

COMPETENCY STANDARDS



BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL II

**AUTOMOTIVE AND LAND
TRANSPORTATION SECTOR**

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
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COMPETENCY STANDARDS FOR BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL II

Section 1 BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL II QUALIFICATIONS

The **BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL II** qualification consists of competencies that a person must achieve to service electrical and mechanical systems and components of battery electric vehicle (BEV) for public utility vehicle (PUV) in accordance with the manufacturer's specifications and standards. It also covers carrying out inspection of electric vehicles for fleet operations in accordance with the user and maintenance manual.

This covers the servicing of 2-wheeled (L3), 3-wheeled (L4-L5) and 4-wheeled (L6, L7, M1, M2, N1) battery electric vehicles. It includes e-trikes (L4-L5), passenger cars (M1), PUV up to 5 tons (M2), e-buses (M3) and e-trucks (N1).

The units of competency comprising this qualification include the following:

Code	BASIC COMPETENCIES
400311210	Participate in workplace communication
400311211	Work in team environment
400311212	Solve/address general workplace problems
400311213	Develop career and life decisions
400311214	Contribute to workplace innovation
400311215	Present relevant information
400311216	Practice occupational safety and health policies and procedures
400311217	Exercise efficient and effective sustainable practices in the workplace
400311218	Practice entrepreneurial skills in the workplace

Code	COMMON COMPETENCIES
CS-ALT723201	Validate electric vehicle specification
CS-ALT723202	Move and position electric vehicle
ALT723214	Utilize automotive tools
ALT723215	Knowledge to Perform mensuration and calculation
ALT723216	Utilize workshop facilities and equipment
ALT723217	Prepare servicing parts and consumables
ALT723218	Prepare vehicle for servicing and releasing

Code	CORE COMPETENCIES
CS-ALT723301	Service battery electric vehicle (BEV) electrical system and components
CS-ALT723302	Service battery electric vehicle (BEV) mechanical system and components
CS-ALT723303	Carry out inspection of electric vehicles (EVs) for fleet operations

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

- Automotive Mechanic of Battery EV
- Automotive Electrician of Battery EV
- Automotive Service Technician of Battery EV
- Battery Electric Vehicle Technician

SECTION 2 COMPETENCY STANDARDS

These guidelines are set to provide the Technical Vocational Education and Training (TVET) providers with information and other important requirements to consider when designing training programs for **BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL II**.

BASIC COMPETENCIES

UNIT OF COMPETENCY : PARTICIPATE IN WORKPLACE COMMUNICATION

UNIT CODE : 400311210

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to gather, interpret, and convey information in response to workplace requirements.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Obtain and convey workplace information	1.1 Specific and relevant information is accessed from appropriate sources . 1.2 Effective questioning, active listening and speaking skills are used to gather and convey information. 1.3 Appropriate medium is used to transfer information and ideas. 1.4 Appropriate non- verbal communication is used. 1.5 Appropriate lines of communication with supervisors and colleagues are identified and followed. 1.6 Defined workplace procedures for the location and storage of information are used. 1.7 Personal interaction is carried out clearly and concisely.	1.1 Effective verbal and nonverbal communication 1.2 Different modes of communication 1.3 Medium of communication in the workplace 1.4 Organizational policies 1.5 Communication procedures and systems 1.6 Lines of Communication 1.7 Technology relevant to the enterprise and the individual's work responsibilities 1.8 Workplace etiquette	1.1 Following simple spoken language 1.2 Performing routine workplace duties following simple written notices 1.3 Participating in workplace meetings and discussions 1.4 Preparing work-related documents 1.5 Estimating, calculating and recording routine workplace measures 1.6 Relating/ Interacting with people of various levels in the workplace 1.7 Gathering and providing basic information in response to workplace requirements 1.8 Basic business writing skills 1.9 Interpersonal skills in the workplace 1.10 Active-listening skills

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Perform duties following workplace instructions	2.1 Written notices and instructions are read and interpreted in accordance with organizational guidelines. 2.2 Routine written instruction are followed based on established procedures. 2.3 Feedback is given to workplace supervisor based instructions/ information received. 2.4 Workplace interactions are conducted in a courteous manner. 2.5 Where necessary, clarifications about routine workplace procedures and matters concerning conditions of employment are sought and asked from appropriate sources . 2.6 Meetings outcomes are interpreted and implemented.	2.1 Effective verbal and non-verbal communication 2.2 Different modes of communication 2.3 Medium of communication in the workplace 2.4 Organizational/ Workplace policies 2.5 Communication procedures and systems 2.6 Lines of communication 2.7 Technology relevant to the enterprise and the individual's work responsibilities 2.8 Effective questioning techniques (clarifying and probing) 2.9 Workplace etiquette	2.1 Following simple spoken instructions 2.2 Performing routine workplace duties following simple written notices 2.3 Participating in workplace meetings and discussions 2.4 Completing work-related documents 2.5 Estimating, calculating and recording routine workplace measures 2.6 Relating/ Responding to people of various levels in the workplace 2.7 Gathering and providing information in response to workplace requirements 2.8 Basic questioning/ querying 2.9 Skills in reading for information 2.10 Skills in locating
3. Complete relevant work- related documents	3.1 Range of forms relating to conditions of employment are completed accurately and legibly. 3.2 Workplace data is recorded on standard workplace forms and documents. 3.3 Errors in recording information on forms/ documents are identified and acted upon. 3.4 Reporting requirements to supervisor are completed according to organizational guidelines.	3.1 Effective verbal and non-verbal communication 3.2 Different modes of communication 3.3 Workplace forms and documents 3.4 Organizational/ Workplace policies 3.5 Communication procedures and systems 3.6 Technology relevant to the enterprise and the individual's work responsibilities	3.1 Completing work-related documents 3.2 Applying operations of addition, subtraction, division and multiplication 3.3 Gathering and providing information in response to workplace requirements 3.4 Effective record keeping skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Appropriate sources	May include: 1.1 Team members 1.2 Supervisor/Department Head 1.3 Suppliers 1.4 Trade personnel 1.5 Local government 1.6 Industry bodies
2. Medium	May include: 2.1 Memorandum 2.2 Circular 2.3 Notice 2.4 Information dissemination 2.5 Follow-up or verbal instructions 2.6 Face-to-face communication 2.7 Electronic media (disk files, cyberspace)
3. Storage	May include: 3.1 Manual filing system 3.2 Computer-based filing system
4. Workplace interactions	May include: 4.1 Face-to-face 4.2 Telephone 4.3 Electronic and two-way radio 4.4 Written including electronic means, memos, instruction and forms 4.5 Non-verbal including gestures, signals, signs and diagrams
5. Forms	May include: 5.1 HR/Personnel forms, telephone message forms, safety reports

EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <p>1.1 Prepared written communication following standard format of the organization</p> <p>1.2 Accessed information using workplace communication equipment/systems</p> <p>1.3 Made use of relevant terms as an aid to transfer information effectively</p> <p>1.4 Conveyed information effectively adopting formal or informal communication</p>
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <p>2.1 Fax machine</p> <p>2.2 Telephone</p> <p>2.3 Notebook</p> <p>2.4 Writing materials</p> <p>2.5 Computer with Internet connection</p>
<p>3. Methods of Assessment</p>	<p>Competency in this unit may be assessed through:</p> <p>3.1 Demonstration with oral questioning</p> <p>3.2 Interview</p> <p>3.3 Written test</p> <p>3.4 Third-party report</p>
<p>4. Context for Assessment</p>	<p>4.1 Competency may be assessed individually in the actual workplace or through an accredited institution</p>

UNIT OF COMPETENCY : WORK IN A TEAM ENVIRONMENT

UNIT CODE : 400311211

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes to identify one's roles and responsibilities as a member of a team.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Describe team role and scope	1.1 The role and objective of the team is identified from available sources of information . 1.2 Team parameters, reporting relationships and responsibilities are identified from team discussions and appropriate external sources.	1.1 Group structure 1.2 Group development 1.3 Sources of information	1.1 Communicating with others, appropriately consistent with the culture of the workplace 1.2 Developing ways in improving work structure and performing respective roles in the group or organization
2. Identify one's role and responsibility within a team	2.1 Individual roles and responsibilities within the team environment are identified. 2.2 Roles and objectives of the team is identified from available sources of information . 2.3 Team parameters, reporting relationships and responsibilities are identified based on team discussions and appropriate external sources.	2.1 Team roles and objectives 2.2 Team structure and parameters 2.3 Team development 2.4 Sources of information	2.1 Communicating with others, appropriately consistent with the culture of the workplace 2.2 Developing ways in improving work structure and performing respective roles in the group or organization
3. Work as a team member	3.1 Effective and appropriate forms of communications are used and interactions undertaken with team members based on company practices. 3.2 Effective and appropriate contributions made to complement team activities and objectives, based on workplace context . 3.3 Protocols in reporting are observed based on standard company practices.	3.1 Communication Process 3.2 Workplace communication protocol 3.3 Team planning and decision making 3.4 Team thinking 3.5 Team roles 3.6 Process of team development 3.7 Workplace context	3.1 Communicating appropriately, consistent with the culture of the workplace 3.2 Interacting effectively with others 3.3 Deciding as an individual and as a group using group think strategies and techniques 3.4 Contributing to Resolution of

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	3.4 Contribute to the development of team work plans based on an understanding of team's role and objectives.		issues and concerns

RANGE OF VARIABLES

VARIABLE	RANGE
1. Role and objective of team	May include: 1.1 Work activities in a team environment with enterprise or specific sector 1.2 Limited discretion, initiative and judgement maybe demonstrated on the job, either individually or in a team environment
2. Sources of information	May include: 2.1 Standard operating and/or other workplace procedures 2.2 Job procedures 2.3 Machine/equipment manufacturer's specifications and instructions 2.4 Organizational or external personnel 2.5 Client/supplier instructions 2.6 Quality standards 2.7 OHS and environmental standards
3. Workplace context	May include: 3.1 Work procedures and practices 3.2 Conditions of work environments 3.3 Legislation and industrial agreements 3.4 Standard work practice including the storage, safe handling and disposal of chemicals 3.5 Safety, environmental, housekeeping and quality guidelines

EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Worked in a team to complete workplace activity 1.2 Worked effectively with others 1.3 Conveyed information in written or oral form 1.4 Selected and used appropriate workplace language 1.5 Followed designated work plan for the job
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> 2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Materials relevant to the proposed activity or tasks
<p>3. Methods of Assessment</p>	<p>Competency in this unit may be assessed through:</p> <ul style="list-style-type: none"> 3.1 Role play involving the participation of individual member to the attainment of organizational goal 3.2 Case studies and scenarios as a basis for discussion of issues and strategies in teamwork 3.3 Socio-drama and socio-metric methods 3.4 Sensitivity techniques 3.5 Written Test
<p>4. Context for Assessment</p>	<ul style="list-style-type: none"> 4.1 Competency may be assessed in workplace or in a simulated workplace setting 4.2 Assessment shall be observed while task are being undertaken whether individually or in group

UNIT OF COMPETENCY : SOLVE/ADDRESS GENERAL WORKPLACE PROBLEMS

UNIT CODE : 400311212

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to apply problem-solving techniques to determine the origin of problems and plan for their resolution. It also includes addressing procedural problems through documentation, and referral.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify routine problems	1.1 Routine problems or procedural problem areas are identified. 1.2 Problems to be investigated are defined and determined. 1.3 Current conditions of the problem are identified and documented.	1.1 Current industry hardware and software products and services 1.2 Industry maintenance, service and helpdesk practices, processes and procedures 1.3 Industry standard diagnostic tools 1.4 Malfunctions and resolutions	1.1 Identifying current industry hardware and software products and services 1.2 Identifying current industry maintenance, services and helpdesk practices, processes and procedures. 1.3 Identifying current industry standard diagnostic tools 1.4 Describing common malfunctions and resolutions. 1.5 Determining the root cause of a routine malfunction
2. Look for solutions to routine problems	2.1 Potential solutions to problem are identified. 2.2 Recommendations about possible solutions are developed, documented , ranked and presented to appropriate person for decision.	2.1 Current industry hardware and software products and services 2.2 Industry service and helpdesk practices, processes and procedures 2.3 Operating systems 2.4 Industry standard diagnostic tools 2.5 Malfunctions and resolutions. 2.6 Root cause analysis	2.1 Identifying current industry hardware and software products and services 2.2 Identifying services and helpdesk practices, processes and procedures. 2.3 Identifying operating system 2.4 Identifying current industry standard diagnostic tools 2.5 Describing common

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
			malfunctions and resolutions. 2.6 Determining the root cause of a routine malfunction
3. Recommend solutions to problems	3.1 Implementation of solutions are <i>planned</i> . 3.2 Evaluation of implemented solutions are planned. 3.3 Recommended solutions are documented and submit to appropriate person for confirmation.	3.1 Standard procedures 3.2 Documentation produce	3.1 Producing documentation that recommends solutions to problems 3.2 Following established procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Problems/Procedural Problem	May include: 1.1 Routine/non – routine processes and quality problems 1.2 Equipment selection, availability and failure 1.3 Teamwork and work allocation problem 1.4 Safety and emergency situations and incidents 1.5 Work-related problems outside of own work area
2. Appropriate person	May include: 2.1 Supervisor or manager 2.2 Peers/work colleagues 2.3 Other members of the organization
3. Document	May include: 3.1 Electronic mail 3.2 Briefing notes 3.3 Written report 3.4 Evaluation report
4. Plan	May include: 4.1 Priority requirements 4.2 Co-ordination and feedback requirements 4.3 Safety requirements 4.4 Risk assessment 4.5 Environmental requirements

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <p>1.1 Determined the root cause of a routine problem. 1.2 Identified solutions to procedural problems. 1.3 Produced documentation that recommends solutions to problems. 1.4 Followed established procedures. 1.5 Referred unresolved problems to support persons.</p>
2. Resource Implications	2.1 Assessment will require access to a workplace over an extended period, or a suitable method of gathering evidence of operating ability over a range of situations.
3. Methods of Assessment	<p>Competency in this unit may be assessed through:</p> <p>3.1 Case Formulation 3.2 Life Narrative Inquiry 3.3 Standardized test</p> <p>The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components.</p>
4. Context for Assessment	4.1 Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY : DEVELOP CAREER AND LIFE DECISIONS

UNIT CODE : 400311213

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes in managing one’s emotions, developing reflective practice, and boosting self-confidence and developing self-regulation.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Manage one’s emotion	1.1 Self-management strategies are identified. 1.2 Skills to work independently and to show initiative, to be conscientious, and persevering in the face of setbacks and frustrations are developed. 1.3 Techniques for effectively handling negative emotions and unpleasant situation in the workplace are examined.	1.1 Self-management strategies that assist in regulating behavior and achieving personal and learning goals (e.g. Nine self-management strategies according to Robert Kelley) 1.2 Enablers and barriers in achieving personal and career goals 1.3 Techniques in handling negative emotions and unpleasant situation in the workplace such as frustration, anger, worry, anxiety, etc.	1.1 Managing properly one’s emotions and recognizing situations that cannot be changed and accept them and remain professional 1.2 Developing self-discipline, working independently and showing initiative to achieve personal and career goals 1.3 Showing confidence, and resilience in the face of setbacks and frustrations and other negative emotions and unpleasant situations in the workplace
2. Develop reflective practice	2.1 Personal strengths and achievements, based on self-assessment strategies and teacher feedback are contemplated. 2.2 Progress when seeking and responding to feedback from teachers to assist them in consolidating strengths, addressing weaknesses and fulfilling their potential are monitored. 2.3 Outcomes of personal and academic challenges by reflecting on previous problem solving and	2.1 Basic SWOT analysis 2.2 Strategies to improve one’s attitude in the workplace 2.3 Gibbs’ Reflective Cycle/Model (Description, Feelings, Evaluation, Analysis, Conclusion, and Action plan)	2.1 Using the basic SWOT analysis as self-assessment strategy 2.2 Developing reflective practice through realization of limitations, likes/ dislikes; through showing of self-confidence 2.3 Demonstrating self-acceptance and being able to accept challenges

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	decision making strategies and feedback from peers and teachers are predicted.		
3. Boost self-confidence and develop self-regulation	3.1 Efforts for continuous self-improvement are demonstrated. 3.2 Counter-productive tendencies at work are eliminated. 3.3 Positive outlook in life are maintained.	3.1 Four components of self-regulation based on Self-Regulation Theory (SRT) 3.2 Personality development concepts 3.3 Self-help concepts (e. g., 7 Habits by Stephen Covey, transactional analysis, psycho-spiritual concepts)	3.1 Performing effective communication skills – reading, writing, conversing skills 3.2 Showing affective skills – flexibility, adaptability, etc. 3.3 Self-assessment for determining one’s strengths and weaknesses

RANGE OF VARIABLES

VARIABLE	RANGE
1. Self-management strategies	May include: 1.1 Seeking assistance in the form of job coaching or mentoring 1.2 Continuing dialogue to tackle workplace grievances 1.3 Collective negotiation/bargaining for better working conditions 1.4 Share your goals to improve with a trusted co-worker or supervisor 1.5 Make a negativity log of every instance when you catch yourself complaining to others 1.6 Make lists and schedules for necessary activities
2. Unpleasant situation	May include: 2.1 Job burn-out 2.2 Drug dependence 2.3 Sulking

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Express emotions appropriately 1.2 Work independently and show initiative 1.3 Consistently demonstrate self-confidence and self-discipline
2. Resource Implications	The following resources should be provided: 2.1 Access to workplace and resources 2.2 Case studies
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Demonstration or simulation with oral questioning 3.2 Case problems involving work improvement and sustainability issues 3.3 Third-party report
4. Context for Assessment	4.1 Competency assessment may occur in workplace or any appropriately simulated environment.

UNIT OF COMPETENCY : CONTRIBUTE TO WORKPLACE INNOVATION

UNIT CODE : 400311214

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to make a pro-active and positive contribution to workplace innovation.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify opportunities to do things better	<p>1.1 Opportunities for improvement are identified proactively in own area of work.</p> <p>1.2 Information are gathered and reviewed which may be relevant to ideas and which might assist in gaining support for idea.</p>	<p>1.1 Roles of individuals in suggesting and making improvements</p> <p>1.2 Positive impacts and challenges in innovation</p> <p>1.3 Types of changes and responsibility</p> <p>1.4 Seven habits of highly effective people</p>	<p>1.1 Identifying opportunities to improve and to do things better. Involvement</p> <p>1.2 Identifying the positive impacts and the challenges of change and innovation</p> <p>1.3 Identifying examples of the types of changes that are within and outside own scope of responsibility</p>
2. Discuss and develop ideas with others	<p>2.1 People who could provide input to ideas for improvements are identified.</p> <p>2.2 Ways of approaching people to begin sharing ideas are selected.</p> <p>2.3 Meeting is set with relevant people.</p> <p>2.4 Ideas for follow up are review and selected based on feedback.</p> <p>2.5 Critical inquiry method is used to discuss and develop ideas with others.</p>	<p>2.1 Roles of individuals in suggesting and making improvements</p> <p>2.2 Positive impacts and challenges in innovation</p> <p>2.3 Types of changes and responsibility</p> <p>2.4 Seven habits of highly effective people</p>	<p>2.1 Identifying opportunities to improve and to do things better. Involvement</p> <p>2.2 Identifying the positive impacts and the challenges of change and innovation</p> <p>2.3 Providing examples of the types of changes that are within and outside own scope of responsibility</p> <p>2.4 Communicating ideas for change through small group discussions and meetings</p>
3. Integrate ideas for change in the workplace	<p>3.1 Critical inquiry method is used to integrate different ideas for change of key people.</p>	<p>3.1 Roles of individuals in suggesting and making improvements</p>	<p>3.1 Identifying opportunities to improve and to do things better. Involvement</p>

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>3.2 Summarizing, analyzing and generalizing skills are used to extract salient points in the pool of ideas.</p> <p>3.3 Reporting skills are likewise used to communicate results.</p> <p>3.4 Current Issues and concerns on the systems, processes and procedures, as well as the need for simple innovative practices are identified.</p>	<p>3.2 Positive impacts and challenges in innovation</p> <p>3.3 Types of changes and responsibility</p> <p>3.4 Seven habits of highly effective people</p> <p>3.5 Basic research skills</p>	<p>3.2 Identifying the positive impacts and the challenges of change and innovation</p> <p>3.3 Providing examples of the types of changes that are within and outside own scope of responsibility</p> <p>3.4 Communicating ideas for change through small group discussions and meetings</p> <p>3.5 Demonstrating skills in analysis and interpretation of data</p>

RANGE OF VARIABLES

VARIABLE	RANGE	
1. Opportunities for improvement	May include: 1.1 Systems 1.2 Processes 1.3 Procedures 1.4 Protocols 1.5 Codes 1.6 Practices	
2. Information	May include: 2.1 Workplace communication problems 2.2 Performance evaluation results 2.3 Team dynamics issues and concerns 2.4 Challenges on return of investment 2.5 New tools, processes and procedures 2.6 New people in the organization	
3. People who could provide input	May include: 3.1 Leaders 3.2 Managers 3.3 Specialists 3.4 Associates 3.5 Researchers 3.6 Supervisors 3.7 Staff	3.8 Consultants (external) 3.9 People outside the organization in the same field or similar expertise/industry 3.10 Clients
4. Critical inquiry method	May include: 4.1 Preparation 4.2 Discussion 4.3 Clarification of goals 4.4 Negotiate towards a Win-Win outcome 4.5 Agreement 4.6 Implementation of a course of action 4.7 Effective verbal communication. See our pages: Verbal Communication and Effective Speaking 4.8 Listening 4.9 Reducing misunderstandings is a key part of effective negotiation 4.10 Rapport Building 4.11 Problem Solving 4.12 Decision Making 4.13 Assertiveness 4.14 Dealing with Difficult Situations	
5. Reporting skills	May include: 5.1 Data management 5.2 Coding 5.3 Data analysis and interpretation 5.4 Coherent writing 5.5 Speaking	

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Identified opportunities to do things better. 1.2 Discussed and developed ideas with others on how to contribute to workplace innovation. 1.3 Integrated ideas for change in the workplace. 1.4 Analyzed and reported rooms for innovation and learning in the workplace.
2. Resource Implications	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> 2.1 Pens, papers and writing implements 2.2 Cartolina 2.3 Manila papers
3. Methods of Assessment	<p>Competency in this unit may be assessed through:</p> <ul style="list-style-type: none"> 3.1 Psychological and behavioral Interviews 3.2 Performance Evaluation 3.3 Life Narrative Inquiry 3.4 Review of portfolios of evidence and third-party workplace reports of on-the-job performance 3.5 Sensitivity analysis 3.6 Organizational analysis 3.7 Standardized assessment of character strengths and virtues applied
4. Context for Assessment	<ul style="list-style-type: none"> 4.1 Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY : PRESENT RELEVANT INFORMATION

UNIT CODE : 400311215

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to present data/information appropriately.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Gather data/information	1.1 Evidence, facts and information are collected. 1.2 Evaluation, terms of reference and conditions are reviewed to determine whether data/information falls within project scope.	1.1 Organizational protocols 1.2 Confidentiality 1.3 Accuracy 1.4 Business mathematics and statistics 1.5 Data analysis techniques/procedures 1.6 Reporting requirements to a range of audiences 1.7 Legislation, policy and procedures relating to the conduct of evaluations 1.8 Organizational values, ethics and codes of conduct	1.1 Describing organizational protocols relating to client liaison 1.2 Protecting confidentiality 1.3 Describing accuracy 1.4 Computing business mathematics and statistics 1.5 Describing data analysis techniques/procedures 1.6 Reporting requirements to a range of audiences 1.7 Stating legislation, policy and procedures relating to the conduct of evaluations 1.8 Stating organizational values, ethics and codes of conduct
2. Assess gathered data/information	2.1 Validity of data/ information is assessed. 2.2 Analysis techniques are applied to assess data/information. 2.3 Trends and anomalies are identified. 2.4 Data analysis techniques and procedures are documented. 2.5 Recommendations are made on areas of possible improvement.	2.1 Business mathematics and statistics 2.2 Data analysis techniques/procedures 2.3 Reporting requirements to a range of audiences 2.4 Legislation, policy and procedures relating to the conduct of evaluations	2.1 Computing business mathematics and statistics 2.2 Describing data analysis techniques/procedures 2.3 Reporting requirements to a range of audiences 2.4 Stating legislation, policy and procedures relating to the conduct of evaluations

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		2.5 Organizational values, ethics and codes of conduct	2.5 Stating organizational values, ethics and codes of conduct
3. Record and present information	Studied data/information are recorded. Recommendations are analyzed for action to ensure they are compatible with the project's scope and terms of reference. Interim and final reports are analyzed and outcomes are compared to the criteria established at the outset. Findings are presented to stakeholders.	3.1 Data analysis techniques/procedures 3.2 Reporting requirements to a range of audiences 3.3 Legislation, policy and procedures relating to the conduct of evaluations 3.4 Organizational values, ethics and codes of conduct	3.1 Describing data analysis techniques/procedures 3.2 Reporting requirements to a range of audiences 3.3 Stating legislation, policy and procedures relating to the conduct of evaluations 3.4 Stating organizational values, ethics and codes of conduct practices

RANGE OF VARIABLES

VARIABLE	RANGE
1. Data analysis techniques	May include: 1.1 Domain analysis 1.2 Content analysis 1.3 Comparison technique

EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Determine data / information 1.2 Studied and applied gathered data/information 1.3 Recorded and studied data/information <p>These aspects may be best assessed using a range of scenarios what ifs as a stimulus with a walk through forming part of the response. These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.</p>
<p>2. Resource Implications</p>	<p>Specific resources for assessment</p> <ul style="list-style-type: none"> 2.1 Evidence of competent performance should be obtained by observing an individual in an information management role within the workplace or operational or simulated environment.
<p>3. Methods of Assessment</p>	<p>Competency in this unit may be assessed through:</p> <ul style="list-style-type: none"> 3.1 Written Test 3.2 Interview 3.3 Portfolio <p>The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components.</p>
<p>4. Context for Assessment</p>	<ul style="list-style-type: none"> 4.1 In all workplace, it may be appropriate to assess this unit concurrently with relevant teamwork or operation units.

UNIT OF COMPETENCY : PRACTICE OCCUPATIONAL SAFETY AND HEALTH POLICIES AND PROCEDURES

UNIT CODE : 400311216

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to identify OSH compliance requirements, prepare OSH requirements for compliance, perform tasks in accordance with relevant OSH policies and procedures.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify OSH compliance requirements	1.1 Relevant OSH requirements, regulations, policies and procedures are identified in accordance with workplace policies and procedures. 1.2 OSH activity non-conformities are conveyed to appropriate personnel . 1.3 OSH preventive and control requirements are identified in accordance with OSH work policies and procedures.	1.1 OSH preventive and control requirements 1.2 Hierarchy of Controls 1.3 Hazard Prevention and Control 1.4 General OSH principles 1.5 Work standards and procedures 1.6 Safe handling procedures of tools, equipment and materials 1.7 Standard emergency plan and procedures in the workplace	1.1 Communication skills 1.2 Interpersonal skills 1.3 Critical thinking skills 1.4 Observation skills
2. Prepare OSH requirements for compliance	2.1 OSH work activity material, tools and equipment requirements are identified in accordance with workplace policies and procedures. 2.2 Required OSH materials, tools and equipment are acquired in accordance with workplace policies and procedures. 2.3 Required OSH materials, tools and equipment are arranged/ placed in accordance with OSH work standards.	2.1 Resources necessary to execute hierarchy of controls 2.2 General OSH principles 2.3 Work standards and procedures 2.4 Safe handling procedures of tools, equipment and materials 2.5 Different OSH control measures	2.1 Communication skills 2.2 Estimation skills 2.3 Interpersonal skills 2.4 Critical thinking skills 2.5 Observation skills 2.6 Material, tool and equipment identification skills
3. Perform tasks in accordance with relevant OSH policies	3.1 Relevant OSH work procedures are identified in accordance with workplace policies and procedures.	3.1 OSH work standards 3.2 Industry related work activities	3.1 Communication skills 3.2 Interpersonal skills

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
and procedures	3.2 Work Activities are executed in accordance with OSH work standards. 3.3 <i>Non-compliance work activities</i> are reported to appropriate personnel.	3.3 General OSH principles 3.4 OSH Violations Non-compliance work activities	3.3 Troubleshooting skills 3.4 Critical thinking skills 3.5 Observation skills

RANGE OF VARIABLES

VARIABLE	RANGE	
1. OSH Requirements, Regulations, Policies and Procedures	May include: 1.1 Clean Air Act 1.2 Building code 1.3 National Electrical and Fire Safety Codes 1.4 Waste management statutes and rules 1.5 Permit to Operate 1.6 Philippine Occupational Safety and Health Standards 1.7 Department Order No. 13 (Construction Safety and Health) 1.8 ECC regulations	
2. Appropriate Personnel	May include: 2.1 Manager 2.2 Safety Officer 2.3 EHS Offices 2.4 Supervisors 2.5 Team Leaders 2.6 Administrators	2.7 Stakeholders 2.8 Government Official 2.9 Key Personnel 2.10 Specialists 2.11 Himself
3. OSH Preventive and Control Requirements	May include: 3.1 Resources needed for removing hazard effectively 3.2 Resources needed for substitution or replacement 3.3 Resources needed to establishing engineering controls 3.4 Resources needed for enforcing administrative controls 3.5 Personal Protective equipment	
4. Non OSH-Compliance Work Activities	May include non-compliance or observance of the following safety measures: 4.1 Violations that may lead to serious physical harm or death 4.2 Fall Protection 4.3 Hazard Communication 4.4 Respiratory Protection 4.5 Power Industrial Trucks 4.6 Lockout/Tag-out 4.7 Working at heights (use of ladder, scaffolding) 4.8 Electrical Wiring Methods 4.9 Machine Guarding 4.10 Electrical General Requirements 4.11 Asbestos work requirements 4.12 Excavations work requirements	

EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Convey OSH work non-conformities to appropriate personnel 1.2 Identify OSH preventive and control requirements in accordance with OSH work policies and procedures 1.3 Identify OSH work activity material, tools and equipment requirements in accordance with workplace policies and procedures 1.4 Arrange/Place required OSH materials, tools and equipment in accordance with OSH work standards 1.5 Execute work activities in accordance with OSH work standards 1.6 Report OSH activity non-compliance work activities to appropriate personnel
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> 2.1 Facilities, materials tools and equipment necessary for the activity
<p>3. Methods of Assessment</p>	<p>Competency in this unit may be assessed through:</p> <ul style="list-style-type: none"> 3.1 Observation/Demonstration with oral questioning 3.2 Third party report
<p>4. Context for Assessment</p>	<ul style="list-style-type: none"> 4.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY : EXERCISE EFFICIENT AND EFFECTIVE SUSTAINABLE PRACTICES IN THE WORKPLACE

UNIT CODE : 400311217

UNIT DESCRIPTOR : This unit covers knowledge, skills and attitude to identify the efficiency and effectiveness of resource utilization, determine causes of inefficiency and/or ineffectiveness of resource utilization and Convey inefficient and ineffective environmental practices.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify the efficiency and effectiveness of resource utilization	1.1 Required resource utilization in the workplace is measured using appropriate techniques. 1.2 Data are recorded in accordance with workplace protocol. 1.3 Recorded data are compared to determine the efficiency and effectiveness of resource utilization according to established <i>environmental work procedures.</i>	1.1 Importance of Environmental Literacy 1.2 Environmental Work Procedures 1.3 Waste Minimization 1.4 Efficient Energy Consumptions	1.1 Recording Skills 1.2 Writing Skills 1.3 Innovation Skills
2. Determine causes of inefficiency and/or ineffectiveness of resource utilization	2.1 Potential causes of inefficiency and/or ineffectiveness are listed. 2.2 Causes of inefficiency and/or ineffectiveness are identified through deductive reasoning. 2.3 Identified causes of inefficiency and/or ineffectiveness are validated thru established environmental procedures.	2.1 Causes of environmental inefficiencies and ineffectiveness	2.1 Deductive Reasoning Skills 2.2 Critical thinking 2.3 Problem Solving 2.4 Observation Skills
3. Convey inefficient and ineffective environmental practices	3.1 Efficiency and effectiveness of resource utilization are reported to <i>appropriate personnel.</i> 3.2 Concerns related resource utilization are discussed with appropriate personnel. 3.3 Feedback on information/ concerns raised are clarified with appropriate personnel.	3.1 Appropriate Personnel to address the environmental hazards 3.2 Environmental corrective actions	3.1 Written and Oral Communication Skills 3.2 Critical thinking 3.3 Problem Solving 3.4 Observation Skills 3.5 Practice Environmental Awareness

RANGE OF VARIABLES

VARIABLE	RANGE
1. Environmental Work Procedures	May include: 1.1 Utilization of Energy, Water, Fuel Procedures 1.2 Waster Segregation Procedures 1.3 Waste Disposal and Reuse Procedures 1.4 Waste Collection Procedures 1.5 Usage of Hazardous Materials Procedures 1.6 Chemical Application Procedures 1.7 Labeling Procedures
2. Appropriate Personnel	May include: 2.1 Manager 2.2 Safety Officer 2.3 EHS Offices 2.4 Supervisors 2.5 Team Leaders 2.6 Administrators 2.7 Stakeholders 2.8 Government Official 2.9 Key Personnel 2.10 Specialists 2.11 Himself

EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Measured required resource utilization in the workplace using appropriate techniques 1.2 Recorded data in accordance with workplace protocol 1.3 Identified causes of inefficiency and/or ineffectiveness through deductive reasoning 1.4 Validate the identified causes of inefficiency and/or ineffectiveness thru established environmental procedures 1.5 Report efficiency and effectiveness of resource utilization to appropriate personnel 1.6 Clarify feedback on information/concerns raised with appropriate personnel
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> 2.1 Workplace 2.2 Tools, materials and equipment relevant to the tasks 2.3 PPE 2.4 Manuals and references
<p>3. Methods of Assessment</p>	<p>Competency in this unit may be assessed through:</p> <ul style="list-style-type: none"> 3.1 Demonstration 3.2 Oral questioning 3.3 Written examination
<p>4. Context for Assessment</p>	<ul style="list-style-type: none"> 4.1 Competency assessment may occur in workplace or any appropriately simulated environment 4.2 Assessment shall be observed while task are being undertaken whether individually or in-group

UNIT OF COMPETENCY : PRACTICE ENTREPRENEURIAL SKILLS IN THE WORKPLACE

UNIT CODE : 400311218

UNIT DESCRIPTOR : This unit covers the outcomes required to apply entrepreneurial workplace best practices and implement cost-effective operations.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Apply entrepreneurial workplace best practices	1.1 Good practices relating to workplace operations are observed and selected following workplace policy. 1.2 Quality procedures and practices are complied with according to workplace requirements. 1.3 Cost-conscious habits in resource utilization are applied based on industry standards.	1.1 Workplace best practices, policies and criteria 1.2 Resource utilization 1.3 Ways in fostering entrepreneurial attitudes: <ul style="list-style-type: none"> • Patience • Honesty • Quality-consciousness • Safety-consciousness • Resourcefulness 	1.1 Communication skills 1.2 Complying with quality procedures
2. Communicate entrepreneurial workplace best practices	2.1 Observed good practices relating to workplace operations are communicated to appropriate person . 2.2 Observed quality procedures and practices are communicated to appropriate person 2.3 Cost-conscious habits in resource utilization are communicated based on industry standards.	2.1 Workplace best practices, policies and criteria 2.2 Resource utilization 2.3 Ways in fostering entrepreneurial attitudes: <ul style="list-style-type: none"> • Patience • Honesty • Quality-consciousness • Safety-consciousness • Resourcefulness 	2.1 Communication skills 2.2 Complying with quality procedures 2.3 Following workplace communication protocol
3. Implement cost-effective operations	3.1 Preservation and optimization of workplace resources is implemented in accordance with enterprise policy 3.2 Judicious use of workplace tools, equipment and materials are observed according to manual and work requirements. 3.3 Constructive contributions to office operations are	3.1 Optimization of workplace resources 3.2 5S procedures and concepts 3.3 Criteria for cost-effectiveness 3.4 Workplace productivity 3.5 Impact of entrepreneurial mindset to	3.1 Implementing preservation and optimizing workplace resources 3.2 Observing judicious use of workplace tools, equipment and materials 3.3 Making constructive

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	made according to enterprise requirements. 3.4 Ability to work within one's allotted time and finances is sustained.	workplace productivity 3.6 Ways in fostering entrepreneurial attitudes: <ul style="list-style-type: none"> • Quality-consciousness • Safety-consciousness 	contributions to office operations 3.4 Sustaining ability to work within allotted time and finances

RANGE OF VARIABLES

VARIABLE	RANGE
1. Good practices	May include: 1.1 Economy in use of resources 1.2 Documentation of quality practices
2. Resources utilization	May include: 2.1 Consumption/ use of consumables 2.2 Use/Maintenance of assigned equipment and furniture 2.3 Optimum use of allotted /available time

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Demonstrated ability to identify and sustain cost-effective activities in the workplace 1.2 Demonstrated ability to practice entrepreneurial knowledge, skills and attitudes in the workplace.
2. Resource Implications	The following resources should be provided: 2.1 Simulated or actual workplace 2.2 Tools, materials and supplies needed to demonstrate the required tasks 2.3 References and manuals 2.3.1 Enterprise procedures manuals 2.3.2 Company quality policy
3. Methods of Assessment	Competency in this unit should be assessed through: 3.1 Interview 3.2 Third-party report
4. Context of Assessment	4.1 Competency may be assessed in workplace or in a simulated workplace setting 4.2 Assessment shall be observed while tasks are being undertaken whether individually or in-group

COMMON COMPETENCIES

UNIT OF COMPETENCY : **VALIDATE ELECTRIC VEHICLE SPECIFICATION**

UNIT CODE : **CS-ALT723201**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitude to check body type of the vehicle, check vehicle electric motor type, check vehicle specifications and complete validation of vehicle specification.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Check body type of the vehicle	1.1 Kind of vehicle is determined according to job order. 1.2 Vehicle dimensions is determined according to manual. 1.3 Vehicle weight is determined according to the manual. 1.4 Body shape is determined according to the manual. 1.6 Power train is determined according to the manual. 1.7 Safety practices are applied following OSHS.	1.1 Kind of vehicle 1.1.1 Aerodynamics 1.1.2 Vehicle Dynamics 1.1.3 Body shapes 1.1.4 Power train 1.1.5 Major dimensions 1.2 Vehicle specifications 1.2.1 Vehicle performance 1.2.2 Weight & Measurements 1.3 Automotive history 1.4 Documentation/ Accomplishing checklist 1.5 Resources information 1.5.1 Bulletin 1.5.2 Shop manual 1.6 OSHS 1.7 PPEs 1.8 Attitude: 1.8.1 Patience 1.8.2 Attention to details	1.1 Identifying kind of vehicle, dimensions, weight, body shape, and power train 1.2 Accomplishing checklist 1.3 Estimating visually dimensions and masses 1.4 Utilizing resource information 1.5 Wearing PPEs 1.6 Applying safety practices
2. Check vehicle motor type	2.1 Electric motor type is identified according to industry standards. 2.2 Electric motor power system is identified according to manual. 2.3 Electric motor components are identified following manual.	2.1 Principles of Operation, voltage, and application 2.2 Principles of Electricity and motors 2.3 History of electric motors 2.4 Hybrid technology 2.5 Resources information 2.5.1 Bulletin 2.5.2 Shop manual	2.1 Identifying motor type, parts & components 2.2 Identifying electric motor power system 2.3 Utilizing resource information

<p>3. Check vehicle specifications</p>	<p>3.1 VIN plate is inspected for specification of vehicle according to manual.</p> <p>3.2 Vehicle specification is verified according to vehicle reference materials.</p> <p>3.3 Vehicle modifications and conversions are checked following the manual.</p> <p>3.4 Vehicle conversions are inspected following the manual.</p>	<p>3.1 Fundamentals of Automotive engineering:</p> <p>3.1.1 Understanding of power & torque</p> <p>3.1.2 Gear Ratios</p> <p>3.1.3 Vehicle Regulations</p> <p>3.1.4 Knowledge of vehicle performance</p> <p>3.1.5 Knowledge in Vehicle manufacturing process</p> <p>3.1.6 Knowledge of vehicle use</p> <p>3.1.7 Automotive history</p> <p>3.2 Knowledge in specifications</p> <p>3.3 Reading of brochure, owner's manuals</p> <p>3.4 Reading of Resources information</p> <p>3.4.1 Bulletin</p> <p>3.4.2 Shop manual</p>	<p>3.1 Reading vehicle reference materials</p> <p>3.2 Conducting vehicle inspection for modification and conversion</p> <p>3.3 Comparing actual vehicle and specification sheets</p> <p>3.4 Utilizing resource information</p>
<p>4. Complete validation of vehicle specification</p>	<p>4.1 Vehicle ownership is verified using repair order and vehicle reference materials.</p> <p>4.2 Dealers check sheet is accomplished following industry standards.</p> <p>4.3 Dealers check sheet is submitted to immediate superior following industry standards.</p>	<p>4.1 Reporting to immediate superior</p> <p>4.2 Documentation/ Accomplishing checklist</p> <p>4.3 Attitude:</p> <p>4.3.1 Accuracy</p>	<p>4.1 Verifying vehicle ownership</p> <p>4.2 Accomplishing dealers check sheet</p> <p>4.3 Reporting skills</p>

RANGE OF VARIABLES

VARIABLE	RANGE
1. Kind of vehicle	May include: 1.1 Motorized 1.2 Not Motorized 1.3 On-Road 1.4 Off-Road 1.5 Passenger 1.6 Commercial 1.7 Utility 1.8 Manned 1.9 Unmanned 1.10 Remote control 1.11 Automated/Self Driving 1.12 Guided
2. Vehicle dimensions	May include: 2.1 Overall length 2.2 Overall width 2.3 Overall height 2.4 Wheelbase 2.5 Tread 2.6 Minimum running ground clearance 2.7 Room Length 2.8 Room Width 2.9 Room Height 2.10 Overhang front 2.11 Overhang rear 2.12 Angle of approach 2.13 Angle of departure
3. Vehicle Weight	May include: 3.1 Gross weight 3.2 Curb weight 3.3 Tare weight 3.4 Net weight
4. Body shape	May include: 4.1 Sedan 4.2 Coupe 4.3 Hardtop 4.4 Convertible 4.5 Multipurpose vehicle (MPV) 4.6 Sports utility vehicle (SUV) 4.7 Truck 4.8 Tractor Head 4.9 Trailer 4.10 Special Utility Truck 4.11 Bus 4.12 Mini Bus 4.13 Articulated bus 4.14 Asian Utility Vehicle (AUV)

VARIABLE	RANGE
5. Power train	May include: 5.1 4x2 5.2 4x4 5.3 Transmission 5.4 Differential
6. Electric Motor Type	May include: 6.1 DC series motor 6.2 Brushless DC motor 6.3 Permanent Magnet Synchronous motor 6.4 Three-phase induction motor
7. Electrical Motor Power System	May include: 7.1 Motor 7.2 Battery 7.3 On-board charger 7.4 Electric Power Control Unit
8. Electric motor components	May include: 8.1 Rotor 8.2 Stator Core 8.3 Conducting wire 8.4 Frame
9. Vehicle reference materials	May include: 9.1 Warranty booklet 9.2 Brochure of the vehicle 9.3 Vehicle registration
10. Dealers check sheet	May include: 10.1 Vehicle mileage 10.2 Owner's information 10.3 Damage

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Checked body type of the vehicle 1.2 Checked vehicle motor type 1.3 Checked vehicle specifications 1.4 Completed validation of vehicle specification
2. Resource Implications	The following resources should be provided: 2.1 Workplace: Real or simulated work area 2.2 Appropriate vehicle or model equivalent 2.3 Materials relevant to the activity 2.4 Resource information, references, and manual
3. Method of Assessment	Competency in this unit may be assessed through: 3.1 Direct Observation 3.2 Interview 3.3 Third Party Report 3.4 Written exam 3.5 Demonstration with Oral questioning
4. Context of Assessment	4.1 Competency may be assessed individually in the actual workplace or through accredited institution.

UNIT OF COMPETENCY : MOVE AND POSITION ELECTRIC VEHICLE

UNIT CODE : CS-ALT723202

UNIT DESCRIPTOR : This unit involves the skills and knowledge and attitudes required to move and position vehicle safely including systematic and efficient control of all vehicle functions.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare vehicle for operation	1.1 Vehicle multi point inspection is conducted according to industry practice. 1.2 Cockpit drill is performed according to industry practice. 1.3 Vehicle is start-up following owner's manual. 1.4 Parking brake is engaged according to industry practice.	1.1 Revolutions per minute during idle 1.2 Transmission and Differential System 1.3 Vehicle parts, components, and functions 1.4 Inspection procedures 1.5 Owner's manual 1.6 Safety procedures	1.1 Performing Cockpit Drill 1.2 Conducting Vehicle Multi point inspection 1.3 Starting the engine 1.4 Using owner's manual
2. Position vehicle	2.1 Workshop hazards are identified and avoided as per standard operating procedures. 2.2 Vehicle is moved according to Occupational Health and Safety Standards (for EV). 2.3 Workshop rules and regulations are recognized according to standard procedures.	2.1 Revolutions per minute in running condition 2.2 Kilometer per hour 2.3 Estimation/ timing 2.4 Transmission and Differential System 2.5 Electric Motors for EV 2.6 Vehicle parts, components, and functions 2.7 Defensive driving 2.8 Owner's Manual 2.9 Safety procedures (for EV c/o sir Neil)	2.1 Skills in positioning vehicle 2.2 Vehicle positioning estimation skill 2.3 Identifying workshop signs and markings
3. Park and stop the vehicle	3.1 Vehicle is positioned according to parking rules and regulations . 3.2 Parking brake is engaged according to industry practice. 3.3 Electrical devices are turned off based on manufacturer's specification. 3.4 Vehicle is shut-off following owner's manual	3.1 Vehicle parts, components and functions 3.2 Inspection procedures 3.3 Owner's Manual 3.4 Procedure in shutting-off vehicle 3.5 Safety procedures 3.6 Parking rules and regulations	3.1 Vehicle positioning estimation skills 3.2 Identifying parking signs and markings

RANGE OF VARIABLES

VARIABLE	RANGE
1. Multi point inspection	May include: 1.1 Check for any obstruction 1.2 Check external condition 1.3 Check internal condition 1.3.1 Transmission 1.3.2 Electric Motor 1.4 Check vehicle drivability
2. Cockpit Drill	May include: 2.1 Car mirror adjustments 2.2 Steering the car 2.3 How to change gears 2.4 Use of parking brake 2.5 Doors, Seat, Steering, Seat belt and Mirrors 2.6 Foot controls 2.7 Hand controls 2.8 Auxiliary controls (indicators)
3. Workshop hazards	May include: 3.1 Workshop tools and materials 3.2 Workshop equipment 3.3 Other vehicles 3.4 Other people 3.5 Oil spills 3.6 Loose parts
4. Parking rules and regulation	May include: 4.1 Parallel parking 4.2 Horizontal parking 4.3 Park facing the wall
5. Electrical devices	May include: 5.1 Lights 5.2 Air conditioning 5.3 Wiper 5.4 Radio

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Prepared vehicle for operation 1.2 Positioned the vehicle 1.3 Parked and stopped the vehicle 1.4 Used owner's manual
2. Resource implication	The following resources MUST be provided: 2.1 Workshop range/area 2.2 Service working bay 2.3 Appropriate vehicle for moving and positioning 2.4 Owner's manual
3. Method of assessment	Competency MUST be assessed through: 3.1 Demonstration with oral questioning 3.2 Written exam 3.3 Interview 3.4 Direct observation
4. Context of assessment	4.1 Competency may be assessed individually in the actual workplace or through accredited institution

UNIT OF COMPETENCY : UTILIZE AUTOMOTIVE TOOLS

UNIT CODE : ALT723214

UNIT DESCRIPTOR : This unit covers the knowledge and skills in selecting and using automotive power tools, hand tools and tools keeping.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare automotive tools	1.1 Automotive tools are identified according to their classification and specification. 1.2 Automotive tools and attachments are selected according to job requirements. 1.3 Automotive tools and attachments are inspected for defects and damages according to manufacturers and workplace procedures. 1.4 Safety practices are applied following OSHS.	1.1 Understanding power to size ratio 1.2 Leverage 1.3 Types of power tools and hand tools 1.4 Uses of automotive power tools and hand tools 1.5 Defects and damages of automotive tools and attachments 1.6 Handling of tools 1.7 Interpretation of contents of user's manuals 1.8 Safety procedures 1.9 Wearing of PPE	1.1 Identifying defects or damages of tools before use 1.2 Knowledgeable in proper handling of tools 1.3 Identifying tools required for the job 1.4 Inspecting the area where power tools will be used
2. Use automotive tools	2.1 Attachments are mounted to automotive tools according to job requirements. 2.2 Power tools are connected to power sources according to operation's manual. 2.3 Power tools are operated according to operation's manual. 2.4 Hand tools are utilized according to operation's manual. 2.5 PPEs are worn in accordance to OSHS.	2.1 Use of automotive tools 2.2 Application of Torque and pressure 2.3 Unit conversion of torque 2.4 English and metric system 2.5 Types of hand tools 2.6 Types of power tools 2.7 Fundamentals of automotive hand tools and power tools 2.8 Interpretation of contents of user's manuals 2.9 OSHS 2.10 Resources information 2.10.1 Bulletin 2.10.2 Shop manual	2.1 Analytical skills 2.2 Technical literacy 2.3 Mounting attachments to automotive tools 2.4 Connecting power tools to power sources 2.5 Operating power tools 2.6 Utilizing hand tools 2.7 Wearing PPEs 2.8 Applying safety practices 2.9 Following manuals

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Maintain automotive tools	3.1 Automotive tools and attachments are cleaned according to user's manual. 3.2 Automotive tools and attachments are checked for serviceability according to workplace and manufacturers procedures. 3.3 Defects and damages are reported to immediate superior following industry standards. 3.4 Automotive tools and attachments are stored according to workplace procedures. 3.5 Safety practices are applied following OSHS. 3.6 Wastes are disposed following environmental law and regulations.	3.1 Different types of power tools and hand tools 3.2 Techniques in tool Arrangement 3.3 Fundamentals of automotive tools 3.4 Cleaning of automotive tools 3.5 Labeling and arranging of power tools and hand tools 3.6 Safety practices 3.7 Procedures in maintaining of power tools and hand tools 3.8 Tagging of damaged/worn power tools and hand tools 3.9 Reporting damage power tools and hand tools 3.10 Proper disposal of damaged tools 3.11 Proper disposal of chemicals used for cleaning 3.12 OSHS 3.13 Environmental law and regulations 3.14 5S of good housekeeping 3.15 3Rs	3.1 Sorting of tools 3.2 Skills in creating reports 3.3 Cleaning of tools 3.4 Checking, cleaning and storing automotive tools and attachments 3.5 Reporting defects and damages 3.6 Disposing wastes 3.7 Practicing safety procedures

RANGE OF VARIABLES

VARIABLE	RANGE	
1. Automotive tools	May include: 1.1 Power tools 1.1.1 Electric power tools 1.1.1.1 Electric drill 1.1.2 Pneumatic tools 1.2 Basic tools 1.3 Special service tools (SST)	
2. Power sources	May include: 2.1 Electric source 2.2 Pneumatic or air 2.3 Hydraulic	
3. Basic tools	May include: 3.1 Wrenches 3.2 Pliers 3.3 Screw drivers 3.4 Power handle 3.5 Ratchet 3.6 Multitester	3.7 Flash light 3.8 Rubber mallet 3.9 Hammer 3.10 Jack 3.11 Jack stand 3.12 Choke
4. Attachments	May include: 4.1 Bits 4.2 Sockets 4.3 Extension	
5. Defects and damages	May include: 5.1 Tools 5.1.1 Cracks 5.1.2 Breakage 5.1.3 Deformity 5.1.4 Looseness 5.1.5 Corrosions 5.1.6 Leaks	5.2 Attachments 5.2.1 Cracks 5.2.2 Breakage 5.2.3 Deformity 5.2.4 Looseness 5.2.5 Corrosions
6. Personal protective equipment (PPEs)	May include: 6.1 Goggles 6.2 Gloves 6.3 Hard hat 6.4 Safety shoes 6.5 Dust mask	
7. Wastes	May include: 7.1 Dead batteries 7.2 Deformed, cracked, broken bits/sockets/extensions 7.3 Used cleaning chemicals 7.4 Used oil 7.5 Contaminated cleaning materials	

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment require evidence that the candidate understands the applications and guidelines specified by the manufacturer. 1.1 Prepared automotive tools 1.2 Used Power tools 1.3 Used Hand tools 1.4 Maintained and stored automotive tools 1.5 Disposed wastes 1.6 Applied safety measures
2. Resource implication	The following resource MUST be provided: 2.1 Appropriate power tools and hand tools 2.2 Tools and materials relevant for training 2.3 Proper place for storage and disposal 2.4 Workshop manuals
3. Method of assessment	Competency MUST be assessed through: 3.1 Written examination 3.2 Demonstrations with oral questioning 3.3 Direct observation 3.4 Third party report 3.5 Interview
4. Context of assessment	4.1 Competency may be assessed individually in the actual workplace or through accredited institution

UNIT OF COMPETENCY : PERFORM MENSURATION AND CALCULATION

UNIT CODE : ALT723215

UNIT DESCRIPTOR : This unit covers the knowledge and skills on how to use automotive measuring tools.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Select measuring instruments	1.1 Component to be measured is identified based on job requirements. 1.2 Automotive measuring instrument is identified based on job requirements. 1.3 Correct specifications are obtained from repair manual. 1.4 Measuring tools are calibrated in line with job requirements. 1.5 Measuring instruments are checked for accuracy and adjusted according to manufacturer's manual. 1.6 Defective measuring instruments are reported and returned to tool keeper following industry standards. 1.7 Safety practices are applied following OSHS.	1.1 Category of measuring instruments 1.2 Types and uses of measuring instruments 1.3 Shapes and Dimensions 1.4 Use of user's manual 1.5 Workshop procedures in reporting defective instruments 1.6 Characteristics of defective measuring instruments 1.7 Procedure in preparing report 1.8 OSHS in calibrating measuring instruments 1.9 Calibration of measuring tools 1.10 Inspection of measuring tools 1.11 Segregation and reporting of defective measuring instruments	1.1 Identifying and selecting measuring instruments 1.2 Visualizing objects and shapes 1.3 Calibration skills 1.4 Identifying defective measuring instruments 1.5 Reporting skills 1.6 Applying safety practices 1.7 Obtaining correct specifications 1.8 Checking measuring instruments for accuracy 1.9 Reporting and segregating defective measuring instruments
2. Carry out measurements and calculation	2.1 Automotive measuring instrument is selected to achieve required outcome in line with job requirements. 2.2 Accurate measurements are obtained in line with job requirements. 2.3 Calculation needed to complete work tasks are performed using mathematical operations . 2.4 Numerical computation is self-checked and corrected	2.1 Formulas for volume, areas, perimeters of plane and geometric figures 2.2 Different automotive measuring instruments 2.3 Calculation & measurement 2.4 Four fundamental operation 2.5 Linear measurement 2.6 Dimensions	2.1 Performing calculation 2.2 Applying formulas for volume, areas, perimeters of plane and geometric figures 2.3 Handling measuring instruments 2.4 Selecting automotive

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>for accuracy following manufacturer's workshop manual.</p> <p>2.3 Tools' limit of accuracy are read following manufacturer's workshop manual.</p> <p>2.4 Report is submitted to immediate supervisor following industry standard operating procedure.</p> <p>2.5 Safety practices are applied following OSHS.</p>	<p>2.7 Unit conversion</p> <p>2.8 Ratio and proportion</p> <p>2.9 Handling of measuring instruments</p> <p>2.10 Tools' limit of accuracy</p> <p>2.11 OSHS</p> <p>2.12 PPEs</p>	<p>measuring instruments</p> <p>2.5 Obtaining accurate measurements</p> <p>2.6 Performing calculation</p> <p>2.7 Self-checking and correcting numerical computation</p> <p>2.8 Reading tools' limit of accuracy</p> <p>2.9 Applying OSHS</p> <p>2.10 Wearing of PPEs</p>
3. Maintain measuring instruments	<p>3.1 Measuring instruments are handled following manufacturer's manual.</p> <p>3.2 Measuring instruments are cleaned following manufacturer's manual.</p> <p>3.3 Instruments are stored according to manufacturer's specifications and standard operating procedures.</p> <p>3.4 Safety practices are applied.</p>	<p>3.1 Types of measuring instruments and their uses</p> <p>3.2 Safe handling procedures in using measuring instruments</p> <p>3.3 Four fundamental operation of mathematics</p> <p>3.4 Formula for volume, area, perimeter and other geometric figures</p> <p>3.5 5S of good housekeeping</p> <p>3.6 Waste management</p> <p>3.7 Storing of measuring instruments</p> <p>3.8 OSHS</p>	<p>3.1 Handling and maintaining measuring instruments</p> <p>3.2 Disposing wastes</p> <p>3.3 Practicing good housekeeping</p> <p>3.4 Applying safety practices</p>

RANGE OF VARIABLES

VARIABLE	RANGE
1. Automotive measuring instruments	May include: 1.1 Torque wrench 1.2 Vernier caliper 1.3 Micrometer (inside and outside) 1.4 Dial gauge 1.5 Feeler gauge 1.7 Pitch/thread gauge 1.8 multi-tester (analog/digital) 1.9 Vacuum Gauge 1.10 Tire depth gauge 1.11 Battery tester 1.12 Steel tape 1.13 Ruler
2. Calculation	May include: 2.1 Volume 2.2 Area 2.3 Displacement 2.4 Inside diameter 2.5 Circumference 2.6 Length 2.7 Thickness 2.8 Outside diameter 2.9 Taper 2.10 Out of roundness 2.11 Voltage 2.12 Resistance 2.13 Current 2.14 Pressure 2.15 Clearance 2.16 Distortion/run-out 2.17 Torque conversion 2.18 Temperature
3. Mathematical operations	Includes: 3.1 Addition 3.2 Subtraction 3.3 Multiplication 3.4 Division 3.5 Fractions 3.6 Percentages 3.7 Mixed numbers

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate perform the following: 1.1 Selected measuring instruments 1.2 Performed measurements and calculation 1.3 Maintained measuring instruments 1.4 Applied safety practices
2. Resource implications	The following resources MUST be provided: 2.1 Workplace: Real or simulated work area 2.2 Appropriate Automotive Measuring Tools & equipment 2.3 Materials relevant to the activity 2.4 Training vehicle or simulators 2.5 User's manual 2.6 Repair manual
3. Method of assessment	Competency MUST be assessed through: 3.1 Written exam 3.2 Demonstration with oral questioning 3.3 Third party report 3.4 Interview
4. Context of assessment	4.1 Competency may be assessed individually in the actual workplace or through accredited institution.

UNIT OF COMPETENCY : UTILIZE WORKSHOP FACILITIES AND EQUIPMENT

UNIT CODE : ALT723216

UNIT DESCRIPTOR : This unit deals with inspecting and cleaning of work area including tools, equipment and facilities. Storage of equipment, including operating of basic workshop equipment.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Perform pre-operation activities	1.1 Workshop facilities are prepared according to work requirements. 1.2 Equipment are prepared according to work requirements. 1.3 Equipment are calibrated following users' manual. 1.4 Minor repairs are carried out based on users' manual . 1.5 Defective equipment are reported to immediate supervisor following company procedures. 1.6 Safety practices are applied following OSHS.	1.1 Different areas of an automotive service facilities 1.2 Preparation procedures of automotive service facilities 1.3 Different equipment in the automotive service facilities 1.4 Preparation procedures of automotive equipment 1.5 Minor repairs of automotive equipment 1.6 Report of defective equipment 1.7 Reporting procedures for defective equipment 1.8 OSHS practices related to the preparation of facilities and equipment 1.9 Workshop facilities and equipment	1.1 Preparing work area 1.2 Preparing equipment 1.3 Calibrating equipment 1.4 Repairing minor equipment issues 1.5 Reporting defective equipment 1.6 Applying safety practice 1.7 Following manuals

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Use facilities and equipment	2.1 Equipment is operated according to operation manual . 2.2 Facilities are utilized according to workshop procedures. 2.3 Equipment performance is monitored following users' manual . 2.4 Facilities functionalities are monitored following workplace procedures. 2.5 Safety practices are applied following OSHS.	2.1 Operate Equipment 2.2 Identify facilities required for task 2.3 Evaluate equipment operation 2.4 Inspect facility functionalities 2.5 OSHS practices related to operation of facilities and equipment 2.6 Manuals in utilizing facility and equipment 2.7 Monitoring procedure of equipment's performance 2.8 Evaluate equipment operation 2.9 Inspection of facility functionalities	2.1 Operating equipment 2.2 Utilizing facility 2.3 Monitoring equipment performance 2.4 Monitoring functionalities of facility 2.5 Practicing safety 2.6 Following manual
3. Conduct post-operation activities	3.1 Workshop facilities are restored according to 5S of good housekeeping. 3.2 Equipment are cleaned and stored according to good housekeeping. 3.3 Wastes are disposed following waste management procedure and OSHS. 3.4 PPEs and Safety practices are applied following OSHS. 3.5 Report is prepared based on workshop procedure.	3.1 5S of Good housekeeping 3.2 3Rs/ Waste segregation and disposal 3.3 Restoration of the facilities 3.4 Maintenance and storage of Equipment 3.5 OSHS 3.6 Preparation of report	3.1 Restoring workshop facilities properly 3.2 Cleaning Equipment 3.3 Storing equipment in proper location 3.4 Disposing waste materials 3.5 Reporting facilities and equipment condition 3.6 Practicing safety 3.7 Practicing 5S and 3Rs

RANGE OF VARIABLES

VARIABLE	RANGE
1. Equipment	May include: 1.1 Lifter (Two Post Lifter / Four Post Lifter/ Scissor type) 1.2 Crocodile Jack 1.3 Jack Stand 1.4 Air Compressor 1.5 Oil drain
2. Workshop facilities	May include: 2.1 Service Stall / Working Bay / Workshop areas for servicing/repairing light and/or heavy vehicle and/or plant transmissions and/or outdoor power equipment 2.2 Overhauling Room 2.3 Electrical / Air-con Room 2.4 Inspection Area 2.5 Open workshop/garage and enclosed, ventilated office area 2.6 Car wash area 2.7 Other variables may include workshop with: 2.7.1 Mess Hall 2.7.2 Washroom 2.7.3 Comfort room 2.7.4 Storage Room 2.7.5 Training Room
3. Manuals	May include: 3.1 Vehicle/plant manufacturer specifications 3.2 Company operating procedures 3.3 Industry/Workplace Codes of Practice 3.4 Product manufacturer specifications 3.5 Industry Occupational Health & Safety 3.6 Equipment Operation Guidelines 3.7 Service/workshop/repair manual
4. PPEs	May include: 4.1 Gloves 4.2 Apron 4.3 Goggles 4.4 Insulated Safety shoes 4.5 Uniforms 4.6 Cap 4.7 Safety helmet
5. Minor repairs	May include: 5.1 Lubrication 5.2 Bolt tightening 5.3 Worn-out parts replacement

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Performed pre-operation activities 1.2 Used facilities and equipment 1.3 Conducted post-operation activities 1.4 Applied safety practices and good housekeeping 1.5 Disposed wastes
2. Resource implications	The following resources should be provided: 2.1 Workplace: Real or simulated work area 2.2 Appropriate Equipment 2.3 Materials relevant to the activity 2.4 Manuals/references 2.5 PPEs 2.6 Fire Extinguishers
3. Method of assessment	Competency in this unit may be assessed through: 3.1 Written exam 3.2 Demonstration with oral questioning 3.3 Direct observation
4. Context of assessment	4.1 Competency may be assessed individually in the actual workplace or through accredited institution.

UNIT OF COMPETENCY : PREPARE SERVICING PARTS AND CONSUMABLES

UNIT CODE : ALT723217

UNIT DESCRIPTOR : This unit of competency covers the ability to prepare parts and consumables for all types and categories of EV in conducting preventive maintenance.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify parts and consumables	1.1 Parts and consumables are determined according to job requirements. 1.2 Availability of parts and consumables are confirmed based on stock. 1.3 Indirect materials are identified according to job requirements. 1.4 Hazardous parts and consumables are identified according to international standards. 1.5 Safety practices are applied according to OSHS.	1.1 Job requirements 1.2 Safety practices 1.3 Understanding manuals 1.4 Hazardous parts and consumables 1.5 Solid waste management act (RA 6969) 1.6 Wearing of PPE's 1.7 OSHS 1.8 Proper storage of materials 1.9 Chemical contents of consumables 1.10 Composition of consumables 1.11 Quality of parts and consumables 1.12 Computation for quantity of parts and consumables 1.13 Vehicle specifications 1.14 Identifying Part no. 1.15 Awareness in part number 1.16 Updated type of parts and consumables	1.1 Determining parts and consumables 1.2 Reading and interpreting job requirements 1.3 Identifying required parts & consumables 1.4 Understanding safety practices 1.5 Determining quantity and quality of parts and consumables 1.6 Confirming availability of parts and consumables 1.7 Identifying indirect materials 1.8 Identifying hazardous parts and consumables 1.9 Applying safety practices 1.10 Understanding safety practices 1.11 Following manuals
2. Retrieve and withdraw parts and consumables	2.1 Requisition slip is prepared according to identified parts and consumables. 2.2 Withdrawal of parts and materials are recorded. 2.3 Quantity of parts and consumables are validated according to job requirements.	2.1 Job requirements 2.2 Safety practices 2.3 Understanding manuals 2.4 Hazardous parts and consumables 2.5 Solid waste management act (RA 6969)	2.1 Reading and interpreting requisition slip 2.2 Validating quantity of parts and materials 2.3 Handling parts and consumables

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	2.4 Parts and materials are handled following safety procedures.	2.6 Wearing of PPE's 2.7 Updated types of parts & consumables for proper usage	
3. Complete work process	3.1 Used parts and consumables are labeled and segregated. 3.2 Used parts are packed and returned to customers. 3.3 Consumables are collected for recycling. 3.4 PPEs are worn following OSHS. 3.5 Wastes are disposed according to RA 6969.	3.1 Labeling and segregation of used parts and consumables 3.2 Job requirements 3.3 Safety practices 3.4 3Rs 3.5 Solid waste management act (RA 6969) 3.6 Wearing of PPE's	3.1 Waste segregation and disposal of parts & consumables according to RA 6969

RANGE OF VARIABLES

VARIABLE	RANGE
1. Parts and consumables	May include: 1.1 Engine oil 1.2 1.3 Transmission oil 1.4 Differential oil 1.5 Power steering fluid 1.6 1.7 Engine coolant 1.8 Engine oil filter 1.9 Fuel filter 1.10 Air cleaner element 1.11 Feed pump strainer 1.12 1.13 Battery 1.14 Air cleaner 1.15 Tire 1.16 Wiper blade 1.17 A/C pollen filter 1.18 Bulb 1.19 Brake pad/brake shoe 1.20 Clutch lining
2. Determining parts and consumables	May include: 2.1 Quantity 2.2 Quality
3. Indirect materials	May include: 3.1 Rags 3.2 Saw dust 3.3 Cleaning fluids 3.4 Sandpaper
4. Hazardous parts consumables	May include: 4.1 Batteries 4.2 Used oil 4.3 Used fluids 4.4 Used coolant 4.5 Used parts 4.6 Used oil filter
5. Wastes	May include: 5.1 Contaminated consumables 5.2 Contaminated parts

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Identified parts and consumables 1.2 Retrieved and withdrawn parts and consumables 1.3 Completed work process 1.4 Applied safety practices
2. Resource implications	The following resources should be provided: 2.1 Workplace: Real or simulated work area 2.2 Materials relevant to the activity 2.3 Repair manuals and related reference materials
3. Method of assessment	Competency in this unit may be assessed through: 3.1 Direct observation 3.2 Interview 3.3 Written examination 3.4 Demonstration with oral questioning 3.5 Third party report
4. Context of Assessment	4.1 Competency may be assessed individually in the actual workplace or through accredited institution.

UNIT OF COMPETENCY : PREPARE VEHICLE FOR SERVICING AND RELEASING

UNIT CODE : ALT723218

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes needed in identifying and preparing the vehicle for servicing and releasing.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Receive vehicle	1.1 Vehicle is located following company standard. 1.2 Checklist is validated for exterior and interior items in accordance with vehicle checklist . 1.3 Job Order is checked for proper assignment according to work classification . 1.4 Work Bay for vehicle is designated based from Job Order. 1.5 Vehicle is moved on the designated work bay .	1.1 Identification of basic vehicle components 1.2 Types of defects 1.3 Read & understand Job Order 1.4 Flat rate time 1.5 Use of PPEs 1.6 Adherence to safety procedures 1.7 Vehicle checklist 1.8 Work classification 1.9 Work Bay 1.10 Attitudes 1.10.1 Patient 1.10.2 Attention to details 1.10.3 Honest 1.10.4 Time Conscious	1.1 Completing vehicle checklist 1.2 Classifying work to be performed 1.3 Assigning work bay 1.4 Validating checklist for exterior and interior items 1.5 Checking job order for proper assignment 1.6 Identifying vehicle 1.7 Moving vehicle to designated work bay
2. Prepare vehicle for servicing	2.1 Protective covers are installed prior to servicing based on workshop operating standards. 2.2 Vehicle is positioned and set-up for lifting according to repair order. 2.3 Vehicle is lifted for servicing following manufacturer's manual. 2.4 Safety practices are applied following safety procedures.	2.1 Familiarization on equipment & facilities 2.2 Time estimation of completion 2.3 Vehicle tagging 2.4 Types of protective covers 2.5 Setting-up of vehicle for lifting 2.6 Read & understand repair order 2.7 Use of PPEs 2.8 Use of safety gears 2.9 OSHS 2.10 Adherence to safety procedures 2.11 Attitudes: 2.11.1 Patient 2.11.2 Attention to details 2.11.3 Honest	2.1 Understanding of vehicle status 2.2 Installation of protective covers 2.3 Positioning vehicle 2.4 Operating lifter 2.5 Moving vehicle 2.6 Setting-up vehicle for lifting 2.7 Practicing safety

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		2.11.4 Time Conscious	
3. Prepare vehicle for releasing	3.1 Job done is confirmed according to repair order. 3.2 Quality check is done based from repair order. 3.3 Transfer of vehicle to wash bay is coordinated according to SOP. 3.3 Vehicle is endorsed to quality control person following workplace procedure.	3.1 Familiarization of equipment & facilities 3.2 Read & understand repair order 3.3 Confirmation of job done 3.4 Quality standards checking 3.5 Coordination of transferring vehicle 3.6 Endorsement procedures for vehicle 3.7 Attitudes 3.7.1 Patient 3.7.2 Attention to details 3.7.3 Honest 3.7.4 Time Conscious	3.1 Confirming job done 3.2 Performing quality checking 3.3 Coordinating transfer of vehicle to wash bay 3.4 Endorsing and turning-over vehicle

RANGE OF VARIABLES

VARIABLE	RANGE
1. Vehicle checklist	May include: 1.1 External scratches, accessories, items, dents, damages and cracks 1.2 Internal items, scratches, noticeable damages, including spare tire, tools, and loose items 1.3 Standard items that are not present during inspection 1.4 Valuable/personal belongings
2. Work classification	May include: 2.1 Body and Paint repair 2.2 General Job repair 2.3 Periodic maintenance service (PMS)
3. Work bay	May include: 3.1 Service Stall / Working Bay / Workshop areas for servicing/repairing light and/or heavy vehicle and/or plant transmissions and/or outdoor power equipment 3.2 Overhauling Room 3.3 Electrical / Air-con Room 3.4 Inspection Area 3.5 Open workshop/garage and enclosed, ventilated office area
5. Protective covers	May include but not limited to: 5.1 Seat Cover 5.2 Steering Wheel Cover 5.3 Handbrake Cover 5.4 Shift Knob Cover 5.5 Fender Cover 5.6 Paper mat

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Received vehicle 1.2 Prepared vehicle for servicing 1.3 Prepared vehicle for releasing 1.4 Applied safety practices
2. Resource implications	The following resources MUST be provided: 2.1 Workplace: Real or simulated work area 2.2 Appropriate Tools & Equipment 2.3 Materials relevant to the activity 2.4 Manuals and references
3. Method of assessment	Competency may be assessed through: 3.1 Direct observation 3.2 Demonstration with Oral questioning 3.3 Interview 3.4 Written Evaluation 3.5 Third Party Report
4. Context of assessment	4.1 Competency may be assessed individually in the actual workplace or through accredited institution.

CORE COMPETENCIES

UNIT OF COMPETENCY: SERVICE BATTERY ELECTRIC VEHICLE (BEV) ELECTRICAL SYSTEM AND COMPONENTS

UNIT CODE : CS-ALT723301

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in servicing electrical systems and components of battery electric vehicle (BEV). It include competencies in preparing servicing activity, diagnosing and repairing BEV control, onboard charging and air-conditioner systems, performing operational check and performance testing, replacing battery pack, monitoring battery and battery management system (BMS) operating condition and conducting periodic maintenance service (PMS) for BEV related components.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare for servicing activity	1.1. Job request is secured based on workplace procedure 1.2. Servicing information is sourced and interpreted following industry criteria . 1.3. Tools, equipment, and materials are selected and checked for serviceability 1.4. Availability of materials are checked and reported following workplace procedures. 1.5. Safety practices are applied following OSHS and environmental measures	1.1. Details of job request 1.1.1. Vehicle identification 1.1.2. Vehicle mileage 1.1.3. Manufacturing date 1.1.4. Completion time 1.1.5. Scope of job request 1.2. Servicing information 1.2.1. Technical documentation 1.2.2. Types of manuals used in the automotive industry 1.3. List of tools, equipment, and test instruments 1.4. Parts inventory 1.5. OSHS and environmental measures 1.6. High Voltage Electrical Safety 1.7. Usage and functions of SST 1.8. Frequency of tool calibration on EV batteries and chargers	1.1. Understanding of the repair order or job request 1.2. Accessing information and data 1.2.1. Reading and interpreting automotive manuals and specifications 1.3. Properly select and identify appropriate tools applicable for the job. 1.4. Secure availability of parts 1.5. Practicing health, safety, and environmental measures 1.6. Practicing High Voltage Electrical Safety 1.7. Using SST

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Diagnose and repair BEV control system	2.1. Initial inspection in BEV propulsion system components is carried out according to manufacturer standard procedures 2.2. BEV problems are verified according to industry standards 2.3. Tools, equipment, and materials are selected and checked for serviceability 2.4. Electric powertrain system components are diagnosed following manufacturer standard procedures 2.5. Controllers are checked and adjusted based on the manufacturer's standards 2.6. Electric motor and controllers are tested and evaluated based on manufacturer's manual 2.7. Electric motors are removed and replaced according to industry procedure. 2.8. Damaged parts are identified and replaced following industry procedure. 2.9. Safety practices are applied following OSHS and environmental measures	2.1. Inspection procedures 2.2. Types of diagnostic tools manuals and usage for troubleshooting and repair. 2.3. Usage of system scanner 2.4. Component's inspection and testing procedures 2.5. Identification of symbols used in the manuals 2.6. Appropriate tools, equipment, and test instruments 2.7. Component parts of electric motors and its functions 2.8. Parts of motor, motor controllers and its functions 2.9. High Voltage Electrical Safety 2.10. Basic knowledge of on-board chargers	2.1. Performing inspection procedures 2.2. Using diagnostic tools 2.3. Analyzing, reading and interpreting trouble codes 2.4. Applying diagnosis procedures for the detected fault codes 2.5. Accessing pertinent information and data 2.6. Selecting and checking tools, equipment, and materials 2.7. Using tools, equipment, and test instruments correctly 2.8. Identifying work associated hazards 2.9. Reporting defective and damaged tools and equipment 2.10. Checking and Reporting availability of materials 2.11. Using PPEs and applying personal safety procedures 2.12. Applying proper inspection procedures 2.13. Practicing High Voltage Electrical Safety 2.14. Basic diagnosis of on-board chargers
3. Perform operational check and	3.1. Electrical power supply is checked based on motor requirements.	3.1. Types of technical documentation used for electric vehicle	3.1. Reading and interpreting automotive

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
performance testing	<p>3.2. Electric motor performance is checked and recorded following the manufacturer's manual.</p> <p>3.3. Controller units are checked based on the manufacturer's manual standards.</p> <p>3.4. Start-up is performed based on industry procedure.</p> <p>3.5. Road test is performed following industry procedure.</p>	<p>3.1.1. symbols used in the manuals</p> <p>3.2. Appropriate tools, equipment and testing instruments</p> <p>3.3. Electric vehicle parts, components, subsystems and its functions</p> <p>3.3.1. Automotive electrical/ electronic systems</p> <p>3.4. Procedure on testing and evaluation of EV unit</p> <p>3.5. Advance driving principles and techniques</p>	<p>manuals and specifications</p> <p>3.2. Using testing and measuring instruments</p> <p>3.3. Checking electrical systems and other related components</p> <p>3.4. Conducting automotive electrical and electronic servicing</p> <p>3.5. Applying procedures in starting up, testing and commissioning of EV unit</p> <p>3.6. Performing road testing</p>
4. Diagnose and repair onboard charging system	<p>4.1. Diagnostic tests are performed according to manufacturer standards procedures.</p> <p>4.2. Inspection of the on-board charging system is carried out according to manufacturer standards procedures.</p> <p>4.3. Inspection results are compared with manufacturer specifications</p> <p>4.4. Faults are identified from diagnostic test results following manufacturer standards procedures</p> <p>4.5. Causes of faults are determined following manufacturer standards procedures</p> <p>4.6. Findings including recommendations for required repairs or adjustments are reported according to manufacturer standards procedures</p> <p>4.7. Repair information on on-board charging system is</p>	<p>4.1. Fundamentals of Battery and EV charging</p> <p>4.2. Industry criteria on charging system performance</p> <p>4.3. Component faults of charging system</p> <p>4.4. Practicing high voltage electrical safety</p> <p>4.5. Mensuration</p> <p>4.6. Inspection procedure</p> <p>4.7. Arithmetic operation</p> <p>4.8. Battery tester operation</p> <p>4.9. Procedure in accomplishing checklists</p> <p>4.10. OSHS</p> <p>4.11. Wearing of PPEs</p> <p>4.12. Health protocols issued by government on prevention on spread of and protection from infectious disease</p>	<p>4.1. Locating appropriate sources of information</p> <p>4.2. Interpreting text, symbols, and wiring diagrams in diagnostic and repair information</p> <p>4.3. Interpreting numerical information in manufacturer repair manual.</p> <p>4.4. Performing diagnostic tests</p> <p>4.5. Carrying out inspection</p> <p>4.6. Comparing inspection results</p> <p>4.7. Identifying faults and its causes</p> <p>4.8. Reporting findings</p> <p>4.9. Using multi testers.</p> <p>4.10. Analyzing and selecting repair symptoms</p> <p>4.11. Selecting and</p>

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>sourced, analyzed and interpreted following manufacturer standards procedures.</p> <p>4.8. Tools, equipment and materials are selected and checked based on work requirements.</p> <p>4.9. Repairs are carried out according to manufacturer standard procedures.</p> <p>4.10. Post-repair testing is carried out according to workplace procedures.</p> <p>4.11. Safety practices are applied following Occupational Health and Safety (OSH) procedure and environmental measures.</p>	<p>in the workplace</p> <p>4.13. 3Rs principles</p> <p>4.14. 5S of good housekeeping</p> <p>4.15. Post-repair testing</p> <p>4.16. Fundamentals of electricity</p> <p>4.17. Hazards associated with the operations</p> <p>4.18. Risk Management</p> <p>4.19. Mensuration and assessment on power-converter / dc-dc converter performance</p> <p>4.20. Resistance checking</p> <p>4.21. Diodes Test</p> <p>4.22. Procedure in accomplishing checklists</p>	<p>checking repairing tools, equipment, and materials</p> <p>4.12. Carrying out repairs and component replacements and adjustments</p> <p>4.13. Carrying out post-repair testing</p> <p>4.14. Perform safety practices following OSH</p> <p>4.15. Managing risk</p>
5. Replace battery pack	<p>5.1. Wiring diagrams, charts and manuals are interpreted in line with job requirements.</p> <p>5.2. Tools, equipment, and materials are selected and checked for serviceability.</p> <p>5.3. Hazards associated with the work are identified and risks are managed.</p> <p>5.4. PPEs are prepared and used in line with job requirements.</p> <p>5.5. Battery performance and condition are inspected according to the standard requirements.</p> <p>5.6. Battery module is removed and submitted to testing area for checking.</p> <p>5.7. Recommendation is secured from testing area.</p> <p>5.8. Below specification batteries are replaced following industry procedure.</p> <p>5.9. Post-battery replacement procedures are carried</p>	<p>5.1. Types of manuals used in the automotive industry</p> <p>5.2. Identification of symbols used in the manuals</p> <p>5.3. Identification of appropriate tools, equipment and test instrument</p> <p>5.4. Fundamentals of EV battery</p> <p>5.5. Component parts of EV battery pack, its functions and charging element</p> <p>5.6. Automotive electrical/ electronic servicing procedures</p> <p>5.7. Basic electrical units and measurement</p> <p>5.8. Procedure in inspecting EV battery parts and components</p> <p>5.8.1. Procedure in inspecting -</p>	<p>5.1. Reading and interpreting automotive manuals and specifications</p> <p>5.2. Accessing information and data</p> <p>5.3. Using tools, equipment and test instrument</p> <p>5.4. Using PPEs and applying personal safety procedures</p> <p>5.5. Following proper procedures in checking and inspecting EV battery</p> <p>5.6. Following procedures in determining the life cycle of the battery</p> <p>5.7. Disassembling/ assembling battery pack components</p> <p>5.8. Disassembling/ assembling</p>

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>out according to workplace procedures.</p> <p>5.10. Safety practices are applied following OSHS and environmental measures.</p>	<p>final inspection</p> <p>5.9. Procedure in replacing batteries</p> <p>5.10. Procedure in accomplishing incident report</p> <p>5.10.1. Fill-up and complete the checklist and job accomplishment report</p> <p>5.11. Checking and storage of tools and equipment</p> <p>5.12. Principles of 5S good housekeeping</p> <p>5.13. RA 9003 Ecological Solid Waste Management Act</p>	<p>electrical system connections</p> <p>5.9. Performing final inspection</p> <p>5.10. Performing turnover of electric vehicle</p> <p>5.11. Performing record keeping and reporting</p> <p>5.12. Applying proper procedure on waste disposal management</p> <p>5.13. Performing 5S of good housekeeping</p> <p>5.14. Restoring work area</p> <p>5.15. Checking and storing tools and equipment</p> <p>5.16. Performing workplace safety procedures</p>
<p>6. Monitor battery and BMS operating condition</p>	<p>6.1. Electrical systems of battery BMS, and other related components are checked based on the manufacturer's manual.</p> <p>6.2. Electrical readings of batteries reported by the BMS are checked based on the manufacturer's specifications.</p> <p>6.3. Start-up/Ready-ON is performed based on manufacturer's procedure.</p> <p>6.4. Road test is performed following industry procedure while monitoring and checking BMS readings.</p>	<p>6.1. Basic electrical units and measurement</p> <p>6.2. Automotive electrical and electronic operation</p> <p>6.3. Procedure in monitoring battery and BMS components</p> <p>6.4. Visual inspection for battery and BMS</p> <p>6.5. Start-up/Ready-ON operation</p> <p>6.6. Road testing procedures</p> <p>6.7. PPEs</p> <p>6.8. OSHS</p>	<p>6.1. Monitoring skills</p> <p>6.2. Reading and interpreting automotive manuals and specifications</p> <p>6.3. Using testing and measuring instruments</p> <p>6.4. Conducting automotive electrical and electronic servicing</p> <p>6.5. Applying procedures in starting-up, testing operation of EV unit</p> <p>6.6. Applying basic driving skills</p>
<p>7. Diagnose and repair air-conditioner system</p>	<p>7.1. Initial inspection is carried out according to manufacturer standard procedures</p>	<p>7.1. Inspection procedures for air-conditioner system components</p>	<p>7.1. Interpreting information from manufacturer and workshop literature.</p>

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>7.2. Air-conditioner system problems are verified and duplicated according to industry standards</p> <p>7.3. Tools, equipment, and materials are selected and checked for serviceability</p> <p>7.4. Troubleshooting is performed using troubleshooting guide in the repair manual.</p> <p>7.5. Repairs and component replacements and adjustments are carried out according to repair manual.</p> <p>7.6. Refrigerant recovery and charging procedure is performed according to manufacturer standard procedures</p> <p>7.7. System performance tests are carried out according to manufacturer standard procedures</p> <p>7.8. Safety practices are applied following Occupational Health and Safety (OSH) procedure and environmental measures.</p> <p>7.9. Findings are reported according to industry criteria.</p> <p>7.10. Checklist is accomplished following industry criteria.</p>	<p>7.2. Basic operation of refrigeration cycle</p> <p>7.2.1. Theory on Pressure</p> <p>7.2.2. Refrigerants</p> <p>7.2.3. Compressor oils</p> <p>7.3. Mensuration</p> <p>7.4. Functions of the following air conditioning components:</p> <p>7.4.1. Electric Compressor</p> <p>7.4.2. AC Controls</p> <p>7.4.3. Condenser</p> <p>7.4.4. Receiver drier</p> <p>7.4.5. Evaporator</p> <p>7.4.6. Blower fan</p> <p>7.5. Types of Refrigerant</p> <p>7.6. Diagnostic tests</p> <p>7.7. Identifying faults and its causes</p> <p>7.8. Troubleshooting guide</p> <p>7.9. Industry criteria</p> <p>7.10. Troubleshooting procedures of manual air conditioner</p> <p>7.11. Repair information</p> <p>7.12. Recharging system</p> <p>7.13. Recovery and charging procedures</p> <p>7.14. Cooling temperature</p> <p>7.15. Repairs and component replacement and adjustment procedures</p> <p>7.16. Procedure in Accomplishing checklists</p> <p>7.17. OSHS</p> <p>7.18. Wearing of PPEs</p> <p>7.19. Health protocols issued by</p>	<p>7.2. Measuring temperatures and pressures, and using basic mathematical operations, including addition and subtraction, to calculate deviations from manufacturer specifications</p> <p>7.3. Troubleshooting manual air-conditioning system</p> <p>7.4. Conducting diagnostic tests</p> <p>7.5. Sourcing repair information</p> <p>7.6. Carrying out repairs and component replacements and adjustments</p> <p>7.7. Recharging system with refrigerant</p> <p>7.8. Conducting system performance tests</p> <p>7.9. Reporting findings</p> <p>7.10. Accomplishing checklist</p> <p>7.11. Applying safety practices</p>

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		government on prevention on spread and protection from infectious disease in the Workplace	
8. Conduct periodic maintenance service (PMS) for BEV related components	<p>8.1. Checking and inspection of BEV parts, components and accessories are planned and prepared based on industry procedure.</p> <p>8.2. Servicing inspection information is sourced and interpreted following industry criteria.</p> <p>8.3. Wiring diagram, chart and manuals are interpreted in line with the job to be performed.</p> <p>8.4. Tools and equipment are selected and checked for serviceability.</p> <p>8.5. PPEs are prepared and used in line with the job to be performed.</p> <p>8.6. Electric motor is tested following manufacturer's manual.</p> <p>8.7. Electric power train components are checked in accordance with manufacturer's manual.</p> <p>8.8. Traction motor cooling system is checked/inspected and replaced according to manufacturer's manual.</p> <p>8.9. Safety practices are applied following OSHS and environmental measures.</p>	<p>8.1. Types of manuals used in the automotive industry</p> <p>8.2. Identification of symbols used in the manuals</p> <p>8.3. Identification of tools, equipment and test instrument</p> <p>8.4. EV parts, components, subsystems and its functions</p> <p>8.5. Types of electric/traction motors</p> <p>8.6. Traction motor cooling system</p> <p>8.7. Automotive electrical and electronic systems</p> <p>8.8. Procedure and standard of inspection</p> <p>8.9. Principle of operation and maintenance of final drive system and components</p> <p>8.10. PPEs</p> <p>8.11. OSHS</p> <p>8.12. Environmental measures</p>	<p>8.1. Reading and interpreting automotive manuals and specifications</p> <p>8.2. Using tools, equipment and test instrument</p> <p>8.3. Using PPEs and applying personal safety procedures</p> <p>8.4. Applying proper procedures in checking and inspecting EV parts and components</p> <p>8.5. Applying proper procedures in conducting adjustment, repair and replacement, and maintenance of EV parts and components</p> <p>8.6. Performing automotive electrical/electronic system operation and maintenance</p> <p>8.7. Testing and evaluation of parts and components functionalities, and BEV performance in running condition</p>

RANGE OF VARIABLES

VARIABLE	RANGE
1. Job request	May include: <ul style="list-style-type: none"> 1.1. Battery problems <ul style="list-style-type: none"> 1.1.1. BMS 1.1.2. Charging system 1.1.3. Battery type 1.1.4. Battery age (SOH) 1.2. Shorten driving range 1.3. No start 1.4. No lights 1.5. Lighting of warning indicators 1.6. Unusual temperature 1.7. Unusual smell 1.8. Unusual noise 1.9. Not charging 1.10. Overcharging 1.11. Sensor problem
2. Servicing information	May include: <ul style="list-style-type: none"> 2.1. Wiring diagram 2.2. Service manual 2.3. Owner's manual
3. Industry criteria	May include: <ul style="list-style-type: none"> 3.1. Manufacturer specifications 3.2. Service or Repair manual 3.3. Workplace procedures 3.4. Safety and environmental requirements 3.5. Service history 3.6. Product recall
4. Tools, equipment, and materials	May include: <ul style="list-style-type: none"> 4.1. Tools: <ul style="list-style-type: none"> 4.1.1. Basic hand tools 4.1.2. Multi-tester 4.1.3. Straight hexagon wrench 4.1.4. Torque wrench (Required torque 100kg cm) 4.1.5. Feeler gauge 4.1.6. Service type Thermometer 4.1.7. Hygrometer 4.1.8. Special service tools (SST) for holding the magnetic clutch hub 4.1.9. Snap ring expander 4.2. Equipment: <ul style="list-style-type: none"> 4.2.1. Recovery and recycling machine 4.2.2. Refrigerant charging gauge with hose 4.2.3. Refrigerant identifier

VARIABLE	RANGE
	<ul style="list-style-type: none"> 4.2.4. Manifold charging gauge with hose 4.2.5. Halogen leak detector 4.2.6. Hygrometer 4.2.7. Vacuum pump 4.2.8. Recovery machine 4.2.9. Vacuum pump 4.2.10. Weighing scale 4.2.11. Graduated cylinder 4.2.12. Pressure washer 4.2.13. Service trouble lamp 4.2.14. Pressure washer 4.2.15. PPEs <ul style="list-style-type: none"> 4.2.15.1. Face mask 4.2.15.2. Face shield 4.2.15.3. Goggles 4.2.15.4. Gloves 4.2.15.5. Coverall suit 4.2.15.6. Safety shoes 4.3. Materials <ul style="list-style-type: none"> 4.3.1. O-ring 4.3.2. Rags 4.3.3. Refrigerant 4.3.4. Compressor oil 4.3.5. Shaft seal 4.3.6. Nitrogen gas 4.3.7. Desiccant materials 4.3.8. Butyl tape 4.3.9. Insulators 4.3.10. Cleaning agents 4.3.11. Cleaning solution 4.3.12. Water 4.3.13. Brush 4.3.14. Soap suds 4.3.15. Car protective equipment (CPE) 4.3.16. Insulation tape
5. Initial inspection	<p>Includes but is not limited to:</p> <ul style="list-style-type: none"> 5.1. Conduct visual check 5.2. Check for terminal defects 5.3. Check for loose connections 5.4. Check for physical damages 5.5. Check for unusual smell 5.6. Check for unusual noise
6. Electric powertrain system components	<p>May include:</p> <ul style="list-style-type: none"> 6.1. Electric motor/Traction Motor 6.2. Motor controller 6.3. Charge controller

VARIABLE	RANGE
	<ul style="list-style-type: none"> 6.4. Auxiliary power and control system 6.5. Contactors 6.6. Battery 6.7. Inverter 6.8. Wiring harness
7. Post-repair testing	<p>May include:</p> <ul style="list-style-type: none"> 7.1. Check and secure wiring connections 7.2. Check belt and belt tension 7.3. Check fuse and relays 7.4. Check charging system warning indicator
8. Battery performance and condition	<p>May include:</p> <ul style="list-style-type: none"> 8.1. Charging and discharging capacity 8.2. Battery voltage 8.3. Bloated battery
9. Post-battery replacement procedures	<p>Includes:</p> <ul style="list-style-type: none"> 9.1. Incident report is accomplished following industry procedure. 9.2. Final inspection is carried out following manufacturer's specification. 9.3. Electric vehicle is turned over to superior for quality inspection. 9.4. Work area is restored following 5S of good housekeeping. 9.5. Waste is managed following environmental rules and regulations. 9.6. Tools and equipment are checked and stored according to workplace procedures. 9.7. Reports are accomplished and submitted to the immediate superior

EVIDENCE GUIDE

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. Prepared for servicing activity 1.2. Diagnosed and repaired BEV control system 1.3. Performed operational check and performance testing 1.4. Diagnosed and repaired onboard charging system 1.5. Replaced battery pack 1.6. Monitored battery and BMS operating condition 1.7. Diagnosed and repaired air-conditioner system 1.8. Conducted periodic maintenance service (PMS) for BEV related components
<p>2. Resource Implications</p>	<p>The following resources MUST be provided:</p> <ol style="list-style-type: none"> 2.1. Actual workplace or simulated assessment area 2.2. Drawings and specifications relevant to the task 2.3. Appropriate tools and equipment needed to perform required tasks 2.4. Appropriate supplies and materials relevant to the proposed activity 2.5. Manual of operation 2.6. Manufacturer's manual 2.7. Appropriate PPEs
<p>3. Methods of Assessment</p>	<p>Competency must be assessed through:</p> <ol style="list-style-type: none"> 3.1. Direct observation / demonstration with oral questioning 3.2. Written test 3.3. Portfolio
<p>4. Context for Assessment</p>	<p>4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center</p>

**UNIT OF COMPETENCY: SERVICE BATTERY ELECTRIC VEHICLE
MECHANICAL SYSTEM AND COMPONENTS**

UNIT CODE : CS-ALT723302

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to diagnose, service, and repair electric vehicle (BEV) mechanical system and components. It include competencies in preparing servicing activity, servicing EV transmission system, mechanical and/or electrical brake system, mechanical and/or electrical/ electronic steering system, suspension system and tires & EV differential system parts and components, servicing EV body mechanisms and conducting regular EV periodic maintenance service (PMS).

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare for servicing activity	1.1. Job request is secured based on workplace procedure 1.2. Servicing information is sourced and interpreted following industry criteria . 1.3. Tools, equipment, and materials are selected and checked for serviceability 1.4. Availability of materials are checked and reported following workplace procedures. 1.5. Emergency response and technical assistance is provided based on standard procedure 1.6. Orientation to drivers and allied workers is provided on EV operations 1.7. Safety practices and environmental measures are applied following OSHS	1.1. Details of job request 1.1.1. Vehicle identification 1.1.2. Vehicle mileage 1.1.3. Manufacturing date 1.1.4. Completion time 1.1.5. Scope of job request 1.2. Servicing information 1.2.1. Technical documentation 1.2.2. Types of manuals used in the automotive industry 1.2.3. List of tools, equipment, and test instruments 1.2.4. Parts inventory 1.3. OSHS and environmental measures 1.4. High Voltage Electrical Safety 1.5. Inspection Procedure for the electric vehicle	1.1. Understanding of the repair order or job request 1.2. Accessing information and data 1.2.1. Reading and interpreting automotive manuals and specifications 1.3. Properly select and identify appropriate tools applicable for the job. 1.4. Secure availability of parts 1.5. Practicing health, safety and environmental measures 1.6. Practicing high voltage electrical safety
2. Service EV transmission system parts and components	2.1. Routine services are performed based on industry criteria 2.2. Tools, materials and equipment are used based on work requirements.	2.1. Routine services 2.2. Industry criteria 2.3. Types, characteristics and operating principles of transmissions	2.1. Performing routine services 2.2. Interpreting information from manufacturer and workshop literature

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	<p>2.3. Transmission is disassembled and reassembled according to manufacturer standard procedures.</p> <p>2.4. Worn-out components are replaced following manufacturer standard procedures.</p> <p>2.5. Tolerances and clearances are measured and adjusted following manufacturer standard procedures.</p> <p>2.6. Transmission is installed based on service and repair manual .</p> <p>2.7. Post-assembly testing is carried out according to industry criteria.</p> <p>2.8. Safety practices and environmental measures are applied following Occupational Safety and Health Standards .</p>	<p>2.4. Component repair methods</p> <p>2.4.1. Transmission disassembling & reassembling procedures</p> <p>2.4.2. Methods for cleaning and preparing transmissions for overhaul</p> <p>2.4.3. Transmission component inspection, measuring and evaluation procedures</p> <p>2.4.4. Replacement of transmission components</p> <p>2.4.5. Tolerances and clearances of components of transmissions</p> <p>2.5. Post-assembly testing</p> <p>2.6. Mensuration</p> <p>2.7. Arithmetic operation</p> <p>2.8. Special service tools (SST)</p> <p>2.9. Occupational Safety and Health Standards (OSHS)</p> <p>2.10. Wearing of PPEs</p> <p>2.11. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace</p> <p>2.12. 3Rs principles</p> <p>2.13. 5S of good housekeeping</p> <p>2.14. Inspection Procedure for transmission system parts and components</p> <p>2.15. High Voltage Electrical Safety</p>	<p>2.3. Using tools and equipment</p> <p>2.4. Disassembling and reassembling transmission</p> <p>2.5. Cleaning and evaluating transmission components</p> <p>2.6. Replacing worn-out components</p> <p>2.7. Measuring transmission components</p> <p>2.8. Using basic mathematical operations, including addition, subtraction, multiplication and division</p> <p>2.9. Arithmetic skills</p> <p>2.10. Mensuration skills</p> <p>2.11. Installing transmission</p> <p>2.12. Carrying out post-assembly testing</p> <p>2.13. Using special service tools (SST)</p> <p>2.14. Operating equipment</p> <p>2.15. Applying safety practices</p> <p>2.16. Practicing high voltage electrical safety</p>

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3. Service mechanical and/or electrical brake system parts and components	3.1. Repair information on mechanical and/or electrical brake system parts and components is sourced, analyzed and interpreted following industry criteria. 3.2. Tools, equipment and materials are selected and checked based on work requirements. 3.3. Repairs are carried out according to manufacturer standard procedures. 3.4. Post-service testing is carried out according to workplace procedures. 3.5. Safety practices and environmental measures are applied following Occupational Health and Safety (OSH) procedure .	3.1. Identification, function and operation of mechanical and/or electrical brake system 3.2. Service/Repair Manual 3.3. Different repair options 3.4. Types and application of mechanical and/or electrical brake fluids 3.5. Tools, equipment and materials 3.6. Repair and post-repair testing procedures for brake system 3.7. Inspection procedures for mechanical and/or electrical brake system, 3.8. Adjustment procedures 3.9. Procedure in accomplishing checklists 3.10. Mensuration 3.11. Arithmetic operations 3.12. Occupational Safety and Health Standards (OSHS) 3.13. Wearing of PPEs 3.14. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace 3.15. Inspection procedure for brake system parts	3.1. Locating appropriate sources of information. 3.2. Interpreting information from manufacturer and workshop literature. 3.3. Measuring mechanical and/or electrical brake components and using basic mathematical operations, including addition and subtraction 3.4. Interpreting measuring equipment scales. 3.5. Using measuring equipment 3.6. Sourcing of information 3.7. Applying safety practices 3.8. Repairing mechanical and/or electrical brake system 3.9. Performing post-repair testing 3.10. Accomplishing checklist
4. Service mechanical and/or electrical/	4.1. Repair information on mechanical and/or electrical/electronic steering system parts and	4.1. Identification, function and operation of mechanical and/or	4.1. Locating appropriate sources of information.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
electronic steering system parts and components	<p>components is sourced, analyzed and interpreted following industry criteria.</p> <p>4.2. Tools, equipment and materials are selected and checked based on work requirements.</p> <p>4.3. Repairs are carried out according to manufacturer standard procedures.</p> <p>4.4. Post-service testing is carried out according to workplace procedures.</p> <p>4.5. Safety practices and environmental measures are applied following Occupational Health and Safety (OSH) procedure.</p>	<p>electrical/electronic steering system</p> <p>4.2. Service/Repair Manual</p> <p>4.3. Different repair options</p> <p>4.4. Types and application of steering fluids</p> <p>4.5. Tools, equipment and materials</p> <p>4.6. Repair and post-repair testing procedures for mechanical and/or electrical/electronic steering system</p> <p>4.7. Inspection procedures for mechanical and/or electrical/electronic steering system</p> <p>4.8. Adjustment procedures</p> <p>4.9. Procedure in accomplishing checklists</p> <p>4.10. Mensuration</p> <p>4.11. Arithmetic operations</p> <p>4.12. Occupational Safety and Health Standards (OSHS)</p> <p>4.13. Wearing of PPEs</p> <p>4.14. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace</p>	<p>4.2. Interpreting information from manufacturer and workshop literature.</p> <p>4.3. Measuring steering components and using basic mathematical operations, including addition and subtraction</p> <p>4.4. Interpreting scales and using measuring equipment</p> <p>4.5. Sourcing of information</p> <p>4.6. Applying safety practices</p> <p>4.7. Repairing mechanical and/or electrical/electronic steering system</p> <p>4.8. Performing post-repair testing</p> <p>4.9. Accomplishing checklist</p>
5. Service suspension system, tires, parts and components	<p>5.1. Repair information is sourced, analyzed and interpreted following industry criteria.</p> <p>5.2. Tools, equipment and materials are selected and checked based on work requirements.</p>	<p>5.1. Types and function of suspension system</p> <p>5.2. Repair and post-repair testing procedures for suspension system and tires</p> <p>5.3. Tools, equipment and materials</p> <p>5.4. Mensuration</p>	<p>5.1. Interpreting information from manufacturer and workshop literature</p> <p>5.2. Measuring suspension system components and tires</p>

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>5.3. Repairs are carried out according to manufacturer standard procedures.</p> <p>5.4. Post-service testing is carried out according to workplace procedures.</p> <p>5.5. Safety practices and environmental measures are applied following Occupational Health and Safety (OSH) procedure.</p>	<p>5.5. Service/Repair Manual</p> <p>5.6. Different repair options</p> <p>5.7. Parts of suspension system and tires</p> <p>5.8. Wheel alignment procedures</p> <p>5.9. Wheel balancer procedures</p> <p>5.10. Arithmetic operations</p> <p>5.11. Inspection procedures for suspension system and tires</p> <p>5.12. Procedure in accomplishing checklists</p> <p>5.13. Occupational Safety and Health Standards (OSHS)</p> <p>5.14. Wearing of PPEs</p> <p>5.15. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace</p>	<p>5.3. Performing wheel and tire inspection</p> <p>5.4. Performing wheel alignment and balancing</p> <p>5.5. Using basic mathematical operations, including addition and subtraction</p> <p>5.6. Interpreting measuring equipment scales</p> <p>5.7. Using measuring equipment</p> <p>5.8. Sourcing of information</p> <p>5.9. Applying safety practices</p> <p>5.10. Applying arithmetic operations</p> <p>5.11. Repairing suspension system and tires</p> <p>5.12. Performing post-repair testing</p> <p>5.13. Mensuration skills</p> <p>5.14. Communication skills</p> <p>5.15. Interpersonal skills</p>
<p>6. Service EV differential system parts and components</p>	<p>6.1. Routine services are performed based on industry criteria</p> <p>6.2. Differential assembly is disassembled and reassembled in a sequence according to manufacturer standard procedures.</p> <p>6.3. Component repair method is carried out according to manufacturer's specifications.</p> <p>6.4. Worn-out parts are replaced following manufacturer standard procedures.</p>	<p>6.1. Types, characteristics and operating principles of differential assembly</p> <p>6.2. Pull down procedures</p> <p>6.3. Methods for cleaning and preparing differential assemblies for overhaul</p> <p>6.4. Differential dismantling and reassembling procedures</p> <p>6.5. Component repair method</p> <p>6.6. Mensuration</p> <p>6.7. Arithmetic operation</p> <p>6.8. Special service tools (SST)</p>	<p>6.1. Interpreting information from manufacturer and workshop literature</p> <p>6.2. Measuring differential components</p> <p>6.3. Using basic mathematical operations, including addition, subtraction, multiplication and division</p> <p>6.4. Performing differential disassembly and reassembly</p> <p>6.5. Pull down skills</p> <p>6.6. Arithmetic skills</p>

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>6.5. Tools and equipment are used according to work requirements.</p> <p>6.6. Components are replaced following manufacturer standard procedures.</p> <p>6.7. Tolerances and clearances are measured and adjusted following manufacturer standard procedures.</p> <p>6.8. Differential assembly is installed based on manufacturer standard procedures.</p> <p>6.9. Post-assembly testing is carried out according to manufacturer standard procedures.</p> <p>6.10. Safety practices and environmental measures are applied following OSHS.</p>	<p>6.9. Differential parts repair and adjustment procedures</p> <p>6.10. Replacement of differential components</p> <p>6.11. Occupational Safety and Health Standards (OSHS)</p> <p>6.12. Wearing of PPEs</p> <p>6.13. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace</p> <p>6.14. 3Rs principles</p> <p>6.15. 5S of good housekeeping</p> <p>6.16. Types, characteristics and operating principles of differential</p> <p>6.17. Tolerances and clearances of parts of differential</p> <p>6.18. Post-assembly testing</p> <p>6.19. Inspection procedure for EV differential system parts and components</p>	<p>6.7. Mensuration skills</p> <p>6.8. Cleaning and evaluating differential parts</p> <p>6.9. Using special service tools (SST)</p> <p>6.10. Applying safety practices</p> <p>6.11. Carrying out post-assembly testing</p> <p>6.12. Communication skills</p> <p>6.13. Interpersonal skills</p>
7. Service EV body mechanisms	<p>7.1. Door and window mechanisms are repaired according to manufacturer standard procedures</p> <p>7.2. Door and window mechanisms are replaced following manufacturer standard procedures.</p> <p>7.3. Door and window alignment are adjusted according to manufacturer standard procedures</p> <p>7.4. Safety practices and environmental measures are applied following OSHS.</p>	<p>7.1. Identification and function of EV body mechanisms</p> <p>7.2. Repair and post-repair testing procedures for EV body doors and windows</p> <p>7.3. Tools, equipment and materials</p> <p>7.4. Mensuration</p> <p>7.5. Service/Repair Manual</p> <p>7.6. Different repair options</p> <p>7.7. Parts of EV body doors, and windows</p>	<p>7.1. Interpreting information from manufacturer and workshop literature</p> <p>7.2. Measuring body components</p> <p>7.3. Using basic mathematical operations, including addition and subtraction</p> <p>7.4. Interpreting measuring equipment scales</p> <p>7.5. Using measuring equipment</p>

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		7.8. Arithmetic operations 7.9. Inspection procedures for EV body doors and windows 7.10. Occupational Safety and Health Standards (OSHS) 7.11. Wearing of PPEs 7.12. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace	7.6. Sourcing of information 7.7. Applying safety practices 7.8. Mensuration skills 7.9. Applying arithmetic operations 7.10. Repairing of EV body doors and windows 7.11. Performing post-repair testing 7.12. Communication skills 7.13. Interpersonal skills
8. Conduct regular EV periodic maintenance service (PMS)	8.1. Electric vehicle is visually inspected according to work requirements and procedures 8.2. Checklist for inspection is prepared according to company standard procedures 8.3. Mensuration and adjustment of parameters is performed according to company standard procedures 8.4. Maintenance service is performed as defined by the checklist	8.1. PMS periodic EV maintenance procedures 8.2. Tools, equipment and materials 8.3. Mensuration 8.4. Service/Repair Manual 8.5. Vehicle operations 8.6. Inspection procedures for EV 8.7. Procedure in accomplishing checklists 8.8. Occupational Safety and Health Standards (OSHS) 8.9. Wearing of PPEs 8.10. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace 8.11. High Voltage Electrical Safety	8.1. Interpreting information from manufacturer and workshop literature 8.2. Applying basic mathematical operations 8.3. Interpreting scales and using measuring equipment 8.4. Sourcing information 8.5. Applying safety practices 8.6. Mensuration skills 8.7. Accomplishing checklists 8.8. Performing post-repair testing 8.9. Communication skills 8.10. Interpersonal skills 8.11. Practicing high voltage electrical safety

RANGE OF VARIABLES

VARIABLE	RANGE
1. Job request	May include: 1.1 Diagnosis of mechanical component faults 1.2 Replacement of component assembly 1.3 Post repair assessment
2. Servicing information	May include: 2.1 Wiring diagram 2.2 Service manual 2.3 Owner's manual
3. Industry criteria	May include: 3.1 Manufacturer specifications 3.2 Service or Repair manual 3.3 Workplace procedures 3.4 Safety and environmental requirements 3.5 Service history 3.6 Product recall
4. Tools, equipment, and materials	May include: 4.1 Tools 4.1.1 Standard technician hand tools 4.1.2 Torque wrench 4.1.3 Vernier caliper 4.1.4 Micrometer 4.1.5 Dial gauge 4.1.6 Special service tools (SST) 4.1.7 Snap ring expander 4.1.8 Hexagon socket wrench 4.1.9 Pin punch 4.1.10 Plastic hammer 4.1.11 Feeler gauge 4.1.12 V-block 4.1.13 Magnetic stand 4.1.14 Hydraulic pressure gauge 4.1.15 Coil spring compressor 4.1.16 Wheel wedge 4.1.17 Puller 4.1.18 Steel rule 4.1.19 Grease gun 4.1.20 Tire pressure gauge 4.2 Equipment 4.2.1 Lifter 4.2.2 Transmission jack 4.2.3 Hydraulic press 4.2.4 Air reel 4.2.5 Electrical reel 4.2.6 Workshop compressor with air line 4.2.7 Oil bucket 4.2.8 Welding equipment (Metal and Plastic) 4.2.9 Coil spring presser

VARIABLE	RANGE
	<ul style="list-style-type: none"> 4.2.10 Hydraulic press 4.2.11 Wheel aligner 4.2.12 Wheel balancer 4.2.13 Air compressor 4.2.14 Drill 4.2.15 Bench vice 4.2.16 General PPEs (for automotive servicing) 4.2.17 High Voltage PPEs <ul style="list-style-type: none"> - High Voltage Gloves (Class 0 rated to 1000V) 4.2.18 High Voltage Hand Tools (Insulated) 4.2.19 MultiMeter Tester (Category 3, 1000V) 4.2.20 Electrical Rescue Hooks 4.3 Materials <ul style="list-style-type: none"> 4.3.1 Rags 4.3.2 Applicable lubrication 4.3.3 Penetrating oil 4.3.4 Power steering oil fluid 4.3.5 Brake fluid 4.3.6 Brake cleaner 4.3.7 Sealant 4.3.8 Sand paper
5. Routine services	<p>May include:</p> <ul style="list-style-type: none"> 5.1 Transmission <ul style="list-style-type: none"> 5.1.1 Visual inspection of transmission 5.1.2 Checking vibration, noises, cracks, leaks, dents, misalignment 5.1.3 Application of lubrication 5.2 Differential <ul style="list-style-type: none"> 5.2.1 Visual inspection of differential 5.2.2 Lubrication of differential
6. Post -service testing	<p>May include:</p> <ul style="list-style-type: none"> 6.1 Inspection of functionality <ul style="list-style-type: none"> 6.1.1 brakes 6.1.2 steering 6.1.3 suspension, tires and wheels 6.1.4 transmission 6.1.5 differential 6.1.6 body mechanism
7. Components repair method	<p>May include:</p> <ul style="list-style-type: none"> 7.1 Cleaning 7.2 Evaluation by measurement 7.3 Evaluation by comparison 7.4 Evaluation by visual 7.5 Tightening in accordance to torque specifications 7.6 Lubrication 7.7 Overhaul

VARIABLE	RANGE
8. Post-assembly testing	May include: 8.1 Inspection of oil leak 8.2 Inspection of functionality 8.3 Inspection of gear run-out 8.4 Inspection of gear backlash 8.5 Inspection of alignment

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1. Prepared for servicing activity 1.2. Serviced EV transmission system parts and components 1.3. Serviced mechanical and/or electrical brake system parts and components 1.4. Serviced mechanical and/or electrical/electronic steering system parts and components 1.5. Serviced suspension system, tires, parts and components 1.6. Serviced EV differential system parts and components 1.7. Serviced EV body mechanisms 1.8. Conducted regular EV periodic maintenance service
2. Resource implications	The following resources MUST be provided: 2.1. Actual workplace or simulated assessment area 2.2. Drawings and specifications relevant to the task 2.3. Appropriate tools and equipment needed to perform required tasks 2.4. Appropriate supplies and materials relevant to the proposed activity 2.5. Manual of operation 2.6. Manufacturer's manual 2.7. Appropriate PPEs
3. Method of assessment	Competency should be assessed through: 3.1. Demonstration with Oral questioning 3.2. Written exam 3.3. Direct Observation
4. Context for assessment	4.1. Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY: CARRY OUT INSPECTION OF ELECTRIC VEHICLE FOR FLEET OPERATIONS

UNIT CODE : CS-ALT723303

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to carry out inspection of electric vehicle for fleet operations. It include competencies in monitoring EV battery and motor condition, conducting pre-dispatch and arrival inspection of the fleet, ensuring periodic maintenance services (PMS) compliance and completing work processes.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Monitor EV battery and motor condition	1.1. EV Battery condition is checked before dispatch and after arrival of the unit based on manufacturer’s recommendations.* 1.2. Common battery and motor issues are identified and documented according to company policies and procedures.* 1.3. Complete EV battery condition parameters are checked according to manufacturer standard procedures.* 1.4. Recommended procedures are performed after vehicle rest and charging periods based on manufacturer’s recommendations.* 1.5. Basic corrective actions are done as needed. 1.6. Vehicle is endorsed for repair and further servicing as necessary.* 1.7. Safety practices are applied following company OSHS guidelines and environmental measures.*	1.1. Basic knowledge of electric vehicles 1.2. Basic knowledge on EV batteries 1.3. Basic knowledge of electrical systems 1.4. Use of multi-tester 1.5. Use of battery tester 1.6. Product supplier guidelines 1.7. Arithmetic operations 1.8. Reporting procedures 1.9. Occupational Safety and Health Standards (OSHS) 1.9.1. Wearing of PPEs 1.10. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace	1.1. Following basic occupational safety and health standards, specially electrical safety 1.2. Using required measuring tools 1.3. Troubleshooting EV batteries 1.4. Reporting skills 1.5. Monitoring skills 1.6. Communication skills
2. Conduct pre-dispatch and arrival inspection of the fleet	2.1. Basic electrical parts and functions are checked based on standard guidelines.* 2.2. Basic mechanical parts and functions are checked and diagnosed	2.1. Basic knowledge of electric vehicles 2.2. Identification of basic mechanical parts, components and their functions	2.1. Following basic occupational safety and health standards, specially electrical safety

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>based on standard guidelines.*</p> <p>2.3. Basic corrective actions are done as needed.</p> <p>2.4. Vehicle is endorsed for repair and further servicing as necessary.</p> <p>2.5. Road worthy vehicle is endorsed for dispatching*</p> <p>2.6. Safety practices are applied following company OSHS guidelines and environmental measures.*</p>	<p>2.3. Diagnosis of basic mechanical components</p> <p>2.4. Basic repair of mechanical components</p> <p>2.5. Basic knowledge of electrical systems</p> <p>2.6. Identification of basic electrical parts, components and their functions</p> <p>2.7. Diagnosis of basic electrical components</p> <p>2.8. Basic repair of electrical components</p> <p>2.9. Use of multi-tester</p> <p>2.10. Familiarity with EV controller scanner</p> <p>2.11. Product supplier guidelines</p> <p>2.12. Arithmetic operations</p> <p>2.13. Reporting procedures</p> <p>2.14. Occupational Safety and Health Standards (OSHS)</p> <p>2.15. Wearing of PPEs</p> <p>2.16. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace</p> <p>2.17. Basic knowledge of fleet management based on vehicle condition, traffic condition, and driver feedback</p>	<p>2.2. Using required measuring tools</p> <p>2.3. Assessing and troubleshooting mechanical parts and components</p> <p>2.4. Assessing and troubleshooting electrical parts and components</p> <p>2.5. Reporting skills</p>
3. Ensure PMS compliance	3.1. Ensures standard <i>EV periodic maintenance services</i> are performed following both minimum supplier and company guidelines.*	<p>3.1. Basic knowledge of electric vehicles</p> <p>3.2. Identification of basic mechanical parts, components and their functions</p>	3.1. Following basic occupational safety and health standards, specially electrical safety

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>3.2. Vehicle is endorsed for repair and further servicing as necessary.</p> <p>3.3. Safety practices are applied following manufacturer and OSHS guidelines.*</p>	<p>3.3. Preventive maintenance of mechanical components</p> <p>3.4. Basic knowledge of electrical systems</p> <p>3.5. Identification of basic electrical parts, components and their functions</p> <p>3.6. Preventive maintenance of electrical components</p> <p>3.7. Familiarity with EV controller scanner</p> <p>3.8. Product supplier guidelines</p> <p>3.9. Arithmetic operations</p> <p>3.10. Reporting procedures</p> <p>3.11. Occupational Safety and Health Standards (OSHS)</p> <p>3.12. Wearing of PPEs</p> <p>3.13. Health protocols issued by government on prevention of spread of and protection from infectious disease in the workplace</p>	<p>3.2. Using required measuring tools</p> <p>3.3. Assessing and troubleshooting mechanical parts and components</p> <p>3.4. Assessing and troubleshooting electrical parts and components</p> <p>3.5. Reporting skills</p>
<p>4. Complete work processes</p>	<p>4.1. Final inspection is made based on workplace procedure*</p> <p>4.2. Vehicle is turned-over to immediate superior for quality control following workplace procedure*</p> <p>4.3. Work area is restored following 5S of good housekeeping.*</p> <p>4.4. Wastes are managed following environmental rules and regulations.*</p> <p>4.5. Tools are checked and stored according to workplace procedures*</p>	<p>4.1. Final inspection procedure</p> <p>4.2. Turn-over of vehicle</p> <p>4.3. Accomplishment of repair order and other forms – Job done</p> <p>4.4. OSHS</p> <p>4.5. Wearing of PPEs</p> <p>4.6. 5S</p> <p>4.7. Waste management</p> <p>4.8. Checking and storage of tools</p> <p>4.9. Workplace documents</p>	<p>4.1. Filling-out workplace documentation.</p> <p>4.2. Reporting diagnostic findings and make repair recommendations</p> <p>4.3. Conducting final inspection</p> <p>4.4. Performing vehicle turn-over</p> <p>4.5. Restoring work area</p> <p>4.6. Managing wastes</p> <p>4.7. Checking and storing tools and equipment</p>

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> fonts are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	4.6. <i>Workplace documents</i> are accomplished according to workplace procedures*		4.8. Wearing of PPEs 4.9. Applying safety practices 4.10. Accomplishing workplace documents

* *Critical Aspects of Competency*

RANGE OF VARIABLES

VARIABLE	RANGE
1. EV Battery	May include: 1.1. Lithium ion 1.2. Lead Acid
2. Common battery and motor issues	Includes but is not limited to: 2.1. Battery 2.1.1. Overvoltage 2.1.2. Loose connection between the battery and the vehicle 2.1.3. Loose connection between battery packs 2.1.4. Bloated battery pack 2.1.5. Under-voltage 2.1.6. Charging problem 2.1.7. Battery degradation 2.2. Motor 2.2.1. Burnt electric motor 2.2.2. Abnormal operation 2.2.3. Unusual noise and vibration
3. Safety Practices	May include: 3.1. Ensuring that the ignition is off. 3.2. Wearing proper PPE (e.g. safety gloves) 3.3. Standard OSH guidelines
4. EV battery condition parameters	May include: 4.1. Battery pack voltage 4.2. Battery state of charge 4.3. Battery wiring connection integrity 4.4. Battery appearance (e.g. bloated)] 4.5. EV Battery Controller condition/response 4.6. EV Charging Station condition and appearance
5. Recommended procedures	May include: 5.1. Resetting of BMS after prolonged idle time 5.2. Reading and interpreting alarm lights/indicators at the battery pack based on the manual 5.3. Checking of fault messages in supplier provided applications/devices 5.4. Following the required rest period for the battery before and after charging
6. Corrective actions	May include: 6.1. Manual balancing of battery pack voltages (for under and overcharged batteries) 6.2. Tightening of loose connections on terminals 6.3. Replacement of bloated battery pack 6.4. Disconnecting the battery (hard reset) 6.5. Diagnose braking system 6.5.1. Vacuum pump 6.5.2. Other mechanical components 6.6. Change/inflate tires

VARIABLE	RANGE
	6.7. Diagnose differential 6.8. Diagnose and replace bearings 6.9. Diagnose, replace or repair electrical components
7. Basic mechanical parts	May include: 7.1. Brakes 7.2. Tires 7.3. Differential 7.4. Bearings 7.5. Auxiliaries
8. Basic electrical parts and functions	May include: 8.1. Wiper motor 8.2. Lights 8.3. Fuse 8.4. Brake vacuum pump 8.5. Contactor 8.6. Accelerator pedal 8.7. Switches 8.8. Controller cooling fan 8.9. Vehicle accessories 8.10. Power steering motor sensor 8.11. AFCS 8.12. GPS 8.13. CCTV
9. EV periodic maintenance services	May include: 9.1. Scanning of controller 9.2. Checking of battery voltage balance 9.3. Checking of motor sensor fit and function 9.4. Testing of brake pressure switch sensor 9.5. Inspection of wiring harness including fuses 9.6. Visual inspection of vehicle condition
10. Workplace documents	May include: 10.1. Job order 10.2. Inspection form 10.3. Diagnostic sheet 10.4. Service history 10.5. Incident report

EVIDENCE GUIDE

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1. Monitored EV Battery Condition 1.2. Conducted pre-dispatch and arrival inspection of the fleet 1.3. Ensured PMS compliance 1.4. Completed work processes
<p>2. Resource Implications</p>	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 2.1. Drawings and specifications relevant to the task 2.2. Appropriate tools and equipment needed to perform required tasks 2.3. Appropriate supplies and materials relevant to the proposed activity 2.4. Actual workplace or simulated assessment area 2.5. Manual of operation 2.6. Manufacturer's manual 2.7. Appropriate PPEs
<p>3. Methods of Assessment</p>	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> 3.1. Direct observation / demonstration with oral questioning 3.2. Written test 3.3. Portfolio
<p>4. Context for Assessment</p>	<ul style="list-style-type: none"> 4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center

SECTION 3. TRAINING ARRANGEMENTS

These standards are set to provide technical and vocational education and training (TVET) providers with information and other important requirements to consider when designing training programs for **BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL II**.

3.1 NOMINAL TRAINING DURATION

Course Title: BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL II

Nominal Training Duration:

37 Hours	(Basic Competencies)
162 Hours	(Common Competencies)
344 Hours	(Core Competencies)
<hr/>	
543 Hours	Total
272 Hours	(Supervised Industry Learning)

Course Description:

This course is designed to enhance the knowledge, skills and attitudes of an individual in the field of battery electric vehicle servicing (BEV) for public utility vehicle (PUV) in accordance with industry standards. It covers specialized competencies such as: servicing BEV electrical system and components, servicing BEV mechanical system and components, and carrying out inspection for BEV fleet operation.

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

BASIC COMPETENCIES
(37 hours)

Units of Competency	Learning Outcomes	Methodology	Assessment Approach	Nominal Duration
1. Participate in workplace communication	1.1 Obtain and convey workplace information 1.2 Perform duties following workplace instructions 1.3 Complete relevant work-related documents	<ul style="list-style-type: none"> ● Group discussion ● Lecture ● Demonstration 	<ul style="list-style-type: none"> ● Oral evaluation ● Written examination ● Observation 	6 hours
2. Work in a team environment	2.1 Describe team role and scope 2.2 Identify one's role and responsibility within team 2.3 Work as a team member	<ul style="list-style-type: none"> ● Group discussion ● Lecture ● Demonstration 	<ul style="list-style-type: none"> ● Oral evaluation ● Written examination ● Observation 	3 hours
3. Solve/address general workplace problems	3.1 Identify routine problems 3.2 Look for solutions to routine problems 3.3 Recommend solutions to problems	<ul style="list-style-type: none"> ● Group discussion ● Lecture ● Demonstration 	<ul style="list-style-type: none"> ● Oral evaluation ● Written examination ● Observation 	3 hours
4. Develop career and life decisions	4.1 Manage one's emotion 4.2 Develop reflective practice 4.3 Boost self-confidence and develop self-regulation	<ul style="list-style-type: none"> ● Discussion ● Interactive Lecture ● Brainstorming ● Demonstration ● Role-playing 	<ul style="list-style-type: none"> ● Demonstration or simulation with oral questioning ● Case problems involving workplace diversity issues 	3 hours
5. Contribute to workplace innovation	5.1 Identify opportunities to do things better 5.2 Discuss and develop ideas with others 5.3 Integrate ideas for change in the workplace	<ul style="list-style-type: none"> ● Interactive Lecture ● Appreciative Inquiry ● Demonstration ● Group work 	<ul style="list-style-type: none"> ● Psychological and behavioral Interviews ● Performance Evaluation ● Life Narrative Inquiry ● Review of portfolios of evidence and third-party workplace reports of on-the-job performance. ● Standardized assessment of character strengths and virtues applied 	3 hours
6. Present relevant information	6.1 Gather data/ information 6.2 Assess gathered data/information	<ul style="list-style-type: none"> ● Group discussion ● Lecture ● Demonstration 	<ul style="list-style-type: none"> ● Oral evaluation ● Written Test ● Observation ● Presentation 	8 hours

Units of Competency	Learning Outcomes	Methodology	Assessment Approach	Nominal Duration
	6.3 Record and present information	<ul style="list-style-type: none"> ● Role Play ● Practical exercises 		
7. Practice occupational safety and health policies and procedures	7.1 Identify OSH compliance requirements 7.2 Prepare OSH requirements for compliance 7.3 Perform tasks in accordance with relevant OSH policies and procedures	<ul style="list-style-type: none"> ● Lecture ● Group Discussion 	<ul style="list-style-type: none"> ● Written Exam ● Demonstration ● Observation ● Interviews / ● Questioning 	4 hours
8. Exercise efficient and effective sustainable practices in the workplace	8.1 Identify the efficiency and effectiveness of resource utilization 8.2 Determine causes of inefficiency and/or ineffectiveness of resource utilization 8.3 Convey inefficient and ineffective environmental practices	<ul style="list-style-type: none"> ● Lecture ● Group Discussion ● Simulation ● Demonstration 	<ul style="list-style-type: none"> ● Written Exam ● Demonstration ● Observation ● Interviews / ● Questioning 	3 hours
9. Practice entrepreneurial skills in the workplace	9.1 Apply entrepreneurial workplace best practices 9.2 Communicate entrepreneurial workplace best practices 9.3 Implement cost-effective operations	<ul style="list-style-type: none"> ● Case Study ● Lecture/ Discussion 	<ul style="list-style-type: none"> ● Case Study ● Written Test ● Interview 	4 hours

**COMMON COMPETENCIES
(162 hours)**

Units of Competency	Learning Outcomes	Methodology	Assessment Approach	Nominal Duration
1. Validate vehicle specifications	1.1 Check body type of the vehicle 1.2 Check vehicle engine type 1.3 Check vehicle specifications 1.4 Complete validation of vehicle specifications	<ul style="list-style-type: none"> ● Lecture ● Demonstration ● Video presentation 	<ul style="list-style-type: none"> ● Written exam ● Demonstrate 	17 hours
2. Move and position vehicle	2.1 Prepare vehicle for operation 2.2 Position vehicle 2.3 Park and stop the vehicle	<ul style="list-style-type: none"> ● Lecture discussion ● Demonstration ● Video presentation ● Workshop visit 	<ul style="list-style-type: none"> ● Demonstration ● Written exam ● Interview 	40 hours
3. Utilize automotive tools	3.1 Prepare automotive tools 3.2 Use automotive tools 3.3 Maintain automotive tools	<ul style="list-style-type: none"> ● Lecture ● Demonstration ● Visual aids ● Videos 	<ul style="list-style-type: none"> ● Written examination ● Interview ● Demonstration ● Practical examination 	16 hours
4. Perform mensuration and calculation	4.1 Select measuring instruments 4.2 Carry out measurements and calculation 4.3 Maintain measuring instruments	<ul style="list-style-type: none"> ● Demonstration ● Video presentation ● Lecture Discussion ● Workshop 	<ul style="list-style-type: none"> ● Demonstration ● Written exam ● Oral questioning 	43 hours
5. Utilize workshop facilities and equipment	5.1 Perform pre-operation activities 5.2 Use facilities and equipment 5.3 Conduct post-operation activities	<ul style="list-style-type: none"> ● Lecture ● Demonstration ● Video presentation ● Workshop visit 	<ul style="list-style-type: none"> ● Demonstration ● Written exam ● Interview 	19 hours
6. Prepare servicing parts and consumables	6.1 Identify parts and consumables 6.2 Retrieve and withdraw parts and consumables 6.3 Complete work process	<ul style="list-style-type: none"> ● Lecture ● Video presentation ● Actual training 	<ul style="list-style-type: none"> ● Demonstration ● Written exam ● Interview 	13 hours
7. Prepare vehicle for servicing and releasing	7.1 Receive vehicle 7.2 Prepare vehicle for servicing 7.3 Prepare vehicle for releasing	<ul style="list-style-type: none"> ● Lecture ● Demonstration ● Video presentation ● Workshop visit 	<ul style="list-style-type: none"> ● Role-playing ● Written exam ● Interview 	14 hours

CORE COMPETENCIES
(344 hours)

Units of Competency	Learning Outcomes	Methodology	Assessment Approach	Nominal Duration
1. Service BEV electrical system and components	1.1. Prepare for servicing activity 1.2. Diagnose and repair BEV control systems 1.3. Perform operational check and performance testing 1.4. Diagnose and repair on-board charging system 1.5. Replace battery pack 1.6. Monitor battery and BMS operating condition 1.7. Diagnose and repair air-conditioner system 1.8. Conduct periodic maintenance service (PMS) for EV-related components	<ul style="list-style-type: none"> ● Lecture ● Demonstration ● Visual aids ● Videos ● PowerPoint Presentation 	<ul style="list-style-type: none"> ● Written examination ● Interview ● Demonstration ● Practical examination 	156 hours
2. Service BEV mechanical system and components	2.1. Prepare for servicing activity 2.2. Service EV transmission system parts and components 2.3. Service brake system parts and components 2.4. Service steering system parts and components 2.5. Service suspension system parts and components 2.6. Service EV differential system component 2.7. Service EV body mechanisms 2.8. Conduct regular periodic maintenance service	<ul style="list-style-type: none"> ● Lecture ● Demonstration ● Visual aids ● Videos ● PowerPoint presentation 	<ul style="list-style-type: none"> ● Written examination ● Interview ● Demonstration ● Practical examination 	148 hours
3. Carry out inspection of BEV for fleet operations	3.1. Monitor EV battery and motor condition 3.2. Conduct pre-dispatch and arrival inspection of the fleet 3.3. Ensure PMS compliance 3.4. Complete work processes	<ul style="list-style-type: none"> ● Lecture ● Demonstration ● Visual aids ● Videos ● PowerPoint presentation 	<ul style="list-style-type: none"> ● Written examination ● Interview ● Demonstration ● Practical examination 	40 hours

3.2 TRAINEE ENTRY REQUIREMENTS

Trainees or students wishing to enroll in this course should possess the following requirements:

- Must have any of the following:
 - Holder of Automotive Servicing NC I certificate
 - With at least 1 year work experience in automotive, electrical or electronics servicing and must undergo the screening process provided by the training institution offering the program.
- Must have basic communication skills
- Must have basic arithmetic skills

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

3.3 TRAINER'S QUALIFICATIONS FOR AUTOMOTIVE AND LAND TRANSPORTATION SECTOR

Trainers who will deliver the training on **BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL II** should have the following:

- Must be a holder of any Training of Trainers Certificate (e.g., Trainer's Methodology Certificate (TMC) OR must be a practicing trainer for two (2) years within the last five (5) years;
- Must have any of the following:
 - training certificates relevant to EV* and with 2 years work experience in automotive servicing;
 - training certificate in Battery Electric Vehicle Servicing (PUV) Level II;
 - at least two (2) years industry experience within the last five (5) years relevant to battery electric vehicle;
 - holder of EIM NCII and ATS electrical repair NCII with training certificate relevant to EV**.

NOTE:

* (At least 40 hours which includes structured training program inclusive of hands-on activities, observation in a workshop, and training certificates with number of hours)

** (Must have industry immersion of 40 hours industry training which includes structured training program inclusive of hands-on activities, observation in a workshop, and training certificates with number of hours)

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS

Recommended list of tools, equipment, and materials for the training of 25 trainees for **BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL II**.

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

BEV - ELECTRICAL

TOOLS	
QTY	DESCRIPTION
5 sets	Basic hand tools (Mechanical pliers, Screwdriver, socket wrench, Allen wrench/keys, spanner, hammer)
5 pc	Snap ring pliers
5 pc	Straight hexagon wrench
2 pcs	Service type Thermometer (10 to 100 degrees C)
1 pc	Hygrometer
1 pc	Bench vice
2 pcs	Wire splicer
5 sets	Feeler gauge
2 pcs	Vernier Caliper
1 pc	Bench vice (6")
1 set	Jumper cable (400amph)
2 pcs	Trouble light LED (15w)
1 unit	Battery/Load tester
5 pcs	Soldering iron (60-100w)
4 pc	Extension/power cable (10m)
1 pc	Impact wrench
1 set	Automotive electrical wire gauge tool (#10,12,14,16)
1 pc	Clamp Type Ammeter
5 pcs.	Digital multi-tester
1 pc	Digital Insulation Tester (up to 1000 volts)

EQUIPMENT	
QTY	DESCRIPTION
1 unit	Training EV vehicle with air-conditioning system
5 units	Electric AC compressor assembly
1 set	AC Refrigerant recovery, recharging and recycling machine
2 pcs.	Crocodile jack (or equivalent)
5 pcs.	Trouble light (or equivalent)
2 pcs.	Dial gauge w/ magnetic stand
2 pcs.	Spring scale
5 sets	Manifold gauge
2 sets	Halogen leak detector
1 unit	Vacuum pump

EQUIPMENT	
QTY	DESCRIPTION
8 units	Jack stand
2 pcs	Creeper
2 units	Working table (4ft x 2ft- wood)
2 units	Wheel wedge
1 unit	Graduated cylinder
5 pcs	Soldering stand
1 unit	Vehicle lifter
1 unit	Battery charger
1 unit	Diagnostic tool/Scanner
1 pc	Heat gun
1 lot	Crimper

MATERIALS	
QTY	DESCRIPTION
25 pairs	Cotton gloves
50 pc	Cotton rags
1 roll	Soldering lead
5 cans	Non-conductive electrical connector spray cleaner
50 pc	Eye terminal
50 pc	Male terminal
50 pc	Female terminal
5 rolls	Electrical tape
10m/type	Automotive wire <input type="checkbox"/> #10 awg <input type="checkbox"/> #12 awg <input type="checkbox"/> #14 awg <input type="checkbox"/> #16awg
20 pc	Alligator clip - Medium
20 pc	O-ring (assorted sizes and thickness)
40 kg	Refrigerant, 134A
1 L	Compressor oil
5 pc	Shaft seal (assorted)
1 can	Nitrogen gas
1 pc	Desiccant materials
2 rolls	Butyl tape
25 pc each item	PPEs - Face mask (optional, as per DOH guidelines*) - Face shield (optional, as per DOH guidelines) - Hard hat - Goggles - Rubber Insulated Gloves - Coverall suit / Training uniform - Insulated Safety shoes
1 gallon	70% Alcohol*
250 ml	Contact cleaner
1 m	Shrinkable tube (5 mm)
1 can	Soldering paste

MATERIALS	
QTY	DESCRIPTION
1 L	Cleaning agent
1 L	Distilled water
1 pack	Cable tie (8")
1 box	Carbon brush
5 rolls	Electrical tape
5 pc/type	Switches <ul style="list-style-type: none"> ● Toggle switch (6 terminal) ● Push pull switch ● Push button switch
2 pc	Relays (30-60 Amp)12 volts
2 pc	Fusible link for battery
5pcs/amp	Fuses <ul style="list-style-type: none"> ● 7.5 Amp ● 10 Amp ● 15 Amp ● 20 Amp ● 30 Amp

NOTE:

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

BEV - MECHANICAL

TOOLS	
QTY	DESCRIPTION
3 pcs	Torque wrench ([5 to] 2800 kgf- cm) (5 to 500Nm), *click type*
2 pcs	Puller (to remove flange coupling lock nut)
1 pc	Puller (for removing the axle shaft)
2 pcs	Drive shaft nut chisel (for un staking the front axle shaft nut)
4 pcs	V block
4 pcs	Union nut wrench (10 mm)*
4 pcs	Snap ring expander
4 pcs	Hexagon socket wrench (6 mm)*
4 pcs	Hexagon socket wrench (8 mm)*
4 pcs	Pin punch (5mm)*
4 pcs	Plastic hammer
5 pcs	Ball peen hammer, 1lb
4 pcs	Micrometer (0 – 25mm)
1 set	Drill bit set
1 set	Screw extractor set
2 pcs	Steering wheel puller
2 pcs	Torx driver (6mm)
2 pcs	Torx driver (8mm)
4 pcs	Adjustable wrench
4 pcs	Box wrench (24mm)

TOOLS	
QTY	DESCRIPTION
4 pcs	Pinion shaft wrench
4 pcs	Stainless Steel Ruler, 12"
4 pcs	Union nut wrench (10mm)
4 pcs	Coil spring compressor
4 pcs	Ball joint puller
1 pc	Grease gun
1 pc	Tire gauge
5 pcs	Feeler gauge
2 pcs	C-clamp
2 pcs	Wheel wedge / stopper
4 pcs	Brake bleeder
1 pc	Tire pressure gauge, ball pen type
1 pc	Multimeter Tester (Category 3, 1000 W)
1 set	High Voltage Hand Tools (Insulated)

EQUIPMENT	
QTY	DESCRIPTION
8 units	Safety stand (for crocodile jack use only)
1 unit	Lifter, 3 tons
1 unit	Battery Lifter ¹
1 unit	Air reel
1 unit	Electrical reel
1 unit	Workshop air compressor with airline, 2hp
5 units	Air dust gun
4 units	Work bench with vise
1 unit	Hydraulic press, 1 ton
1 unit	Bench Grinder, 1hp
1 unit	Tracking gauge for measuring toe angle
2 units	Turning radius gauge
1 pc	Oil bucket, 20L cap.
1 pc	Drain pan, 20L cap.
1 pc	Differential stand
1 set	Electrical Rescue Hooks
1 set	Impact Wrench
1 unit	Television, Smart TV

MATERIALS	
QTY	DESCRIPTION
5 cans	Grease (500mg/can)
2 cans	Penetrating oil (500ml/cans)
8 L	Gear oil
2 L	Brake fluid
5 sets	Mop
5 units	Trash bins, 10 L
100 grams	lithium soap base glycol grease
4 sets	Caliper brake overhauling (O/H) kit

MATERIALS	
QTY	DESCRIPTION
4 sets	Drum brake overhauling (O/H) kit
2 sets	Brake wheel cylinder repair kit
12 pcs	Sandpaper, assorted
4 pcs	Container (for bleeding fluid)
4 pcs	Tray, aluminum, 20cmx20cm
4 pcs.	Vinyl hose (2 m)
1 tube	Mechanic blue, 200ml
1 box	Brake cleaner
1 can	Degreaser, 450ml
2 tubes	Sealant
5 sachets	Soap detergent
1 set	First aid kit
1 unit	Fire extinguisher, 5 lbs., ABC
3 sets	High Voltage Gloves (Class 0 rated to 1000V)
4 pcs	Manual References: -Repair manuals -Workshop manual

NOTE:

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

3.5 TRAINING FACILITIES: BATTERY ELECTRIC VEHICLE SERVICING (PUV) LEVEL III

The automotive workshop must be made of reinforced concrete or steel structure. The size must be suited on the requirements of the competencies. The class size of 25 students/trainees is reserved for the lecture room and the practical demonstration area for carrying out servicing of minor automotive parts. Most of the learning activities such as on-vehicle servicing is performed in the workshop.

SPACE REQUIREMENT	SIZE IN METERS	AREA IN SQ. METERS	GRAND TOTAL AREA IN SQ. METERS
A. Building (permanent)			180.00
• Lecture Room	5 x 6	30	30
• Laboratory/Workshop Area with safety barricade (caution tape)			100
• Tool room & S/M storage area,		20	20
• EV battery storage ²			
• Learning resource area	5 x 4	20	20
• Wash area/comfort room (male & female, PWD, GAD)		10	10
TOTAL			180.00

NOTE:

1. Access to and use of equipment /facilities can be provided through cooperative arrangements or MOA with other partner-companies/institutions.
2. Existing workplace (Under the MOA, the dealer is part of the auditing team. In context, to make the training place is at par with safety compliance.)

GLOSSARY OF TERMS

- 1) **4x2** or 2WD is a vehicle that has a two-wheel drive (2WD) with four wheels.
- 2) **4x4** also called 4WD, means a system in which a car's engine powers all 4 wheels evenly.
- 3) **5S principles** is a system for organizing spaces so work can be performed efficiently, effectively, and safely.
- 4) **Adjustment** a small alteration or movement made to achieve a desired fit, appearance, or result.
- 5) **Aerodynamics** is the way air moves around things.
- 6) **Arithmetic** Is the branch of mathematics that deals with the study of numbers using various operations on them
- 7) **AFCS** refers to 'Automated Fare Collection System' - is a technology that has revolutionized the way people pay for transportation. AFCS eliminates the need for manual ticketing and payment systems, making transportation transactions faster, more efficient, and more convenient for both passengers and transit operators.
- 8) **Asian Utility Vehicle** a.k.a. AUV were designed to be sold in developing countries – primarily in East Asia.
- 9) **Aspect** a particular part or feature of something.
- 10) **Assessment** a systematic process of documenting and using empirical data on the knowledge, skill, attitudes, and beliefs to refine programs and improve student learning.
- 11) **Basic hand tools** are tools that is powered by hand (manual labour) rather than by any other force (ex. Electric, Air, Hydraulics, etc.). Hand tools are generally less dangerous than power tools.
- 12) **Battery** is a device consisting of one or more electrochemical cells with external connections for powering electrical devices.
- 13) **Battery Management System (BMS)** is any electronic system that manages a rechargeable battery), monitoring its state, calculating secondary data, reporting that data and controlling its environment.

- 14) Battery modules** consists of individual battery cells and modules organized in series and parallel.
- 15) BEV** refers to 'Battery Electric Vehicle'
- 16) Checklist** a basic example is the "to do list". A more advanced checklist would be a schedule, which lays out tasks to be done according to time of day or other factors.
- 17) CCTV** refers to 'Closed Circuit Television' - is a TV system in which signals are not publicly distributed but are monitored, primarily for surveillance and security purposes.
- 18) Cockpit** the cockpit is the section where the operator manage the vehicle.
- 19) Commissioned** also known as releasing of vehicle.
- 20) Competency** a set of demonstrable characteristics and skills that enable, and improve the efficiency or performance of a job
- 21) Component** part or element of a larger whole, especially a part of a machine or vehicle.
- 22) Diagnose** identify the nature of problem by inspection of the symptoms.
- 23) Diagnostic symptoms** a physical manifestation that is regarded as indicating a condition of malfunction.
- 24) Diagram** is a symbolic representation of information using visualization techniques.
- 25) Dynamics** the branch of mechanics concerned with the motion of bodies under the action of forces.
- 26) Element** a part or aspect of something abstract, especially one that is essential or characteristic.
- 27) Environment** a surroundings or conditions in which a person, works or operates.
- 28) Etiquette** the conduct or procedure required by good breeding or prescribed by authority to be observed in social or official life.

- 29) Evaluation of components** the making of a judgment about the condition of a part/component.
- 30) Evidence guide** the evidence guide provides advice to inform and support appropriate assessment of this unit. It contains an overview of the assessment requirements followed by identification of specific aspects of evidence of competency.
- 31) Final inspection** includes road testing, oil leakage, functionality, etc.
- 32) Fuel Cell** work like batteries, but they do not run down or need recharging. They produce electricity and heat as long as fuel is supplied.
- 33) GPS** refers to 'Global Positioning System' - is a network of satellites and receiving devices used to determine the location of something on Earth.
- 34) Inspection** examination or formal evaluation exercise of vehicle part, it involves the measurements, tests, and gauges applied to certain characteristics.
- 35) Internal Combustion Engine (ICE)** is a heat engine in which the combustion of a fuel occurs with an oxidizer (usually air) in a combustion chamber that is an integral part of the working fluid flow circuit.
- 36) Leverage** to use something that you already have in order to achieve something new or better.
- 37) Liaison** is a person who acts to arrange and assist interaction between parties.
- 38) Literacy** ability to read and write in at least one method of writing, an understanding reflected by mainstream dictionaries.
- 39) Maintenance** the regular or periodic maintenance servicing of vehicles to keep it in top condition.
- 40) Manuals** an instructional book or booklet that is supplied with almost all technologically advanced consumer products such as vehicles.
- 41) Mensuration** measuring of geometric magnitudes, lengths, areas, and volumes.

- 42) Multi-Purpose Vehicle (MPV)** the term MPV stands for Multi-Purpose Vehicle (MPV). This vehicle type is primarily designed to carry a number of passengers.
- 43) Occupational Safety and Health** also commonly referred to as OHS is a multidisciplinary field concerned with the safety, health, and welfare of people at occupation.
- 44) Out of standard** worn-out, unserviceable components, not conforming to manufacturer's standard.
- 45) Overhaul** take apart a major automobile component in order to examine it and repair/replace a part if necessary to bring back the major component to working condition.
- 46) Performance** it is also defined as the action or process of carrying out or accomplishing an action, task, or function.
- 47) Periodic Maintenance Service (PMS)** periodic maintenance is a strategy that requires maintenance tasks to be performed at set time intervals while the vehicle is operational.
- 48) Personal Protective Equipment** commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses.
- 49) Policy** refers to a deliberate system of principles to guide decisions and achieve rational outcomes.
- 50) Power tools** is a tool that is actuated by an additional power source and mechanism other than the solely manual labor used with hand tools.
- 51) Power train** encompasses every component that converts the engine's power into movement. This includes the engine, transmission, the driveshaft, differentials, axles; basically anything from the engine through to the rotating wheels.
- 52) Procedure** a series of actions conducted in a certain order or manner.
- 53) Propelled** to drive forward or onward by or as if by means of a force that imparts motion.
- 54) PUV** Refers to Public Utility Vehicle
- 55) Regulation** management of complex systems according to a set of rules and trends.

- 56) Repair** fix or return to working condition a part/component. It refers to cleaning, adjustment, and replacement.
- 57) Requirement** a necessary condition or a functional need that a particular design, parts or process aims to satisfy.
- 58) Sensors** are sophisticated devices that are frequently used to detect and respond to electrical or optical signals.
- 59) Service** perform routine maintenance or repair work on a vehicle or machine.
- 60) Solar Cell** is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon.
- 61) Specifications** often refers to a set of documented requirements to be satisfied by a material, design, product, or service of certain industry.
- 62) Special tools** are tools used to enable the safe, accurate, and efficient performance of service operations that are difficult or impossible to perform using basic hand tools alone
- 63) Sports utility vehicle (SUV)** is a car classification that combines elements of road-going passenger cars with features from off-road vehicles, such as raised ground clearance and four-wheel drive.
- 64) Standards** something established by authority, custom, or general consent as a model, it contain technical specifications or other precise criteria designed to be used consistently as a rule, guideline, or definition.
- 65) Subsystems** a set of elements, which is a system itself, and a component of a larger system of vehicle
- 66) SWOT** stands for Strengths, Weaknesses, Opportunities, and Threats, and so a SWOT Analysis is a technique for assessing these four aspects of your business.
- 67) Torque** is a measure of the force that can cause an object to rotate about an axis.
- 68) Troubleshooting** trace and correct faults
- 69) Warranty** is a type of guarantee that a manufacturer or similar party makes regarding the condition of its product.

70) Wheel alignment

part of standard automobile maintenance that consists of adjusting the angles of wheels so that they conform to manufacturer's standard.

71) Wheel balance

describes the distribution of mass within an automobile tire or the entire wheel (including the rim) to which it is attached.

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