



RQF LEVEL 5



RENVC501

RENEWABLE ENERGY

Electrical Vehicle (EV) Charging Station Installation



October, 2024



ELECTRICAL VEHICLE (EV) CHARGING STATION INSTALLATION

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Original published version: October 2024

ACKNOWLEDGEMENTS

The publisher would like to thank the following for their assistance in the elaboration of this training manual:

Rwanda TVET Board (RTB) extends its appreciation to all parties who contributed to the development of the trainer's and trainee's manuals for the TVET Certificate V in Renewable Energy, specifically for the module " **RENVC501-Electrical Vehicles (EV) Charging Station Installation.**"

We extend our gratitude to KOICA Rwanda for its contribution to the development of these training manuals and for its ongoing support of the TVET system in Rwanda

We extend our gratitude to the TQUM Project for its financial and technical support in the development of these training manuals.

We would also like to acknowledge the valuable contributions of all TVET trainers and industry practitioners in the development of this training manual.

The management of Rwanda TVET Board extends its appreciation to both its staff and the staff of the TQUM Project for their efforts in coordinating these activities.

This training manual was developed:

Under Rwanda TVET Board (RTB) guiding policies and directives



Under Financial and Technical support of



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ACRONYMS

AC: Alternative Current
BEV: Battery Electric Vehicle
CBT: Competence Based Training
CCS: Combined Charging System
CPO: Charge Point Operator
DC: Direct Current
EMS: Energy Management System
EV: Electrical Vehicle
EVSE: Electrical Vehicle Supply Equipment
FCEV: Fuel Cell Electric Vehicle
GFCI: Ground Fault Circuit Interrupter
GPS: Global Positioning System
HEV: Hybrid Electric Vehicle
HIRA: Hazard identification and Risk Assessment
ICCB: In-cable Control Box
ICE: Internal combustion Engine
LAN: Local Area Network
PDU: Power Distribution Unit
PHEV: Plug-in Hybrid Electric Vehicle
PPE: Personal Protective Equipment
RCD: Residual Current Device
RTB: Rwanda TVET Board
TQUM Project: TVET Quality Management Project
V2G: Vehicle to Grid technology

INTRODUCTION

This trainer's manual includes all the methodologies required to effectively deliver the module titled " **Electrical Vehicle Charging station Installation.**" Students enrolled in this module will engage in practical activities designed to develop and enhance their competencies.

The development of this training manual followed the Competency-Based Training and Assessment (CBT/A) approach, offering ample practical opportunities that mirror real-life situations.

The trainer's manual is organized into Learning Outcomes, which is broken down into indicative content that includes both theoretical and practical activities. It provides detailed information on the key competencies required for each learning outcome, along with the objectives to be achieved.

As a trainer, you will begin by asking questions related to the activities to encourage critical thinking and guide trainees toward real-world applications in the labor market. The manual also outlines essential information such as learning hours, didactic materials, and suggested methodologies.

This manual outlines the procedures and methodologies for guiding trainees through various activities as detailed in their respective trainee manuals. The activities included in this training manual are designed to offer students opportunities for both individual and group work. Upon completing all activities, you will assist trainees in conducting a formative assessment known as the end learning outcome assessment. Ensure that students review the key reading and the points to remember section.

MODULE CODE AND TITLE: RENVC501: ELECTRICAL VEHICLE (EV) CHARGING STATION INSTALLATION

Learning Outcome 1: Prepare electrical vehicle charging station workplace

Learning Outcome 2: Assemble electrical vehicle charging station components

Learning Outcome 3: Maintain electrical vehicle charging station

Learning Outcome 1: Prepare electrical vehicle charging station



Indicative contents

- 1.1: Introduction of electrical vehicle charging station**
- 1.2: Interpretation of electrical vehicle charging station drawing**
- 1.3: Conduction of site visit**
- 1.4: Implementation of Hazard and safety control**
- 1.5: Selection of tools, materials and equipment**
- 1.6: Setting out the EV charging station site**

Key Competencies for Learning Outcome 1: Introduction of electrical vehicle charging station

Knowledge	Skills	Attitudes
<ul style="list-style-type: none"> ● Introduction of electrical vehicles and EV charging station ● Description of electrical vehicle and EV charging station ● Interpretation of electrical vehicle and EV charging station drawings ● Identification of workplace hazard and safety measures 	<ul style="list-style-type: none"> ● Selecting tools, materials and equipment ● Conducting site survey and reporting ● Setting out the site of EV charging station 	<ul style="list-style-type: none"> ● Being Attentive ● Being analytical while conducting site survey ● Being participative ● Having accuracy while setting out ● paying attention while selecting tools, material and equipment ● Having self confidence ● Being a time manager



Duration: 10 hrs



Learning outcome 1 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Introduce properly electrical vehicle and EV charging station
2. Describe correctly EV charging station based on their working principle
3. Interpret properly EV charging station drawing based on the designer
4. Identify clear the site hazard based on the workplace
5. Conduct properly site survey based on activities
6. Select correctly tools, material, and equipment correctly based on the work to be done
7. Set out correctly the EV charging station site based on installation



Resources

Equipment	Tools	Materials
<ul style="list-style-type: none"> ● Personal Protective Equipment (PPE) ● First aid ● Multi-meter ● Earth resistance meters ● Ladder ● Computer ● Office equipment ● compactor 	<ul style="list-style-type: none"> ● Tape measure ● Grass slasher ● Axe ● pick axe ● Spade ● Hoe ● Pegs ● Rope ● Hammers ● Spirit level ● Hack saw ● drawing tools ● Machete ● drawing software ● cleaning tools 	<ul style="list-style-type: none"> ● PVC pipe and fittings ● Cable tray ● Papers ● bolt and nut ● Cement ● concrete iron ● Water ● Crushed stone ● Silicon ● sand

	<ul style="list-style-type: none">● wheelbarrow● concrete Mixer● Conduit Benders	
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Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail the site
- Have site Survey tools, materials and equipment
- Avail images, photo and video related to EV and EV charging station
- Have a plan to visit EV Charging station



Indicative content 1.1: Introduction of electrical vehicle charging station



Duration: 2 hrs



- Trainer may use small group for describing EV charging station
- The use of physical objects, images, videos, illustrations and didactic materials is required.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask the trainees to answer the following:

- Define the following key terms:
 - Charging station
 - Electrical vehicle
 - Adapter
- Describe EV charging station.
- Identify types of charging

Step 2: Ask trainees to present the findings from their small group

Step 3: Provide and clarify the expert view

Step 4: Address any questions or concerns

Step 5: Ask them to read the Key readings 1.1.1 in their manuals



Points to Remember

- Charging Station: A designated infrastructure or facility where electric vehicles (EVs) can recharge their batteries using an electrical power supply.
- Electrical Vehicles (EVs): Vehicles powered by electric motors using energy stored in batteries or another energy storage device.
- Adapter: An adapter is a device that facilitates compatibility between different hardware or power systems by converting physical connections, voltage levels, or data formats.
- Example: A power adapter converts electricity from a wall outlet to a voltage suitable for a laptop or smartphone
- AC Charging AC (Alternating Current) charging refers to charging devices, such as electric vehicles (EVs), by supplying alternating current electricity from a standard power outlet or charging station.

- EV charging station is a power supply device that supplies electrical power for recharging plug-in electrical vehicle
- Classification of EV charging station are: Level 1 (Slow Charging), Level 2 (Fast Charging) and Level 3 (Rapid Charging)
- Power Supply, Connector, Charging Cable, Control Board, User Interface are the main component of EV charging station
- The working principal of EV charging station is based on converting the alternating current (AC) from the power grid to the direct current (DC) needed by the vehicle's battery.
- EV charging station will allow users to easily and quickly get back on the road with a battered battery.



Theoretical Activity 1.1.2: Description of electrical vehicles



Notes to the trainer:

- Trainer may use small group for describing electrical vehicles
- The use of physical objects, images, videos, and illustrations as didactic materials is required



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask the trainees to answer the following questions

- i. Describe an electric vehicle (EV)
- ii. identify electric vehicle storage and drives

Step 2: Ask trainees to present the findings from their small group

Step 3: Provide and clarify the expert view

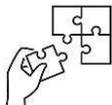
Step 4: Address any questions or concerns.

Step 5: Ask them to read the Key readings 1.1.2 in their manuals



Points to Remember

- **An Electrical vehicle (EV)** is a vehicle that can be powered by an electric motor that draws electricity from a battery and is capable of being charged from an external source.
- **There exist different types of EVs including:** Battery electric vehicle (BEVs), Hybrid electric vehicles (HEVs), Plug-in hybrid electrical vehicle (PHEVs)
- Electric vehicle operates by converting electrical energy from the battery into mechanical energy through an electric motor, with advanced systems in place for efficiency, performance, and energy recovery. This innovative technology enables EVs to provide a sustainable alternative to traditional gasoline-powered vehicles.
- Electric vehicles (EVs) storage includes: Battery Pack, Charging Mechanisms



Application of learning 1.1

GoGreen Company in Rwanda needs to improve the living lifestyle of its staff by brought for them the hybrid car but the staffs resist to that type of vehicle, they prefer the gasoil and diesel car due to their limitation of knowledge on the hybrid car. The company hires you as external expert to explain to their staff the benefit of electrical vehicle (Hybrid car). As trainee who applied the introduction of electrical vehicle and electrical vehicle charging station explain to the staff the benefit of hybrid car to the company and the benefit to the whole society include them

Checklist:

Criteria	Indicators	Yes	No
The benefit of electrical vehicle is well explained	1.1 Electrical vehicle are introduced		
	1.2 Environmental Impact are explained		
	1.3 Energy Efficiency is explained		
	1.4. Operating Costs is explained		



Indicative content 1.2: Interpretation of electrical vehicle charging station drawings



Duration: 2 hrs



- Trainer may use small group for analysing electrical vehicles charging station drawing
- The use of physical objects, images, videos, and illustrations as didactic materials is required
- The trainer may have electrical charging station drawing



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and invite the trainees to do the following questions in small group:

- what is electrical drawings
- Describe electrical symbols
- Identify types of diagrams

Step 2: Monitor the discussion and asks trainees to write the findings on paper

Step 3: Ask trainees to present the findings from their small group

Step 4: refer to the trainees answers, provide and clarify the expert view

Step 5: Address any questions or concerns.

Step 6: Ask them to read the Key readings 1.2.1 in their manuals



Points to Remember

- **A drawing** is a picture or plan made by means of lines on a surface which represent the real object. It is made of different symbols depending on the object.

- **Symbol** is a character used as a conventional representation of an object, function, or process
- Schematic, wiring, block, pictorial are four basic types of diagrams



Practical Activity 1.2.2: Interpretation of EV charging station drawing



Notes to the trainer:

- Trainer may :
Avail the EV charging station drawing
- Trainer may use small group while explaining how to interpret a drawing

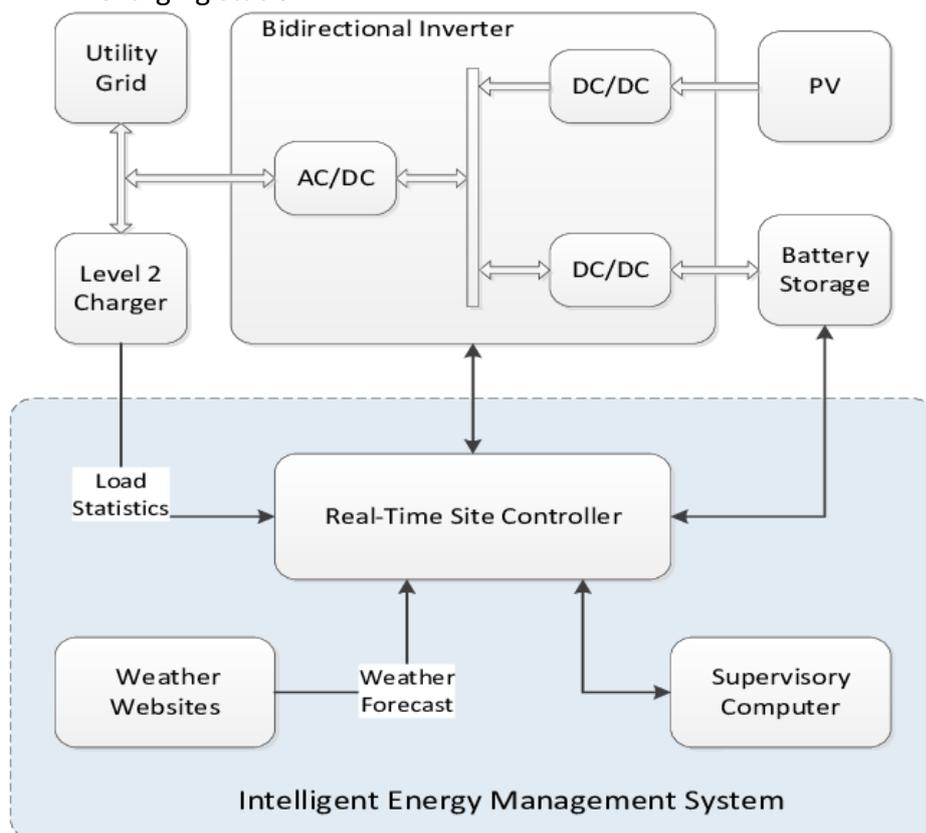


Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the topic and ask learners to perform the task described below:

Referring to the previous activity 1.2.1, Interpret the key components of the provided block diagram to understand the layout and wiring configuration for the EV charging station.



Step 2: Explain the task and provide clear instructions (PPE, Time allocated)

Step 3: Demonstrate how to the key components of the drawing to understand the layout and wiring configuration for the EV charging station.and While demonstrating, explain each step

Step 4: Ask trainees to interpret EV charging station drawing and monitor the activity

Step 5: Assess their performance and provide feedback

Step 6: Allow trainees to ask question or clarification if any

Step 7: Ask trainees to read key readings 1.2.2



Points to Remember

- **Key steps to follow while interpreting EV charging station**

Step 1. Review the Title Block

Step 2. Understand the Symbols and Legends

Step 3. Identify the View Types

Step 4. Check Dimensions and Annotations

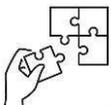
Step 5. Analyze the Layout and Relationships

Step 6. Look for Additional Details

Step 7. Confirm Scale and Measurements

Step 8. Seek Clarification if Needed

Step 9. Apply the Information



Application of learning 1.2.

You are tasked with installing an EV charging station at a new office complex. Before the installation, your manager hands you the site drawing and electrical layout for the charging station and asks you to review it.

Task: Interpret the key components of the drawing to understand the layout and wiring configuration for the EV charging station.

Checklist

Criteria	Indicators	Yes	No
Drawing is well interpreted	1.4 Title block is reviewed		
	1.5 symbols are identified		
	1.6 views are identified		
	1.4. Layout are analysed		
	1.5 Additional details are checked		
	1.6 Measurement are confirmed		



Indicative content 1.3: Conduction of site visit



Duration: 2 hrs



Theoretical Activity 1.3.1: Description of site visit



Notes to the trainer:

- Trainer must avail the site
- Have different tools, materials and equipment needed to conduct site survey



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and invite the trainees to do the following questions
- What is an Electrical Vehicle charging station site?
 - What do you understand by the term EV charging station site visit?
 - What is the purpose of site visit
 - What is site visit report
- Step 2:** Ask trainees to present the findings from their small group
- Step 3:** Provide and clarify the expert view
- Step 4:** Address any questions or concerns.
- Step 5:** Ask them to read the Key readings 1.3.1 in their manuals



Points to Remember

- **An Electrical Vehicle charging station site** generally refers to a specific location or area where EV charging station activities are conducted or EV charger projects are implemented
- **An EV charging station site visit** refers to an on-location inspection, assessment, or evaluation of a site where electric vehicle (EV) charging stations are planned, under construction, or already operational.
- The purpose of a site visit can vary depending on the context, but generally, it serves several key objectives:
 1. Assessment of Conditions
 2. Data Collection
 3. Verification

4. Stakeholder Engagement
5. Planning and Decision-Making
6. Relationship Building



- Trainer may avail the site
- Have different tools, materials and equipment needed to conduct site survey
- Trainer may use small group while explaining how to conduct site survey



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the topic and ask learners to perform the task described below:

- I. Referring to the previous theoretical activities 1.3.1 as a technician you are requested to inspect the given site based on its suitability location of EV charging station and elaborate a report

Step 2: Explain the task and provide clear instructions (PPE, Time allocated)

Step 3: Demonstrate how to conduct a site visit. While demonstrating, explain each step

Step 4: Ask trainees to conduct a site visit and monitor the activity

Step 5: Assess their performance and provide feedback

Step 6: Allow trainees to ask question or clarification if any

Step 7: Ask trainees to read key readings 1.3.2



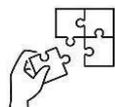
Points to Remember

- **Key steps to follow while conducting EV Charging station sit visit**
 - Step 1. Initial Planning and Preparation
 - Step 2. Perform On-Site Inspection
 - Step 3. Check for site suitability factors
 - Step 4. Environmental and Zoning Considerations
 - Step 5. Utility Company Coordination
 - Step 6. Connectivity for Software and Networks
 - Step 7. Take detailed measurements such as distances and photos

Step 8. Report Findings and Recommendations

Step 9. Obtain approvals and permits from local authorities

Step 10. Final review by double-checking survey findings with all stakeholders and create a project plan based on the survey results.



Application of learning 1.3.

Mr XY is the investor in your district and he wishes to make investment in modern technology of electrical vehicle by constructing the EV charging station in your district. After reviewing the master plan of your district, the place Z has been proposed to be the site of that project (EV charging station project). You are hired as individual consultant to inspect the suitability of that place Z proposed to be the location of EV charging station and provide the report.

Checklist

SN	Criteria	Indicators	Yes	No
1	Site visit is well conducted	1.1 clear objective is set		
		1.2 Physical inspection is conducted		
		1.3 safety is evaluated		
		1.4 Measurement are checked		
		1.5 Data are collected		
2	Report is well elaborated	2.1. Site visit and data collection		
		2.2. Drafting the report		
		2.3. Review and finalization		
		2.4. Submission and presentation		



Indicative content 1.4: Implementation of Hazard and safety control



Duration: 1 hr



- Trainer may Avail the site
- The trainer have to avail safety tools and different hazard symbols
- Trainer will use small groups to explain well the identification of hazard and safety measures



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask the trainees to do the following questions

- What is hazard in EV charging station installation?
- What do you understand by the term safety measure?

Step 3: Ask trainees to present the findings from their small group

Step 4: Provide and clarify the expert view

Step 5: Address any questions or concerns.

Step 6: Ask them to read the Key readings 1.4.1 in their manuals



Points to Remember

- A dangerous phenomenon, substance, human activity or condition is called **hazard** or shortly a potential source of harm
- **Safety** is the freedom from those conditions that can cause death, injury or illness

- An action, procedure or contrivance designed to lower the occurrence or risk of injury, loss and danger to persons, property or the environment is called **safety measure**



- Trainer may :
Avail the site
Have different tools, materials and equipment needed to conduct site survey
- Trainer may use small group while explaining Hazard Identification and Risk Assessment



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the topic and ask learners to perform the task described below:

- i. Referring to the previous activity 1.4.1, you are requested to identify potential hazards associated with EV charging station installation
- ii. Implement control measures to mitigate or eliminate identified risks, such as using appropriate personal protective equipment

Step 2: Explain the task and provide clear instruction to be followed

Step 3: Demonstrate how to identify hazards and how to manage risks.

Step 4: Assess their performance and provide feedback

Step 5: Allow learners to ask question or clarification if any

Step 6: Lead them to read key readings 1.4.2 in their manual

Step 7: Ask learners to perform the task provided in application of learning 1.4



Points to Remember

- Step-by-step guide for performing Hazard Identification and Risk Assessment (HIRA) for EV charging stations

Step 1. Form a Risk Assessment Team that understands the technical aspects of EV charging stations, local safety regulations, and risk management practices.

Step 2: Define the Scope of the Assessment including objectives, boundaries and activities to be covered

Step 3. Identify Hazards such as Electrical, mechanical, fire, chemical, environmental and ergonomic hazards

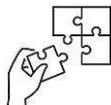
Step 4. Assess risks for each identified hazard

Step 5. Implement Control Measures, evaluate and monitor controls to reduce risks

Step 6. Record and register risk assessment findings

Step 7. Perform the periodic reviews and incident investigation

Step 8. Provide ongoing training on safety procedures, including the use of PPE and emergency response protocols.



Application of learning 1.4.

The company EVCO in which you are employed has signed contract to install an EV charging station in Musanze city. Your employer gives you the task of Perform a detailed inspection of the EV charging station installation site. Identify potential hazards and provide a detailed report with the safety measures that will be respected to prevent accidents and illness to you and your colleagues.

Checklist

SN	Criteria	Indicators	Yes	No
1	Site Inspection and Potential Hazards analysis	1.1 Electrical hazards are identified		
		1.2 Tripping and falling hazards are identified		
		1.1 Heavy equipment and lifting hazards		
		1.4 Fire Hazards are shown		
		1.5 Exposure to hazardous Materials		
		1.6 Weather condition hazards are		

		identified		
		1.7 Traffic and noise hazards are analysed		
		1.8 Ergonomic hazards are analysed		
2	General Safety Protocols	2.1 Safety training		
		2.2 First aid and emergency response		
		2.3 Regular inspections		



Indicative content 1.5: Selection of tools, materials and equipment



Duration: 1hr



- Trainer may choose the appropriate facilitation techniques to deliver this activity
- Trainer may avail physical tools, material and equipment/images, video clips as didactic materials



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introducing the activity by asking trainees to discuss on the following questions

- i. What do you understand by the following terms: tool, material and equipment
- ii. State the types of tool, material and equipment's
- iii. Identify the applications/uses of tools, material and equipment

Step 2: Ask trainees to present their findings

Step 3: Involve trainees in agreeing on correct answers

Step 4: Allow trainees to ask questions if any

Step 5: Provide expert view and address questions or concerns.

Step 6: Orient Trainees to read the Key readings 1.5.1 in their manual for more clarification.



Points to Remember

- **Tools** are any instruments or simple piece of equipment that you hold in your hands and use to do a particular kind of work
- **Materials** refers to any substance or matter that can be used to create, build, or produce something.
- **Equipment:** refers to the tools, machinery, devices, or other tangible items necessary for a specific purpose, task, or activity.



Practical Activity 1.5.2: Selection of tools, materials and equipment used in preparation of EV charging station workplace.



Notes to the trainer



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity by explaining the selection criteria.

Step 2: Provide the instructions regarding to the task to be performed:

Selecting tools, material and equipment according to their application/uses

Step 3: Demonstrate a sample application example of the activity

Step 4: Ask trainees to perform the given task

Step 5: Evaluate the trainees task performance by providing the feedback where necessary

Step 6: Orient trainees to read key readings 1.5.2 in their manuals.



Points to Remember

- The steps to follow when selecting tools, materials, and equipment for EV Charging station installation

Step 1. Define project requirements: Understand the scope and identify key activities

Step 2. Consult technical specifications: Refer to equipment manufacturer guidelines and regulatory and safety standards

Step 3. List the necessary tools and equipment including hand tools, power tools, specialized tools and safety equipment

Step 4. Determine the necessary materials including electrical, structural and auxiliary materials

Step 5. Consider equipment availability and quality

Step 6. Evaluate cost and budget constraints

Step 7. Check compatibility and interoperability

Step 8. Consider environmental and site conditions such as weather and corrosion resistance

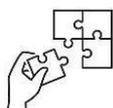
Step 9. Account for safety and ergonomics

Step 10. Review and approve the selection

Step 11. Once the selection is finalized, procure the tools, materials, and equipment and inspect them

Step 12. Plan for tool and equipment storage and maintenance

- **Selection criteria of tools** should consider effectiveness, accessibility, affordability, and user experience of tools..
- **Selection criteria of materials** involves checking for mechanical properties, physical properties, economic and availability factors and the sustainability considerations of the material.
- **Selection criteria of electrical and construction equipment** considers the design and specifications, budget, The safety standards, availability and compatibility



Application of learning 1.5

After investigation conducted by the development team of the district, they found that there are many electrical vehicle in the district but the owner face the challenge of not having a station to help them to recharge the batteries, so the district decides to construct 3 EV charging station to help them, as Engineer you are called by the development team to help the to select tools, material and equipment which will be used during the construction of those stations safety measures that will be respected to prevent accidents and illness to you and your colleagues.

Checklist

SN	Criteria	Indicators	Yes	No
1	Tools are selected	1.1 Hand tools are selected		
		1.2 Power tools are selected		
		1.3 Cutting tools are selected		
2	Materials are selected	2.1 Electrical materials are selected		
		2.2 Construction Materials are selected		
		2.3 Networking and Communication Materials are selected		
		2.4 Signage and labels are selected		
3	Equipment required are selected	3.1 Electrical equipment (transformers, EV chargers, distribution panels) are selected		
		3.2 Heavy equipment (Excavators or trenching machines, Cranes and concrete mixers) are selected		
4	Selection of Personal protective equipment	Overalls are selected		
		Safety boots are selected		
		Harnesses and helmets are selected		
		Eye protection devices are selected		



Indicative content 1.6: Setting out the EV charging station site



Duration: 3hrs



Theoretical Activity 1.6.1: Identification of site set out activities



Notes to the trainer:

Trainer may :

- Choose the appropriate facilitation techniques to deliver this activity
- Avail physical tools, material and equipment'/images, video clips as didactic materials



Key steps:

While delivering this activity, pass through the following steps:

Step 1:Introducing the activity by asking trainees to discuss on the following questions

- What do you understand by the term set out?
- Identify the main activities which can be done while setting out the site

Step 2:Ask trainees to present their findings

Step 3:Involve trainees in agreeing on correct answers

Step 4:Allow trainees to ask questions if any

Step 5:Provide expert view and address questions or concerns.

Step 6:Orient Trainees to read the Key readings 1.6.1 in their manual for more clarification.



Points to Remember

- **Setting out** is the process of transferring the dimensions and layout of a proposed structure from the architectural plans to the actual
- **Clearing the site, levelling and layout** are the procedures of site set out
- Other than to direct the employees as they start work, **the major goal of setting out is to guarantee that the construction stays within the legal bounds**



Practical Activity 1.6.2: Setting out the site



Notes to the trainer

- The trainer have to try first the task to address any need that should occur
- The trainer should make sure that workplace is well prepared
- The trainer have to check the availability of required tools, materials and equipment's



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity by explaining the EV charging station site set out

I. Referring to the theoretical activity 1.6.1, using appropriate tools, you are requested to conduct the site visit for EV charging station installation (the EV fast charger EVQC030 site)

Step 2: Provide the instructions regarding to the task to be performed:

Step 3: Demonstrate a sample application example of the activity

Step 4: Ask trainees to perform the given task

Step 5: Give guidance to trainees

Step 6: Evaluate the trainees task performance by providing the feedback where necessary

Step 7: Orient trainees to read key readings 1.6.2 in their manuals.



Points to Remember

- **Set out procedures:**

Site clearance is the process of removing waste as a way of making sure that an area is free from hazardous material and any other obstacles or huge mess as part of preparing the area for a construction or demolition project.

The purpose of **levelling** in construction is to establish a level reference plane or surface, ensuring that structures are built on a stable foundation

- **Key steps to follow while setting out an EV charging station site**

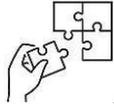
Step 1. Review the Master Plan and Design Documents

Step 2. Perform the preliminary Site Assessment

Step 3. Operate site Set-Out Process

Step 4. Review and Verification

Step 5. Final Reporting



Application of learning 1.6

ABC Company is willing to construct EV charging station in rural area to promote the use of electrical vehicle. After reviewing the master plan of your district, the place x has been proposed to be the site of that project (EV charging station project). As an engineer you are hired to do a set out of that site.

Checklist:

SN	Criteria	Indicators	Yes	No
1	Site Set-Out Process is well performed	Master Plan is reviewed		
		Site Plan is reviewed		
		Topographical Survey is done		
		Natural features are Identified		
		Utility connections are planned		
		Drainage issues or water runoff patterns are checked		
		Equipment and tools for the set-out are correctly selected		
		String Lines and Chalk or Marker Spray		
		Reference points are well established		
		Marking charging station locations and parking area is well done		
		Marking signage locations		
		Review and Verification is well done		
		Site layout diagrams Site Coordinates are correctly reported		



Learning outcome 1 end assessment

Theoretical assessment

Q1. Define an electric vehicle (EV) and list the types of electric vehicles (EVs) that exist.

Answer:

An electric vehicle (EV) is a vehicle that uses one or more electric motors powered by batteries, rather than a traditional internal combustion engine. Types of EVs include:

- **Battery Electric Vehicles (BEVs)**
- **Hybrid Electric Vehicles (HEVs)**
- **Plug-In Hybrid Electric Vehicles (PHEVs)**
- **Fuel Cell Electric Vehicles (FCEVs)**

Q2. Match the main components of an EV charging station to their functions

Part name	Function	Answer
1. Power Supply	A. Transfers the electrical current to the vehicle.	1.....
2. Connector:	B. Allows users to operate the charging station.	2.....
3. Charging Cable	C. Provides the required voltage to charge the EV battery.	3.....
4. Control Board	D. Connects the charging station to the vehicle.	4.....
5. User Interface	E. Manages the charging process and ensures efficiency.	5.....

Answer:

Part name	Function	Answer
1 Power Supply	A Transfers the electrical current to the vehicle.	1=C
2 Connector:	B Allows users to operate the charging station.	2=D
3 Charging Cable	C Provides the required voltage to charge the EV battery.	3=A
4 Control Board	D Connects the charging station to the vehicle.	4=E
5 User Interface	E Manages the charging process and ensures efficiency.	5=B

Q3. Answer By TRUE or FALSE

- a) EVs work by using a battery to store electrical energy, which is then converted into mechanical energy by an electric motor to drive the wheels. The battery is charged by plugging into a power source.

Answer: True

b) The battery pack stores energy and determines the range of the EV. A higher capacity battery allows the vehicle to travel further between charges

Answer: True

c) The DC-DC converter reduces high-voltage battery power to a lower voltage to power accessories like lights and infotainment systems.

Answer: True

d) DC (Direct Current) is common in Level 1 and Level 2 charging, slower charging speed while AC (Alternating Current) is used in Level 3 charging, much faster charging.

Answer: False

e) Multimeters measure voltage and current, while circuit testers ensure that circuits are safe and functional.

Answer: True

f) Electrical cables must not be rated for the voltage and current used in EV chargers and be compliant with local regulations.

Answer: False

g) Grounding materials ensure that excess electrical energy is safely directed into the ground, preventing shocks and equipment damage.

Answer: True

Q4. Choose the letter corresponding to the correct answer

I. The following are hazards associated with EV charging station installations.

- a) Electrical shock
- b) Fire risks
- c) Falling objects.
- d) a, b and c are correct
- e) No correct answer

Answer: d) a, b, and c are correct

II. Which device that serves the purpose of detecting ground faults and disconnects power, preventing electrical shocks.

- a. GFCI
- b. Circuit breaker
- c. Surge arrestor
- d. Lightning arrestor

Answer: a. GFCI

III. The following are the types of electrical vehicle, except:

- a) Battery Electric Vehicles
- b) Plug-in Hybrid Electric Vehicles
- c) Battery Swapping
- d) Hybrid Electric Vehicles

Answer: c. Battery swapping

IV. The following component are the key components of the electrical vehicle drive system, except

- a) Electric motor
- b) Inverter
- c) Battery pack
- d) Controller.
- e) Charging station

Answer: e) Charging station

Practical assessment

You are working in GoGreen Company that installs the EV charging stations. Your company wants to install the 6 ways charging station in Musanze district. As a technician, you are requested to conduct site visit and set out the EV charging station site according to the drawings provided by the engineer and select all tools, materials and equipment that will be required to build that infrastructure.

Checklist

SN	Criteria	Indicators	Yes	No
1	EV charging station drawings are correctly interpreted	1.1 Type of drawing is identified		
		1.2 Key Components in the EV charging Drawing are identified		
		1.3 Key Functions to Consider for EV charger installation		
		1.4 Pre-installation Checklist for Components		
2	Site visit is well conducted	2.1 Introduction is well prepared		
		2.2 Location Overview (Place name,		

		geographical location details, site size)		
		2.3 Site suitability factors (accessibility, power infrastructure condition, market potential safety and security)		
		2.4 Recommendations		
		2.5 Conclusion		
		2.6 Consultant details are shown (names, titles, date and signatures)		
3	site set out is perfectly performed	3.1 Revision of the Master Plan and Design Documents		
		3.2 Equipment and Tools for the Set-Out are arranged		
		3.3 Site Set-Out Process is done step by step		
		3.4 Safety and Regulatory Compliance is performed		
		3.5 Review and Verification of site is done		
		3.6 Final Reporting is well prepared		



Further information to the trainer

Afida Ayob, M. F. (2014). *Review on electric vehicle, battery charger, charging station and standards*. ISSN:2024-7459: Green Technology corporation.

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Learning Outcome 2: Assemble Electrical Vehicle Charging Station Components



Indicative contents

2.1 Fixation of electrical vehicle charging station Components

2.2 Laying of electrical cables

2.3 Interconnection of electrical vehicle charging station components

Key Competencies for Learning Outcome 2: Assemble electrical vehicle charging station components

Knowledge	Skills	Attitudes
<ul style="list-style-type: none">● Introduction on fixing● description of supporting structure● description of cable laying● Introduction on interconnection	<ul style="list-style-type: none">● Fabricating supporting structure● Applying fixing techniques● Applying cable laying techniques● Interconnecting electrical vehicle charging station components	<ul style="list-style-type: none">● Being Attentive● Being analytical● Being participative● Having accuracy while setting out● being careful while selecting tools, material and equipment● Having self confidence● Being a time manager



Duration: 40 hrs



Learning outcome 2 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Describe correctly cable laying and fixing techniques based on the types
2. Describe correctly supporting structure based their types
3. Fix correctly electrical vehicle charging station Components based on the fixing techniques
4. Lay appropriately electrical cables according to cable laying techniques
5. Interconnect correctly electrical vehicle charging station components based on working principal



Resources

Equipment	Tools	Materials
<ul style="list-style-type: none"> ● Personal Protective Equipment (PPE) ● Insulation tester ● First aid ● Multi-meter ● Earth resistance meters, Ladder ● Computer ● cable fault locator ● Office equipment compactor 	<ul style="list-style-type: none"> ● Tape measure ● pick axe ● Spade, ● Hoe, Pegs ● Rope ● Hammers ● Spirit level ● Screwdrivers ● Pliers ● Crimping tools ● Hack saw ● Electrician knife ● Allen key ● Spanners ● Phase tester ● cleaning tools 	<ul style="list-style-type: none"> ● Circuit breakers (MCCB, RCD, MCBO and MCB) ● Switches ● Socket outlet Wires/conductor ● PVC pipe and fittings ● Cable tray ● Insulating tape ● Contactors ● Relays ● Earth rods ● Din Rail ● Surge arrester ● Phase monitor ● Cable trunk

	<ul style="list-style-type: none"> • wheelbarrow 	<ul style="list-style-type: none"> • Screws, cable ties • Drill bit • Lightning arrester unit • bolt and nut, cable lugs Electronic protection unit • EV battery charger electronic filter, EV battery charger rectifier DC to DC • Converter • EV charger controller • Voltage regulator • Distribution board • Electrical vehicle charger and user interface
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Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail tools, materials and equipment
- Avail personal protective equipment
- Avail user guide



Indicative content 2.1: Fixation of electrical vehicle charging station

Components



Duration: 10hrs



Theoretical Activity 2.1.1: Description of EV charging station components

supporting structure



Notes to the trainer:

- Avail physical tools, material and equipment'/images, video clips as didactic materials
- While delivering this content, small groups may be used to describe supporting structure



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- Define the terms “supporting structure”
- identify the types of supporting structure
- Identify different materials used in supporting structure fabrication

Step 2: Ask trainees to present their findings

Step 3: Provide expert view and engage trainees to ask for clarification if any

Step 4: Ask trainees to read the Key readings 2.1.1



Points to Remember

- **A supporting structure** is a framework or system designed to bear loads and provide stability to an object or system
- The key elements of the supporting structure include foundation, mounting framework, enclosures and canopies, cable management system, signage and lighting.
- The main types of supporting structures used in EV charging stations include Pedestal Supports, Canopies and Shelters, Mounting Frames, Electrical Enclosures, Cable Management Systems, and Foundations and Footings.
- The most common materials utilized in supporting structure fabrication are Steel, Aluminum, Concrete, Composite Materials, Wood, Masonry, Plastic
- The supporting structure ensures the following purposes: stability, accessibility, safety, and aesthetic integration.



Practical Activity 2.1.2: Fabrication of EV charging station components supporting structure



Notes to the trainer

- The trainer should avail tools, materials and equipment and PPE which are in good condition
- Avail the workplace



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to read the task

Referring to the theoretical activity 2.1.1, using appropriate materials, you are requested to fabricate a supporting structure for EV fast charger EVQC030 components

Step 2: Explain the task and provide clear instructions (PPE, Time allocated)

Step 3: Demonstrate how to fabricate a supporting structure. While demonstrating, explain each step

Step 4: Ask trainees to fix EV charging station component and monitor the activity

Step 5: Assess their performance and provide feedback

Step 6: Allow trainees to ask question or clarification if any

Step 7: Ask trainees to read key readings 2.1.2



Points to Remember

- fabricating a support structure involves several techniques, depending on the materials used, the design requirements, and the intended application. Some common techniques: **welding, bolting, machining, casting, and forging.**
- Essential steps to follow while fabricating the EV charging station components supporting structure include foundation design, selecting materials, fabricating.
- The fabrication process involves the following steps:
 - Step 1: Fabricate Steel or Aluminum Frames
 - Step 2: Prepare and Pour Concrete Foundation
 - Step 3: Install Mounting Poles/Frames
 - Step 4: Attach Charging Components



Theoretical Activity 2.1.3: Description of EV charging station fixing components



Notes to the trainer:

- Trainer may avail physical tools, material and equipment'/images, video clips as didactic materials
- While delivering this content, small groups may be used to describe the fixing and mounting



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- Define the following terms: mounting, fixing
- Identify mounting techniques used in EV charging station
- Identify fixing techniques used in EV charging station

Step 2: Ask trainees to present their findings

Step 3: Provide expert view and engage trainees to ask for clarification if any

Step 4: Ask trainees to read the Key readings 2.1.3



Points to Remember

- Mounting refers to the process of securely attaching an object to a surface or structure.
- The following are common used mounting techniques: Ground mounting, pole mounting, wall mounting
- Fixing refers to the process of securely attaching or joining objects or components together. It encompasses various methods and techniques depending on the materials, environment, and specific requirements of the task.
- Here is the main fixing techniques. Fixing by bolt and nut, fixing by screws, fixing by welding



Practical Activity 2.1.4: Fixing of EV charging station components



Notes to the trainer

- The trainer should avail tools, materials and equipment and PPE which are in good condition
- Avail the workplace



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to read the task

Refer to the previous activity 2.1.3, using a suitable fixing techniques, you are requested to fix EV Fast charger components to the prepared mounting structure

Step 2: Explain the task and provide clear instructions (PPE, Time allocated)

Step 3: Demonstrate how to fix EV charging station component. While demonstrating, explain each step

Step 4: Ask trainees to fix EV charging station component and monitor the activity

Step 5: Assess their performance and provide feedback

Step 6: Allow trainees to ask question or clarification if any

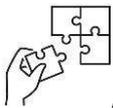
Step 7: Ask trainees to read key readings 2.1.4



Points to Remember

- **The following are the most used fixing steps:** Identify the Objective, Gather Tools and Materials, Measure and Mark, Position the Object, Secure with Fastener
- **Steps to follow while fixing by bolt nut**
 1. Gather Materials and Tools
 2. Prepare the Surfaces
 3. Select the Right Bolt and Nut
 4. Insert the Bolt
 5. Position the Nut
 6. Tighten the Assembly
 7. Check for Stability

- **Steps to follow while fixing by screws**
 1. Gather Materials and Tools
 2. Prepare the Surfaces
 3. Select the Right Screws
 4. Mark the Screw Holes
 5. Drill pilot holes
 6. Position the Objects
 7. Insert the Screws
 8. Tighten the Screws
 9. Check for Stability
 10. Finish Up
- **Steps to follow while fixing by welding**
 1. Gather Materials and Tools
 2. Prepare the Workspace
 3. Select the Right Welding Method
 4. Clean the Surfaces
 5. Fit Up the Pieces
 6. Set Up the Welding Machine
 7. Wear Protective Gear
 8. Test the Welding Machine
 9. Weld the Joint
 10. Check for Proper Penetration
 11. Allow the joint to Cool
 12. Inspect the Weld
 13. Finish the Project



Application of learning 2.1

Mr XY is the investor in Kicukiro district and he makes investment in EV charging station construction. Now the station is on stage of fixing electrical vehicle charging station components. You are hired as technician to perform the following tasks:

- a) Fabricate supporting structure and mount EV charging station components
- b) Fix EV charging station components for a better future interconnection.

Checklist:

SN	Criteria	Indicators	Yes	No
1	Support structure is well fabricated	1.1 The support structure design is done		
		1.2 Materials are for EV support structure selected		
		1.3 Joining components of EV charging is performed		
2	EV charging station component is well mounted	2.1 Control board is mounted		
		2.2 Charging unit is mounted		
		2.3 Power supply mounted		
3	EV charging station components are well fixed	3.1 Power supply is fixed		
		3.2 Voltage regulator is fixed		
		3.3 Control board is fixed		
		3.4 Charging unit is fixed		



Indicative content 2.2: Laying of electrical cables



Duration: 10 hrs



Theoretical Activity 2.2.1: Introduction to EV charging station cable laying



Notes to the trainer:

- While delivering this content, small groups may be used to describe cable laying
- **Trainer may** Avail physical tools, material and equipment'/images, video clips as didactic materials



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions

- Define the term “cable laying”
- Identify the main cable laying methods

Step 2: Ask trainees to present their findings

Step 3: Provide expert view and engage trainees to ask for clarification if any

Step 4: Orient Trainees to read the Key readings 2.2.1



Points to Remember

- **Cable laying** refers to the process of installing underground cables, typically for telecommunications or power distribution
- **There are generally four cable laying techniques:** direct buried cable laying, pipe cable laying, cable laying in cable trenches or tunnels, and bridge cable laying
- **Cable laying procedures:** Plan the route, Selection of electrical cables, conduits and fittings, Fix conduits and fitting, Laying cables and Labeling.



Practical Activity 2.2.2: Electrical cable laying



Notes to the trainer

- The trainer should avail tools, materials and equipment and PPE which are in good condition
- Avail the workplace



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to read the task

- Refer to the previous activity 2.2.1, using a suitable cable laying techniques, you are requested to lay correctly electrical cable between EV charging station components using the suitable cable laying technique

Step 2: Explain the task and provide clear instruction to be followed

Step 3: Demonstrate how to lay electrical cables. While demonstrating, explain each step

Step 4: Ask learner's lay electrical cable and monitor the activity

Step 5: Assess their performance and provide feedback

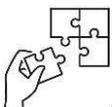
Step 6: Allow learners to ask question or clarification if any

Step 7: Lead them to read key readings 2.2.2



Points to Remember

- Here are the steps typically involved in the direct buried cable laying process:
- Planning and Design, Preparation, Excavation Cable Laying, Backfilling, Termination and Connections, Testing, Documentation
- Here are the typical steps involved in the pipe cable laying method:
- Planning and Design, Material Selection, Preparation, Excavation, Pipe Installation, Cable Laying, Termination and Connections, Backfilling, Testing, Documentation



Application of learning 2.2.

Mr XY is the investor in RUTSIRO district and he makes investment in modern technology of constructing EV charging station. Now the station is on a stage of electrical cables laying. You are hired as a technician to lay those electrical cables for a better future use

Criteria	Indicators	Yes	No
Electrical cable is well laid	Laying method is chosen		
	Cable are perfectly selected		
	Conduit are selected and fixed		
	Fittings are chosen and correctly used		
	Cables are perfectly laid		
	Cables are correctly labelled		



Indicative content 2.3: Interconnection of Electrical Vehicle Charging Station Components



Duration: 20 hrs



- While delivering this content, small groups may be used to describe the interconnection
- Trainer may
- use physical objects, images, videos, illustrations and didactic materials



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions

- i. Define the term interconnection
- ii. Identify the main EV charging station components interconnection methods

Step 2: Ask trainees to present their findings

Step 3: Provide expert view and engage trainees to ask for clarification if any

Step 4: Ask trainees to read the Key readings 2.3.1



Points to Remember

- Interconnection refers to the linking or joining of different systems, components, or networks to enable them to work together effectively.
- The main interconnection methods used for EV charging station components includes:
 1. Wiring Connections
 2. Connector Systems
 3. Communication Interfaces.



Practical Activity 2.3.2: Interconnecting EV charging station component



Notes to the trainer

The trainer may

- Avail tools, materials and equipment PPE, which are in good condition
- Avail the workplace



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to read the task:

After laying cables between EV charging station components, you are requested to interconnect correctly EV charging station (EV fast charger EVQC030) component according to the working principle of EV charging station

Step 2: Explain the task and provide clear instruction to be followed

Step 3: Demonstrate how to do interconnection of EV charging station component. While demonstrating, explain each step

Step 4: Ask trainees to do interconnection of EV charging station component and monitor the activity

Step 5: Assess their performance and provide feedback

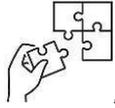
Step 6: Allow trainees to ask question or clarification if any

Step 7: Lead them to read key readings 2.3.2



Points to Remember

- The interconnection of components in an EV charging station involves various methods and technologies that facilitate communication, power delivery, and data exchange.
- Steps for interconnecting EV charging station (EVQC030) components
 - Step 1. The EV charger site must have been prepared and
 - Step 2. The EV charger main components must be well mounted and fixed
 - Step 3. Install Power Supply Units and Shelf Controllers
 - Step 4. Configure Cellular Modem and Registering Charger on Network
 - Step 5.** Configure and Wire AC Input Power



Application of learning 2.3

XZ company's EV charging station installation activities are on a stage of interconnecting electrical vehicles charging station components, as an expert you are hired by the company to help them in that activity of making interconnection of that EV charging station component for its future productivity

SN	Criteria	Indicators	Yes	No
1	EV charging station component are well interconnected	Power Supply unit is connected		
		Wiring is performed		
		Charging unit is connected		
		Testing is performed		



Learning outcome 2 end assessment

Theoretical assessment

Q1. Read the following statement and answer by **True** if the statement is correct or **false** if statement is not incorrect

a) Fixing is the action of fastening something in place

Answer: True

b) Fixing by hammer is one of the different fixing methods

Answer:False

c) Mounting involves several key element that ensure instability of component

Answer:False

d) Fixing by screws is the way of fixing a component by using nails

Answer:False

e) hammer is one of tools use while fixing by screws

Answers:False

Q2. Table below contains cable laying method in column **A**, and their description in the column **B**, Match column **A** to column **B** and write the answer to the provided place

ANSWERS	COLUMN A	COLUMN B
1. G	1. Direct buried cable laying.	a. installing cables in underground tunnels typically used for utility or transportation
2. F	2. pipe cable laying	b. Involves specific techniques to ensure safety, durability and compliance with engineering standards
3. A	3. cable laying in cable trenches or tunnels	c. installing cables under water
4. B	4. bridge cable laying	d. installing the cable on the top of the house
		e. installing cable by using trunk
		f. installing cables within protective conduit or pipe to safeguard them from environment factors and physical damage
		g. installing cables directly into the ground without the use of conduits

Q3. Read the following sentence and fill in blank space with the flowing words:

Control systems, Charging Unit, Electrical Wiring, User Interface, Protocols

I. is the main component that delivers power to the vehicle

Answer: Charging Unit

- II.interface with the user, guiding them through the charging process and integrating with payment systems.

Answer: Control systems

- III.connects the power source to the charging unit, providing the necessary energy

Answer: Electrical Wiring

- IV.Displays information to users, such as charging status, payment options, and instructions

Answer: User Interface

- V.Common communication protocols include OCPP (Open Charge Point Protocol) for standardizing interactions between charging stations and central systems

Answer: Protocols

Practical assessment

The district decide to construct an electrical vehicle charging station in one of their sector In order to avoid the complaint of many people of that district of not having a nearby station to help them to recharge their electrical vehicles

For this reason, XZ Company that won the tender to install reliable and efficient electrical charging stations is seeking the best EV charging station installer. As a competent technician in electrical charging station installation, you have been tasked to install an EV charging station to that sector. You are required to wire the distribution board, interconnect the internal parts of the charger, connect electrical vehicle charging station components and commission the installed charging station. The design, tools, equipment, and materials are provided. The given work will be performed in 7 hours

Checklist:

SN	Criteria	Indicators	Yes	No
1	EV charging station support structure is well fabricated	1.1 The support structure design is done		
		1.2 Materials are for EV support structure selected		
		1.3 Joining components of EV charging		

		is performed		
2	EV charging station components are fixed	2.1 Power supply is fixed		
		2.2 Voltage regulator is fixed		
		2.3 Control board is fixed		
		2.4 Charging unit is fixed		
3	Cables are properly laid	3.1 Cables are well selected		
		3.2 Conduits are selected		
		3.3 Appropriate techniques are used		
		3.4 Cables are correctly labelled		
4	EV charging station components are correctly interconnected	4.1 Power Supply unit is connected		
		4.2 EV charger components are perfectly wired		
		4.3 Charging unit is connected		

END



Further information to the trainer

Afida Ayob, M. F. (2014). *Review on electric vehicle, battery charger, charging station and standards*. ISSN:2024-7459: Green Technology corporation.

Avinash V. shrivastav, 1. S. (2020). *ELECTRIC VEHICLE CHARGING STATION* . Journal Emerging technologies and technologies, volume 7.

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Learning Outcome 3: Maintain Electrical Vehicle Charging station.



Indicative contents

3.1: Interpretation of user guide of electrical vehicle charging station

3.2: Performance of preventive maintenance

3.3: Performance of Corrective maintenance

3.4: Conducting functionality test

3.5: Elaborating E-V charging station report

Key Competencies for Learning Outcome 3: Maintain electrical vehicle charging station

Knowledge	Skills	Attitudes
<ul style="list-style-type: none">● Interpret user guide of electrical vehicle charging station● Review the charging station setting parameters and troubleshooting tips	<ul style="list-style-type: none">● Performing preventive and corrective maintenance● Conducting functionality test● Elaborating E-V charging station report	<ul style="list-style-type: none">● Being careful● Having critical thinker while reviewing the charging station setting parameters and troubleshooting tips.● Being self-confident● Being attentive



Duration: 20 hrs



Learning outcome 3 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Interpret correctly the user guide of electrical vehicle charging station as used in EV charging station installation
2. Perform properly Preventive and corrective maintenance of electrical vehicle charging station component according to the manufacturer used guid.
3. Conduct correctly the functionality test of electrical vehicle charging station according to functionality and testing technics.
4. Elaborate properly E-V charging station report according to reporting technics



Resources

Equipment	Tools	Materials
<ul style="list-style-type: none"> ● Personal Protective Equipment (PPE), ● Insulation tester, ● First aid, ● Multi-meter, ● Frequency meter, ● Clamp meter, ● Earth resistance meters, ● Computer, ● Fault locator, ● Office equipment, ● Voltage Tester, 	<ul style="list-style-type: none"> ● Tape measure ● Spirit level ● Steel rulers ● Screwdrivers ● Pliers ● Crimping tools ● Electrician knife ● Allen key ● drawing tools ● spanners ● drawing software ● wheelbarrow cleaning tools and 	<ul style="list-style-type: none"> ● Electronic protection unit, ● EV battery charger ● Electronic filter, ● EV battery charger rectifier, ● DC to DC converter, ● EV charger controller, ● Voltage regulator, ● Distribution board, ● Electrical vehicle charger ● EV charger user interface

		<ul style="list-style-type: none"> ● Circuit breakers (MCCB, RCD, and MCB) ● Switches, ● Socket outlet, Wires/conductor, ● Insulating tape, ● Contactors, ● Relays, ● Earth rods, ● Surge arrester, ● Phase monitor, ● Screws, ● cable ties, ● Lightening arrester unit, ● bolt and nut and ● cable lugs
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Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Prepare the site visit of EV charging station that will be after delivering the module.
- Have Tools, materials and equipment used in the maintenance of EV charging station
- Have Measuring instruments for Checking the charging station parameters setting
- Have necessary equipment used in functionality test of EV charging station
- Have classroom and workshop
- Have photos, videos and didactic materials used in EV charging station
- Have computer



Indicative content 3.1: Interpretation of User Guide of Electrical Vehicle Charging Station



Duration: 2hrs



- Trainer may have:
 - ✓ EV charging station operation manual (Catalogues),
 - ✓ photos, videos and didactic materials of EV charging station,
 - ✓ Tools, materials and equipment used in in EV Charging installation and maintenance.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

i. Describe EV charging station user guide

Step 2: Ask trainees to write their findings

Step 3: Provide the expert view and engage trainees to ask for clarification if any

Step 4: Ask trainees to read the key reading 3.1.1



Points to Remember

- **An EV charging station user guide** is a comprehensive document designed to help users understand how to operate electric vehicle (EV) charging stations effectively and safely
- The importance of an EV charging station user guide cannot be overstated. Here are several key reasons why such a guide is essential:
 - ✓ User Education
 - ✓ Safety Assurance
 - ✓ Troubleshooting Support
 - ✓ Enhancing User Experience
 - ✓ Standardization
 - ✓ Supporting Sustainable Practices.



Practical Activity 3.1.2: Interpretation of EV charging station user guide



Notes to the trainer

Trainer may:

- Avail EV charging station user guide



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to read the task

By interpreting the EV charging station user guide, you are requested to verify if the EV charging station are correctly interconnected

Step 2: Explain the task and provide clear instructions (PPE, Time allocated)

Step 3: Demonstrate how to do interpretation of EV charging station user guide. While demonstrating, explain each step

Step 4: Ask trainees to do interpretation of EV charging station user guide and monitor the activity

Step 5: Assess their performance and provide feedback

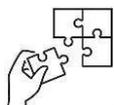
Step 6: Allow trainees to ask question or clarification if any

Step 7: Ask trainees to read key readings 3.1.2



Points to Remember

- User guide interpretation techniques include simplify technical jargon, visual aids and infographics, step-by-step demonstration, interactive and digital guides, multilingual support, real-time support features, on-site signage, practice-based learning, user feedback loops, use of examples and scenarios, repetition for reinforcement.



Application of learning 3.1.

After finishing the installation of EV charging station components, as a technician you are requested to interpret the user guide of that charging station and explain its working principal to the owner of the station.

Checklist

Criteria	Indicators	Yes	No
EV charging station user guide is well interpreted	Maintenance Instructions are identified		
	the charging station parameters setting are reviewed		
	Troubleshooting tips are identified		



Indicative content 3.2: Performance of Preventive Maintenance



Duration: 5 hrs



- Trainer may
 - ✓ Avail electrical vehicle charging station operation manual (Catalogues),
 - ✓ Avail photos, videos and didactic materials of EV charging station maintenances,
 - ✓ Prepared classroom and computer,



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions

- I. what is preventive maintenance
- II. What is the purpose of doing preventive maintenance of EV charging station?
- III. Identify the activities to be done during preventive maintenance of EV charging station.

Step 2: Ask trainees to write the findings

Step 3: Provide the expert view and engage trainees to ask for clarification if any

Step 4: Ask trainees to read the key readings 3.2.1.



Points to Remember

- Implementing a preventive maintenance program is vital for maximizing the lifespan of EV charging stations. Establish a routine maintenance schedule to inspect and service charging stations periodically.
- **Cleaning:** Regular cleaning of charging units to prevent the accumulation of dust, grime, and other contaminants that could affect performance.
- **Component Testing:** Periodic testing of key components such as transformers, circuit breakers, and cooling systems to ensure they are operating within optimal parameters.
- **Load Managing:** Ensuring the efficient distribution of electrical loads across the chargers within an EV charging station.



Practical Activity 3.2.2: Performing Preventive maintenance



Notes to the trainer

The trainer should prepare:

- ✓ Avail Measuring instruments to be used in preventive maintenance
- ✓ Avail electrical vehicles charging station operation manual (Catalogues),
- ✓ Avail photos, videos and didactic materials of EV charging station maintenances,



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to read the task

By interpreting the EV charging station user guide, you are requested to perform the given task:

You are an EV charging station technician tasked with performing preventive maintenance at a high-use charging station located in a busy urban area. The station has both AC Level 2 and DC fast-charging capabilities. This routine check aims to ensure all station components are in optimal condition and to prevent any potential failures or safety issues.

Step 2: Explain the task and provide clear instructions (PPE, Time allocated)

Step 3: Demonstrate how to perform preventive maintenance. While demonstrating, explain each step

Step 4: Ask trainees to perform preventive maintenance and monitor the activity

Step 5: Assess their performance and provide feedback

Step 6: Allow trainees to ask question or clarification if any

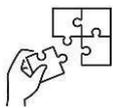
Step 7: Ask trainees to read key readings 3.2.2



Points to Remember

- **Maintenance Schedules:** All parts of the electrical installation and associated equipment shall be maintained to be in a safe working condition and/or fit for its protection purpose while delivering the services required in a secure and reliable manner.
- Maintenance schedules shall include:
 - a) inspection and/or testing schedules, shall include the requirements of regulation 67 and regulation 110 of the Regulations;
 - b) maintenance schedules; and

- c) Replacement schedules for components approaching the end of their operating life.
- **Maintenance Record** : All records of the design, construction, operation, inspection, testing and maintenance of the electrical vehicle charger installation shall be kept, periodically updated and be accessible to relevant and authorized persons.
- **Preventive maintenance (PM)** :is a proactive approach to ensure equipment and systems function optimally by performing regular checks, servicing, and adjustments. Below are key procedures commonly followed in preventive maintenance such as :
- **Steps to Implement an Effective Preventive Maintenance Inspection Plan**
 1. Identify critical assets for operational continuity
 2. Create a comprehensive checklist for maintenance tasks
 3. Define inspection frequencies for every asset class
 4. Train inspection teams
 5. Document findings and actions.



Application of learning 3.2.

Mr M is the owner of a new charging station which is located in RUTSIRO district, as a technician you are requested to perform preventive maintenance to ensure the good functionality and durability of the charging station

Checklist

SN	Criteria	Indicators	Yes	No
1	EV charging station component are checked	1.1 Power Supply is checked		
		1.2 protection system		
		1.3 Charging cable is checked		
		1.4 Connections are checked		
		1.5 User interfaces are checked		
2	EV charging station component are cleaned	2.1 Power Supply unit is cleaned		
		2.2 Connectors are cleaned		
		2.3 Charging unit is checked		



Indicative content 3.3: Perform Corrective maintenance



Duration: 6hrs



Theoretical Activity 3.3.1: Description of Corrective Maintenance



Notes to the trainer:

- The trainer should prepare:
 - ✓ EV charging station operation manual (Catalogues),
 - ✓ photos, videos and didactic materials of EV charging station maintenances,
 - ✓ Prepared computer and classroom



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- i. What do you understand by corrective maintenance?
- ii. Describe EV charging station corrective maintenance

Step 2: Ask trainees to present their findings

Step 3: Provide the expert view and engage trainees to ask for clarification if any

Step 4: Orient Trainees to read the Key readings 3.3.1



Points to Remember

- Corrective maintenance is unscheduled maintenance activities performed to restore a system, component, equipment or asset to its operational state after a failure or breakdown has occurred.
- **Three types of corrective maintenance are:** Predictive Corrective Maintenance, Scheduled Corrective Maintenance and Deferred Corrective Maintenance.



Practical Activity 3.3.2: Perform Corrective maintenance



Notes to the trainer

- The trainer should prepare:
 - ✓ Measuring instruments to be used in corrective maintenance
 - ✓ EV charging station operation manual (Catalogues),
 - ✓ photos, videos and didactic materials of EV charging station maintenances,

- ✓ Tools, materials and equipments used in EV Charging maintenance.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to read the task

You are an EV charging station technician called to perform corrective maintenance at a charging station in a busy commercial area. The station has been reported as non-operational, and users have encountered an error message stating "Charging Unavailable." The station includes both AC Level 2 and DC fast-charging options. Your task is to assess, diagnose, and repair the issue to bring the station back online. corrective maintenance to EV charging station when the charging shuts down suddenly

Step 2: Explain the task and provide clear instructions (PPE, Time allocated)

Step 3: Demonstrate how to perform corrective maintenance. While demonstrating, explain each step

Step 4: Ask trainees to perform corrective maintenance and monitor the activity

Step 5: Assess their performance and provide feedback

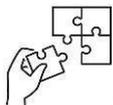
Step 6: Allow trainees to ask question for clarification

Step 7: Lead them to read key readings 3.3.2 in their manual



Points to Remember

- Here are the general steps to follow while performing corrective maintenance: Identify the Problem, Assess the Impact, Plan the Maintenance, Notify Stakeholders, Prepare the Work Area, Perform the Repair, Test the Equipment, Document the Maintenance



Application of learning 3.3.

Mr M is the owner of a new charging station which is located in RUTSIRO district, the operators notice that the charging station is not in good working conditions, as a technician you are requested to perform corrective maintenance to ensure the good functionality of the charging station

Checklist

SN	Criteria	Indicators	Yes	No
1	Maintenance instruction are followed	1.1 Regular Visual inspection is performed		
		1.2 Cleaning instructions		

		1.3 Electrical safety checks		
2	the charging station parameters are checked	2.1 Voltage is checked		
		2.2 Current is checked		
		2.3 Frequency is checked		
		2.4 Temperature is checked		
3	Troubleshooting is done	3.1 power supply is troubleshooted		
		3.2 protection system is troubleshooted		
		3.3 Connections is troubleshooted		
		3.4 error messages is troubleshooted		
		3.5 charging cable is troubleshooted		



Indicative content 3.4: Conduction of E-V charging Station Functionality Test



Duration: 3hrs



- Trainer may :
- Avail photos, videos and didactic materials of EV charging station maintenances,
- Avail Tools, materials and equipment used in EV Charging maintenance.



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
- What is functionality test?
 - identify the method of conducting functionality test
- Step 2:** Ask trainees to present their findings
- Step 3:** Provide the expert view and engage trainees to ask for clarification if any
- Step 4:** Orient Trainees to read the Key readings 3.4.1



Points to Remember

- A functionality test is designed to verify that a system or component operates according to specified requirements.
- It assesses whether all features work as intended and meets user expectations



Practical Activity 3.4.2: Perform functionality test of EV charging station



Notes to the trainer

The trainer should prepare:

- ✓ Measuring instruments to be used in in functionality test maintenance
- ✓ EV charging station operation manual (Catalogues),
- ✓ videos and didactic materials of EV charging station maintenances,
- ✓ Tools, materials and equipment used in EV Charging maintenance tests.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to read the task

Refer to the previous activity 3.4.2, you are requested to perform EV changing station functionality test

Step 2: Explain the task and provide clear instructions (PPE, Time allocated)

Step 3: Demonstrate how to conduct functionality test. While demonstrating, explain each step

Step 4: Ask trainees to perform conduct functionality test and monitor the activity

Step 5: Assess their performance and provide feedback

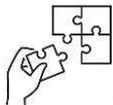
Step 6: Allow trainees to ask question for clarification

Step 7: Lead them to read key readings 3.4.2 in their manual



Points to Remember

- **Steps to Conduct Functionality Testing:** testing objectives, Review requirements, Develop test cases, prepare the test Environment, Execute test cases, Document results



Application of learning 3.4.

Mr M is the owner of a new charging station which is located in RUTSIRO district, the operators of the station notice that the charging station is not in good working conditions, as a technician you are requested to conduct functionality test to ensure the good functionality of the charging station.

Checklist

SN	Criteria	Indicators	Yes	No
1	Functionality test is well Conducted	electrical components are tested		
		electrical vehicle charger is tested		
		charging process is monitored		
		metering and billing system is checked		



Indicative Content 3.5: Elaboration of EV Charging Station Report



Duration: 4hrs



- The trainer should prepare:
 - ✓ Avail the computer
 - ✓ Avail images and photo related to EV and EV charging station



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- Define the following terms:
 - report
 - Data Recording
 - Commissioning Process
 - As-built Drawings
- Describe the commonly used reporting methodologies

Step 2: Ask trainees to present their findings

Step 3: Provide the expert view and engage trainees to ask for clarification if any

Step 4: Orient Trainees to read the Key readings 3.5.1



Points to Remember

- A report is a structured document that presents information, findings, or analyses on a specific topic or issue. It is typically used to convey results from research, assessments, or investigations and can serve various purposes across different fields, including business, education, science, and engineering.

Overall, the reporting methodology you choose can depend on the nature of the data, the objectives of the report and the needs of the audience. Organizations may use a combination of methodologies to provide a comprehensive view of a situation or to address different needs of stakeholders.
- Charging data are collected from one of three sources, each with varying levels of additional information.

- An as-built drawing is a document used in the construction industry to provide a final record of the installed conditions, including all changes that occurred during the project.
- The commissioning process is a set of procedures for planning, documenting, scheduling, testing, and verifying that equipment and systems meet the project requirements and comply with regulations.



- The trainer should:
 - ✓ Avail computer and report forms



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to read the task

Refer to the previous activity 3.5.1, you are requested to perform the following task:

You are an EV charging station technician responsible for both preventive and corrective maintenance on a busy urban charging station that serves both AC Level 2 and DC fast-charging users. After completing the necessary maintenance tasks, you need to create a detailed report that accurately documents the work performed, the station's current condition, and any ongoing issues. This report will be used by the maintenance management team to track service needs, analyze station reliability, and plan future maintenance.

Step 2: Explain the task and provide clear instructions (PPE, Time allocated)

Step 3: Demonstrate how to elaborate a report. While demonstrating, explain each step

Step 4: Ask trainees to elaborate a report and monitor the activity

Step 5: Assess their performance and provide feedback

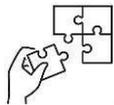
Step 6: Allow trainees to ask question for clarification

Step 7: Lead them to read key readings 3.5.2 in their manual



Points to Remember

- Elaborating a report involves several systematic steps to ensure that the content is clear, well-organized, and effective in conveying the intended message. Here's a step-by-step guide:
- **Steps to Elaborate a Report:** Define the Purpose, Research and Gather Information, Outline the Structure, Write the Introduction, Develop the Methodology Section, Present Findings/Results, Analyze the Data, Draw Conclusions



Application of learning 3.5.

XL Ltd in RUTSIRO district install EV charging station, as a worker of company they give you the task of making clear document of report which composed of all important information of the installation

Checklist

SN	Criteria	Indicators	Yes	No
1	Report are well prepared	1.1. Information are collected		
		1.2. Documentation structure are reviewed		
2	Report are well structured	2.1. Title are structured		
		2.2. Table of content are provided		
3	Report are well introduced	3.1. Purpose of report are explained		
		3.2. Background information on the project are provided		
4	Installation procedures are well identified	4.1. Component are well placed		
		4.2. Piping and tubing layout are described		
		4.3. Electrical connection are documented		
		4.4. Fluid management are well documented		
5	System are well commissioned and tested	5.1. Pre-operation are checked		
		5.2. Testing procedures are described		
6	Safety are well measured	6.1. Safety protocol are documented		
		6.2. Risk are assessed		

7	Report are well documented	7.1. System standard and regulation are confirmed		
		7.2. References to installation manual are included		
		7.3. Problem or deviation from the installation plan are documented		



Learning outcome 3 end assessment

Theoretical assessment

Q1. Read the following statement and answer by **True** if the statement is correct or **False** if statement is not incorrect

- a) A report is a structured document that presents information, findings, analyses, or recommendations on a specific topic or issue

Answer: True

- b) Testing is a systematic process used to evaluate the functionality, performance, reliability, and quality of a product

Answer: True

- c) Maintenance doesn't play a crucial role in ensuring reliability, safety, and efficiency, and can be applied across various fields

Answer: False

- d) Cleaning is the process of removing dirt, dust, debris, and contaminants from surfaces and environments.

Answer: True

Q2. Table below contains types of maintenance in **column A**, and their description in the **column B**, **Match column A to column B and** write the answer to the provided place

ANSWERS	COLUMN A	COLUMN B
1. C	1. Corrective maintenance.	A. Maintenance based on monitoring and analysing equipment performance data to predict when maintenance should be performed.
2. D	2. preventive maintenance	B. Unscheduled maintenance performed in response to unexpected equipment failures or emergencies.
3. A	3. Predictive Maintenance	C. Maintenance performed to fix defects or failures after they have occurred.
		D. Regularly scheduled maintenance activities aimed at preventing failures before they occur.
		E. Planned maintenance activities that are performed at specific intervals, regardless of equipment condition.

Q3. CHOOSE THE CORRECT ANSWER

The following are the importance of functionality test, except:

- a) Validation of Requirements
b) Quality Assurance

- c) waste of material
- d) User Satisfaction
- e) Cost Efficiency

Answer: C

The following are activities of preventive maintenance except:

- a) Regular Inspections:
- b) Replacing
- c) Cleaning:
- d) Adjustments:
- e) Parts Replacement
- f) Software Updates
- g) Testing

Answer: B

Practical assessment

XYZ Ltd in RUTSIRO district installed EV charging station after finishing their work of installation there are handover with the owner, as technician you are requested to prepare clear documentation used in handover.

Task:

- i. Draw clear as-built drawing
- ii. Shows data recorded of the system commissioning
- iii. Make clear report of the station functionality

Checklist:

SN	Criteria	Indicators	Yes	No
1	All information are well presented	1.1. Information are collected		
		1.2. Information are specified		
		1.3. Any change are modified		
2	Site survey are well conducted	2.1. Site are visited		
		2.2. Current condition are Measured		
		2.3. Measuring instrument are used		
3	All changes are well recorded	3.1. Initial drawing and actual construction are Compared		
		3.2. Changes are documented		
		3.3. Changes location and specification are noted		
4	Drawing are well updated	4.1. Initial drawing are used to reflect as-built drawing		
		4.2. all changes and modifications are accurately incorporated into		

		the drawings		
5	Data recording are well prepared	5.1. components and parameters are identified		
		5.2. Tools and equipment are gathered		
		5.3. System documentation are reviewed		
6	Parameter to record are well defined	6.1. components and parameters are identified		
		6.2. Tools and equipment are gathered		
		6.3. System documentation are reviewed		
7		7.1. Voltage is defined		
		7.2. current is defined		
		7.3. frequency is defined		
8	All data are well collected	8.1. voltage is measured		
		8.2. current is measured		
		8.3. frequency is measured		
		8.4. charging time is measured		
9	All data are well recorded	9.1. Data are recorded in logbook		
		9.2. Data are clear labelled in their unit measurement		
		9.3. Data are entered in electronics system		
10	All data are verified	10.1. Data accuracy are checked		
		10.2. Data trends are analysed		
11	All data are well documented	11.1. Recording data are updated		
		11.2. Recording data are reported		
12	Data are well archived	12.1. Data are stored in organized manner		
		12.2. Data are stored in organized manner		
		12.3. Data are protected from unauthorized access		
13	Report are well prepared	13.1 Information are collected		
		13.2. Documentation structure are reviewed		
14	Report are well structured	14.1. Title are structured		
		14.2. Table of content are provided		

15	Report are well introduced	15.1. Purpose of report are explained		
		15.2. background information on the project are provided		
16	Installation procedures are well identified	16.1. Component are placed		
		16.2. Piping and tubing layout are described		
		16.3. Electrical connection are documented		
		16.4. Fluid management are well documented		
17	System are well commissioned and tested	17.1. Pre-operation are checked		
		17.2. Testing procedures are described		
18	Safety are well measured	18.1. Safety protocol are documented		
		18.2. Risk are assessed		
19	Report are well documented	19.1 System standards and regulation are confirmed		
		19.2. References to installation manual are included		
		19.3. Problem or deviation from the installation plan are documented		

END



Further information to the trainer

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October 2024