 2.3 Program smart devices through mobile phone for control application operation. 2.4 Apply appropriate techniques and procedures to diagnose and rectify faults in system. 2.5 Observe and follow safety rules at all times.
3. Manage Intelligent Building Control System	3.1 Program and setup to activate home appliances using voice activated devices. 3.2 Install and program the voice-controlled devices using <u>IFTTT</u> to create chains of simple conditional statements. 3.3 Test the installed voice-controlled home automation for correct operation. 3.4 Apply appropriate techniques and procedures to diagnose and rectify faults. 3.5 Observe and follow safety rules at all times.

RANGE OF VARIABLES

1. PLC system	PLC system including but not limited to: 1.1 Hardware <ul style="list-style-type: none"> • Crimp wire • Wiring input and output devices 1.2 Software <ul style="list-style-type: none"> • SX-Programming • GX-Work2 • GX-Work3 • Zelio Soft 2
2. Faults	Faults including but not limited to: 2.1 Fault circuit 2.2 Application Faults 2.3 Component Faults
3. Smart home	Smart home including but not limited to: 3.1 Smart Lighting Solutions 3.2 Smart Entertainment Devices for the Home 3.3 Smart Home Appliances 3.4 Smart Home Utilities

	3.5 Smart Blinds Solutions 3.6 Smart Home Surveillance Cameras 3.7 Smart Door Locks 3.8 Smart Garage Door Openers and Gadgets 3.9 Smart Home Sensors 3.10 Smart Voice Recognition and Voice Activated Products 3.11 Smart Home Window Solutions 3.12 Eco-Friendly Smart Home Products 3.13 Smart Remote Controls 3.14 Smart Home Apps
4. IFTTT	IFTTT including but not limited to: 4.1 IOS 4.2 Android

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Programmed PLC system 1.2 Installed smart home system 1.3 Managed Intelligent Building Control System
2. Underpinning knowledge	2.1 Describe the PLC architecture. 2.2 Describe the working principle of various types of PLC components. 2.3 Describe the differences between PLC and Smart Relay. 2.4 Describe the working principle, characteristics, and application of the energy meter. 2.5 Describe the communication protocol of the PLC and energy meter. 2.6 Describe a home electrical control system architecture. 2.7 Describe the types of input and output devices used for home electrical control system. 2.8 Describe the working principle, characteristic and application of sensors in the home electrical control system. 2.9 Describe the working principle of the actuator/pump in the home electrical control system. 2.10 Explain the need for compliance with relevant codes of practices, standards, and regulations for the household appliances in installations. 2.11 Explain the common home automation standards and products. 2.12 Explain the protocols for Smart Home devices and its interoperability and safety. 2.13 Explain the various types of network configuration. 2.14 Explain the differences between conventional switches and smart switches. 2.15 Explain the benefits and advantages of Smart Home systems. 2.16 Explain the concept of controlling the smart devices using mobile phone. 2.17 Explain the importance of Voice Controlled Home Automation. 2.18 Explain the common voice activated devices. 2.19 Explain the common voice-controlled devices. 2.20 Explain methods to configure and link up the devices. 2.21 Explain the meaning of IFTTT and applets.
3. Underpinning Skills	3.1 Configure the PLC for input and output operation

	3.2 Connect input and output devices to PLC I/O channels 3.3 Program the PLC for input and output application 3.4 Test and troubleshoot PLC operation 3.5 Explain the importance of Voice Controlled Home Automation 3.6 Explain the common voice activated devices 3.7 Explain the common voice-controlled devices 3.8 Explain methods to configure and link up the devices 3.9 Explain the meaning of IFTTT and applets 3.10 Drawing the power factor control circuit 3.11 Program and setup home appliances with voice activated devices 3.12 Install and program the voice-controlled devices using IFTTT to create chains of simple conditional statements 3.13 Test the installed voice-controlled home automation for correct operation 3.14 Apply appropriate techniques and procedures to diagnose and rectify faults 3.15 Observe and follow safety rules at all times
4. Resource Implications	The following resources MUST be provided: 4.1 Tools 4.2 Test equipment/instruments 4.3 Field and control devices 4.4 Materials 4.5 PPE 4.6 Technical manuals 4.7 PLC System 4.8 Appropriate equipment
5. Methods of Assessment	Competency may be assessed through: - 5.1 Demonstration with oral questioning 5.2 Observation 5.3 Interview Test 5.4 Written Test 5.5 Portfolio
6. Context for Assessment	6.1 Competency may be assessed in an accredited assessment center 6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations

UNIT OF COMPETENCY: MAINTAIN SOLAR PHOTOVOLTAIC SYSTEMS	UNIT CODE: POWE 6507
UNIT DESCRIPTOR: This Competency Standard identifies the knowledge, skills and attitudes required to test and maintain off-grid and grid-tie solar photovoltaic (PV) systems in compliance with relevant local standards, regulations, and codes of practice.	

ELEMENTS AND PERFORMANCE CRITERIA MATRIX

(Terms in the performance criteria that are written in **bold and underlined** are detailed in the range of variables)

ELEMENT	PERFORMANCE CRITERIA
1. Connect Solar Modules in various configurations	1.1. Test a photocell under different <u>light condition</u> and measure its output voltage. 1.2. Connect and measure open circuit voltage for 2 cells in series and in parallel respectively. 1.3. Connect and measure the open circuit voltage and short circuit current for a given PV module. 1.4. Connect 2 PV modules in series and measure Voc and Isc. 1.5. Connect 2 PV module in Parallel and measure Voc and Isc of combination. 1.6. Connect and pair 2 series PV modules in parallel and measure Voc and Isc of combination. 1.7. Group the PV modules to produce the required system voltage. 1.8. Observe and follow safety rules at all times.
2. Test PV Modules Performance under different operating conditions	2.1 Interpret information on <u>solar system</u> from manual, wiring diagrams and drawings correctly. 2.2 Set up the PV panels under different radiant light condition, measure the irradiance and determine its effect on Voc and Isc of PV. 2.3 Set up the PV panels under different tilting angles and measure its effect on Voc and Isc of PV. 2.4 Measure the Voc and Isc when the surface temperature of the PV module is heated up over a period of time. 2.5 Verify system start-up and shut-down functionality in accordance with procedures. 2.6 Maintain PV system according system specifications, safety standards and code of practice. 2.7 Inspect the PV module to examine for microcrack, corrosion, browning, dirt stain etc., according to checklist. 2.8 Observe and follow safety rules at all times.
3. Maintain Off grid PV system	3.1 Interpret information on the solar system from manual, wiring <u>diagrams and drawings</u> correctly. 3.2 Install the PV system as per drawing requirements. 3.3 Perform inspection checks on the PV system. 3.4 Conduct the essential electrical tests before the PV system is turned on. 3.5 Measure the Voc and Isc to check for abnormally. 3.6 Conduct functional checks on the PV operation. 3.7 Complete inspection and test technical reports. 3.8 Observe and follow safety rules at all times.
4. Maintain On grid PV system	4.1 Interpret information on the solar system from manual, wiring diagrams and drawings correctly. 4.2 Install the PV system as per drawing requirements. 4.3 Perform inspection checks on the PV system. 4.4 Conduct the essential electrical tests before the PV system is turned on.

	4.5 Measure the Voc and Isc to check for abnormally. 4.6 Conduct functional checks on the PV operation. 4.7 Complete inspection and test technical reports. 4.8 Observe and follow safety rules at all times.
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RANGE OF VARIABLES

1. Light condition	Light condition including but not limited to: 1.1 Regional light density 1.2 Light angle
2. Solar system	Solar system including but not limited to: 2.1 PV Panel 2.2 Charge Control 2.3 Battery 2.4 Inverter 2.5 DC Circuit Breaker 2.6 AC Circuit Breaker
3. Diagrams and drawings	Diagrams and drawings including but not limited to: 3.1 Solar panel installation circuit

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate is able to: 1.1 Connected Solar Modules in various configurations 1.2 Tested PV Modules Performance under different operating conditions 1.3 Maintained Off grid and On grid PV system
2. Underpinning knowledge	2.1. Describe how a solar cell works. 2.2. Electrical symbols for PV installations and equipment. 2.3. Describe the Basic electrical knowledge for PV system. 2.4. Explain the different terminology used in Solar PV. 2.5. Describe the following terminology used in PV module. 2.6. Describe the use of common types of electrical circuit testers to measure PV circuits. 2.7. Use of relevant Personal Protective Equipment (PPE). 2.8. Describe the standard test conditions (STC) used in PV module manufacturing. 2.9. Describe how the light condition affects solar performance and determine the effect of shading. 2.10. Describe how the tilting mount on PV panel on the roof and the side of a building affects the PV performance. 2.11. Explain how the insolation and temperature affects the PV performance. 2.12. Describe the tools to be used to measure PV performance. 2.13. Describe of PV efficiency factors such as irradiance, temperature, and shading. 2.14. Describe the components and their function in a standalone PV system. 2.15. Describe the operation of the stand-alone PV system. 2.16. Describe the electrical tests to be carried out on the Off-grid PV system during maintenance. 2.17. Describe the tools to be used during maintenance of Off Grid PV system. 2.18. Describe the components and their function in a grid tied PV system. 2.19. Describe the operation of the Grid Tie PV system.

	<p>2.20. Explain what anti-islanding protection is.</p> <p>2.21. Describe the electrical tests to be carried out on the grid-tied PV system during maintenance.</p> <p>2.22. Describe the tools to be used during maintenance of Grid-Tied PV system.</p>
3. Underpinning Skills	<p>3.1 Testing a photocell under different light condition and measure its output voltage</p> <p>3.2 Connecting 2 PV modules in series and measuring its open circuit voltage and short circuit current</p> <p>3.3 Connect 2 PV module in Parallel and measure Voc and Isc of combination</p> <p>3.4 Group the PV modules to produce the required system voltage</p> <p>3.5 Interpreting information on solar system from manual, wiring diagrams and drawings correctly</p> <p>3.6 Determining the effect of different radiant light condition on its effect on Voc and Isc of PV</p> <p>3.7 Measuring the Voc and Isc with change in surface temperature of the PV module heated up over a period of time</p> <p>3.8 Verifying system start-up and shut-down functionality in accordance with procedures</p> <p>3.9 Maintaining PV system according to system specifications, safety standards and code of practice</p> <p>3.10 Inspecting the PV module to examine for microcrack, corrosion, browning, dirt stain etc., according to checklist</p> <p>3.11 Drawing the circuit for standalone PV system</p> <p>3.12 Identifying correctly all the parts of the PV systems</p> <p>3.13 Inspecting the different parts of the PV system</p> <p>3.14 Performing all the required electrical testing of the standalone PV system</p> <p>3.15 Interpreting information on the solar system from manual, wiring diagrams and drawings correctly</p> <p>3.16 Installing the grid tie PV system as per drawing requirements</p> <p>3.17 Performing inspection checks on the PV system</p> <p>3.18 Conducting the essential electrical tests before the PV system is turned on</p> <p>3.19 Measuring the Voc and Isc to check for abnormally</p> <p>3.20 Conducting the functional checks on the PV operation</p> <p>3.21 Completing inspection and test technical reports</p>
4. Resource Implications	<p>4.1 Access to the workplace</p> <p>4.2 Tools and equipment appropriate to joint and connection process</p> <p>4.3 Availability of materials</p>
5. Methods of Assessment	<p>Competency may be assessed through: -</p> <p>5.1 Demonstration with oral questioning</p> <p>5.2 Observation</p> <p>5.3 Interview Test</p> <p>5.4 Written Test</p> <p>5.5 Portfolio</p>
6. Context for Assessment	<p>6.1 Competency may be assessed in an accredited assessment center</p> <p>6.2 Competency assessment must be undertaken in accordance with the approved NTB regulations</p>

5. GLOSSARY OF TERMS

Certification	is the process of verifying and validating the competencies of a person through assessment.
Certificate of competency (COC)	is a certification issued to individuals who pass the assessment for a single unit or cluster of units of competency.
Competency	is the possession and application of knowledge, skills and attitudes to perform work activities to the standard expected in the workplace.
Competency Assessment	is the process of collecting evidence and making judgments on the weather competency has been achieved.
Competency Standard (CS)	is the industry-determined specification of competencies required for effective work performance.
Context of Assessment	refers to the place where assessment is to be conducted or carried out.
Core Competencies	are the specific skills knowledge and attitude needed in a particular area of work-industry sector/occupation/job role.
Critical aspects of competency	refers to the evidence that is essential for successful performance of the unit of competency.
Elements	are the building blocks of a unit of competency. They describe in outcome terms the functions that a person performs in the workplace.
Evidence Guide	is a component of the unit of competency that defines or identifies the evidences required to determine the competence of the individual. It provides information on critical aspects of competency, underpinning knowledge, underpinning skills, resource implications, assessment method and context of assessment.
Level	refers to the category of skills and knowledge required to do a job
Method of Assessment	refers to the ways of collecting evidence and when evidence should be collected.
National Certificate (NC)	is a certification issued to individuals who achieve all the required units of competency for a national qualification defined under the Training Regulations. NCs are aligned to specific levels within the National Qualification Framework (NQF).
Performance Criteria	are evaluative statements that specify what is to be assessed and the required level of performance.
Qualification	is a cluster of units of competencies that meets job roles and is significant in the workplace; is also a certification awarded to a person on successful completion of a course in recognition of having demonstrated competencies in an industry sector.
Range Variable	describes the circumstances or context in which the work is to be performed.

Resource Implications	Refer to the resources needed for the successful performance of the work activity described in the unit of competency. It included work environment and conditions, materials, tools and equipment.
Standard Training Package	Is the document consist of Competency standard, Competency Based Curriculum and Competency Assessment Package.
Underpinning knowledge	refers to the competency that involves in applying knowledge to perform work activities. It includes specific knowledge that is essential to the performance of competency.
Underpinning skills	refers to the list of the skills needed to achieve the elements and performance criteria in the unit of competency. It includes generic and industry specific skills.
Unit of Competency	is a component of the competency standards stating a specific key function or role in a particular job or occupation, it is the smallest component of achievement that can be assessed and certified under the NQF.
OSH	Occupation Safety and Health.
Drawing	is a design or layout of something made using a pencil or pen rather than paint.
PPE	Personal Protective Equipment.
CAD software	is technology for design and technical documentation, which replaces manual drafting with an automated process.
Test equipment	is any testing equipment used by the MANUFACTURER to test the Products and any related sub-assemblies and provide the Services and Additional Services, including all associated equipment and Documentation required to use the Testing Equipment.
Earthing system	is circuitry which connects parts of the electric circuit with the ground.
Meter board	is temporary disposable signs or sustainable and re-usable.
Motor	is any power unit that generates motion, that is a "prime mover", while "electric motor" refers to a "prime mover using electricity."
Faults	is a condition which can cause equipment failures (in transformers, transmission lines, alternators, busbars, etc.) and disturbs the normal working of the system.

Synchronous	doing something at the same time, and with learning, it's no different.
Transformer	is a device that transfers electric energy from one alternating-current circuit to one or more other circuits, either increasing (stepping up) or reducing (stepping down) the voltage.
Relay	is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals.
Fire alarm system	is designed to alert us to an emergency so that we can take action to protect ourselves, staff and the general public.
PLC	is an industrial computer control system that continuously monitors the state of input devices and makes decisions based upon a custom program to control the state of output devices.
Smart home	means your home has a smart home system that connects with your appliances to automate specific tasks and is typically remotely controlled.
IFTTT	IFTTT derives its name from the programming conditional statement “if this, then that.” What the company provides is a software platform that connects apps, devices and services from different developers in order to trigger one or more automations involving those apps, devices and services.
Solar Photovoltaic	is the generation of electricity using energy from the sun.
Off grid PV	an installation that is not connected to the electricity grid. This means that all the energy produced is stored and used on site.
On grid PV	is an electricity generating solar PV power system that is connected to the utility grid.

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6.1 NTB, Sub-committee of Competency Standards, Testing and Certifications

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1.	H.E Hing Sideth	Royal Government Delegation in Charge of Technical and Vocational Education and Training of the Ministry of Labor and Vocational Training	Chief
2.	Mr. Muong Pasy	Vice President of National Polytechnic Institute of Cambodia	Vice Chief
3.	H.E Chan Sopha	Director General of the Cambodian Standards Institute of the Ministry of Industry, Science, Technology and Innovation	Vice Chief
4.	Mr. Phuong Visith	Deputy Director General of Technical and Vocational Education and Training of the Ministry of Labor and Vocational Training	Vice Chief
5.	H.E Teang Sak	Director of Department Standard and Curriculum	Vice Chief
6.	H.E Sanet Vattana	Undersecretary of State, Ministry of Social Affairs, Veterans and Youth Fitness	Member
7.	Mr. Ung Chinna	Director of Education Quality Assurance Department of the Ministry of Education, Youth and Sports	Member
8.	Mr. Chan Savuth	Deputy Director of Department Labor Market Information of the Ministry of Labor and Vocational Training	Member
9.	Mr. Khim Yorm	Deputy Director of Department Standard and Curriculum	Member
10.	Mrs. Ieng Sochanthy	Deputy Director of Department Institute Management of the Ministry of Labor and Vocational Training	Member
11.	Mr. Kuon Phymalene	Deputy Director of Department Quality Assurance of the Ministry of Labor and Vocational Training	Member
12.	Mr. Koh Chhino	Deputy Director of Personnel and Human Resource Development of the Ministry of Agriculture, Forestry and Fisheries	Member
13.	Mr. Thi Bunthorn	Deputy Director of Personnel Department, General Department of Administration and Finance of the Ministry of Public Works and Transport	Member
14.	Mr. Enn Vuthy	Deputy Director of Department Standard and Curriculum	Member

15.	Mr. Chum Vuth	Deputy Director of Preah Kossamak Polytechnic Institute Representative of training providers	Member
16.	Mr. Ok Vireak	Deputy Director of Industrial Technical Institute Representative of training providers	Member
17.	Mr. Moeun Thannak	Deputy Director of National Polytechnic Institute of Angkor Representative of technical teachers	Member
18.	Mr. Proum Peou	Dean of the Faculty of Mechanical Engineering of the National Polytechnic Institute of Cambodia Representative of technical teachers	Member
19.	Mr. Chy Vanny	Dean of the Faculty of Electricity, Kossamak Polytechnic Institute Representative of technical teachers	Member
20.	Mr. Khay Socheat	Chief Office of Department Standard and Curriculum	Member
21.	Mr. Nea Sovantha	Chief Office of the Ministry of Labor and Vocational Training	Member
22.	Mr. Mam Say	Chief Office of Education Quality Supervision Office of National Polytechnic Institute of Cambodia	Member
23.	Mr. Kong Dyna	Deputy Director of Industrial Technical Institute	Member
24.	Mrs. Men Makara	Deputy Director of the Institute for the Smile of Children Representatives of national and international organizations	Member
25.	Mr. Chaov Sing	Vice Chief of Basic Training Office of the General Department of Health Technology of the Ministry of Health	Member
26.	Mr. Sok Huosambath	Technical Advisor of Mong Rithy Group	Member
27.	Mr. Vong Borith	General Treasurer of the Federation of Trade Unions of Cambodia	Member
28.	Mr. Say Ratanak	Head of Training and Development, RMA (Cambodia)	Member
29.	Mr. Cheam Sovannarith	Director of Maintenance and Repair Services of Komin Khmer Co., Ltd.	Member
30.	Mr. Ri Saokhun	N.C.X Spray Manager	Member
31.	Mrs. Pich Rothmony	Member of the Executive Committee of the Chamber of Commerce and Micro-Enterprises	Member
32.	Mr. Bunheang	Chief Office of Department Standard and Curriculum	Secretary

6.2 Sector Skills Council (SSC)

1.			Chief
2.			Vice Chief

3.			Member
4.			Member
5.			Member
6.			Member
7.			Member
8.			Member
9.			Member
10.			Member

6.3 Technical Working Group (TWG)

1.	Mr. Yoeurn Samrem	Deputy Chief Department of National Technical Training Institute	Chief
2.	Mr. Vann Phay	Instructor of National Technical Training Institute	Vice Chief
3.	Mr. Ros Raksa	Deputy Dean of Preah Kossomak Polytechnic Institute	Member
4.	Mr. Nam Sokkhim	Instructor of National Polytechnic Institute of Angkor	Member
5.	Mr. Sok Sorithy	Instructor of Reginal Polytechnic Institute Techo Sen Svay Rieng	Member
6.	Dr. Vai Vannak	Instructor of Institute Technology of Cambodia	Member

6.4 Secretariat

1.	H.E Teang Sak	Director of Department Standard and Curriculum	Chief
2.	Mr. San Seng	Director of Department Quality Assurance	Vice Chief
3.	Mr. Khim Yorm	Deputy Director of Department Standard and Curriculum	Vice Chief
4.	Mr. Enn Vuthy	Deputy Director of Department Standard and Curriculum	Member
5.	Mr. Khay Socheat	Chief Office of Department Standard and Curriculum	Member
6.	Mr. Mam Pich	Chief Office of Department Standard and Curriculum	Member
7.	Mr. Horn Vanna	Chief Office of Department Standard and Curriculum	Member
8.	Mr. Sem Bunthorn	Chief Office of Department Quality Assurance	Member
9.	Mr. Mom Naro	Official of Department Standard and Curriculum	Member
10.	Mrs. Teav Saroeung	Official of Department Standard and Curriculum	Member
11.	Ms. Lim Rina	Official of Department Standard and Curriculum	Member
12.	Mr. Sam Vandeth	Official of Department Standard and Curriculum	Member

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