Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

RENVC501

ELECTRICAL VEHICLE (EV) CHARGING STATION INSTALLATION

Install electrical vehicle (ev) charging station

Competence

RQF Level: 5

Learning Hours 70

Credits: 7

Sector: Energy

Trade: Renewable Energy

Module Type: Specific

Curriculum: ENGREN5001- TVET Certificate V in Renewable Energy

2024/25

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<table>
<tr><td>Purpose statement</td><td colspan="5">This module describes the skills, knowledge and attitude required to install electrical vehicle charging station. At the end of this module the learner will be to prepare electrical vehicle charging station workplace, assemble electrical vehicle charging station components and maintain electrical vehicle charging station.</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="5">Digital electronics fundamentals and Power electronics fundamentals</td></tr>
<tr><td rowspan="6">Delivery modality</td><td colspan="2"></td><td></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">Theoretical content</td><td>30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td colspan="2">Practical work:</td><td rowspan="3">70%</td><td rowspan="3">70%</td></tr>
<tr><td>● Group project and presentation</td><td>30%</td></tr>
<tr><td>● Individual project /Work</td><td>40%</td></tr>
<tr><td colspan="2"></td><td colspan="3">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. **Prepare electrical vehicle charging station workplace**	1.1. Drawings are correctly interpreted based on designer's installation guide
	1.2. Site visit is correctly conducted according to installation requirements
	1.3. Hazard and safety control are properly implemented according to the installation requirements
	1.4. Equipment, tools and materials are well selected according to installation requirements
	1.5. Site is correctly set out according to the installation requirements
2. Assemble electrical vehicle charging station components	2.1. Components of electrical vehicle charging station are properly fixed according to the drawing
	2.2. Cable of electrical vehicle charging station are properly laid according to the drawing and laying method
	2.3. Components of electrical vehicle charging station are properly interconnected according to the drawing
3. **Maintain electrical vehicle charging station**	3.1. The electrical vehicle charging station user guide is Properly interpreted based on the manufacturer's instructions
	3.2. Preventive maintenance is properly performed based on maintenance plan
	3.3. Corrective maintenance is properly performed based on faults or defects
	3.4. Functionality test of electrical vehicle charging station system is properly conducted in accordance to the design performance
	3.5. The report of E-V charging station system is correctly elaborated according to the reporting techniques

Knowledge, Skills, and Attitudes

Knowledge	Skills	Attitude
✓ Fundamentals of electricity ✓ Fundamental of electronics ✓ Basic electrical installation ✓ Power electronics ✓ Digital electronics ✓ Electrical measurement and instrumentation ✓ Electrical wires ✓ Electrical appliances and tools ✓ Electrical systems protection ✓ Electrical diagrams ✓ Safety and environment regulation ✓ Energy storage principles	✓ Use of tools and equipment ✓ Fixing skills ✓ Electrical wire connection ✓ Interpretation of diagrams ✓ Precision cutting ✓ Data recording ✓ Alignment techniques ✓ Documentation and reporting ✓ Computer skills ✓ Maintenance and Troubleshooting skills ✓ Communication and Teamwork Skills ✓ Problem-Solving Skills ✓ Produce BoQ	✓ Honest ✓ Polite ✓ Self-motivated ✓ Decisive ✓ Punctual ✓ Humble ✓ Patient ✓ Responsible ✓ Flexible ✓ Observant ✓ Goal oriented ✓ Self-confident ✓ Attentive ✓ Cooperative ✓ Faithful ✓ Energetic ✓ Strong moral character ✓ Open-minded ✓ Organized ✓ Positive work ethics ✓ Gender sensitivity ✓ Problem solver

Learning outcomes	At the end of the module the learner will be able to: 1. Prepare electrical vehicle charging station workplace 2. Assemble electrical vehicle charging station components 3. Maintain electrical vehicle charging station
Learning outcome 1: Prepare electrical vehicle charging station workplace	**Learning hours: 10**
Indicative content	

- **Introduction of electrical vehicle charging station**

✓ Definition of key terms

✓ Classification

✓ Components

✓ Working principles

✓ Applications

✓ Advantages and disadvantages

✓ Introduction of electrical vehicles

- Types
- Working principle
- Energy storage
- Electrical drives

- **Interpretation of electrical vehicle charging station drawing**
  - ✓ Introduction to electrical vehicle charging station
    - Definition of key terms
    - Description of electrical vehicles
    - Description of electrical vehicle charging station
    - Advantages and disadvantages
  - ✓ Analysis of electrical vehicle charging station drawings
    - Description of electrical symbols
    - Types of diagrams
    - Review of electrical vehicle charging station drawings

- **Conduction of site visit**
  - ✓ Site inspection techniques
    - Availability of energy resources
    - Physical inspection
    - checking and measurement
  - ✓ Site visit report

- **Implementation of Hazard and safety control**
  - ✓ Identification of workplace hazard
  - ✓ Safety measures
- **Selection of tools, materials and equipment**
  - ✓ Tools
    - Types

- Applications

✓ Materials

- Types
- Applications

✓ Equipment

- Types
- Application

✓ Selection criteria

- Quality standard
- Safety
- Compatibility
- Functionality

- **Setting out the EV charging station site**

✓ Clearing the site

- Environmental Protection standards
- Safety Measures
- Vegetation and debris Removal

✓ Leveling the ground

- Checking for Level
- Compaction

✓ Layout of charging base station

Site demarcation

- Excavation
- Construction of the bases

Resources required for the learning outcome	
Equipment	Personal Protective Equipment (PPE), Insulation tester, First aid, Multi-meter, Frequency meter, Clamp meter, Earth resistance meters, Ladder, Computer, cable fault locater, Office equipment, compactor, Voltage Tester.
Materials	Circuit breakers (MCCB, RCD, MCBO and MCB) Switches, Socket outlet, Wires/conductor, PVC pipe and fittings, Cable tray, Papers, Insulating tape, Contactors, Relays, Earth rods, Din Rail, Surge arrester, Phase monitor, Cable trunk, Screws, cable ties, Drill bit, Lightening arrester unit, bolt and nut, cable lugs Cement, concrete iron, , 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 ,Water and Crushed stone and silicon
Tools	Tape measure, Grass slasher, Axe, pick axe, Spade, Hoe, Pegs, Rope, hammers, Spirit level, Steel rulers, Screwdrivers, pliers, Crimping tools, Hack saw, Electrician knife, Allen key, drawing tools, Machete, spanners, drawing software, Phase tester, silicon gun, cleaning tools, wheelbarrow, Mixer and Conduit Benders

Facilitation techniques	• Demonstration • Brainstorming • Individual and group work • Practical exercise • Trainer guided • Group discussion • etc
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Product based assessment • Project based assessment

Learning outcome 2: Assemble electrical vehicle charging station components	Learning hours: 40

Indicative content

- **Fixation of electrical vehicle charging station Components**

  - ✓ Fabrication of Support structure
  - ✓ Mounting technics
    - Ground mounting
    - Pole mounting
    - Wall mounting
  - ✓ Applying Fixation techniques
    - By bolt and nut
    - By screws
    - By welding
  - ✓ Fixing Power supply unit
    - Distribution board
    - Voltage regulator
  - ✓ Fixing Electrical vehicle charger
  - ✓ Fixing lightning protection systems.

- **Laying of electrical cables**

  - ✓ Plan the route
  - ✓ Selection of electrical cables, conduits and fittings
  - ✓ Fix conduits and fitting
  - ✓ Laying cables

✓ Labeling

- **Interconnection of electrical vehicle charging station components**

  ✓ Connecting internal components of distribution board

  - Circuit breakers
  - Surge arrester
  - Switches
  - Phase monitor

  ✓ Connecting internal component of electrical vehicle charger

  - Protection unit
  - Filter
  - Rectifier
  - DC to DC converter
  - Control unit system
  - User interface

  ✓ Connection of electrical vehicle charging station components

  - Voltage regulator
  - Distribution board
  - Electrical vehicle charger

Resources required for the indicative content	
Equipment	Personal Protective Equipment (PPE), Insulation tester, First aid, Multi-meter, Frequency meter, Clamp meter, Earth resistance meters, Ladder, Computer, Fault locator, Office equipment, Voltage Tester, 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
Materials	Circuit breakers (MCCB, RCD, and MCB) Switches, Socket outlet, Wires/conductor, PVC pipe and fittings, Cable tray, Papers, Insulating tape, Contactors, Relays, Earth rods, Din Rail, Surge arrester, Phase monitor, Cable trunk, Screws, cable ties, Drill bit, Lightening arrester unit, bolt and nut, cable lugs and silicon
Tools	Tape measure, hammers, Spirit level, Screwdrivers, pliers, Crimping tools, Hack saw, Electrician knife, Allen key, spanners, Phase tester, silicon gun, and Conduit Benders
Facilitation techniques	• Demonstration • Brainstorming • Individual and group work • Practical exercise • Trainer guided • Group discussion • etc

Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Product based assessment • Project based assessment

Learning outcome 3: Maintain electrical vehicle charging station	**Learning hours: 20**

Indicative content

- **Interpretation of user guide of electrical vehicle charging station**

  - ✓ Maintenance Instructions
    - Regular Visual inspection
    - Cleaning instructions
    - Electrical safety checks
  - ✓ Review the charging station parameters setting
    - Voltage
    - Current
    - Frequency
    - Temperature
  - ✓ Review Troubleshooting Tips
    - power supply
    - protection system
    - connections
    - error messages
    - charging cable

- **Performance of preventive maintenance**

  - ✓ General Inspection of electrical vehicle charging station
  - ✓ Maintenance Schedules
  - ✓ Conducting of planned maintenance

- **Performance of Corrective maintenance**
  - ✓ Interpretation of user interface
  - ✓ Checking the charging station parameters setting
    - Voltage
    - Current
    - Frequency
    - Temperature
  - ✓ Checking electrical vehicle charging station components status
    - power supply
    - protection system
    - connections
    - User interface
    - charging cable
  - ✓ Analyse root cause of failures
  - ✓ Repairing or replacing damaged parts

- **Conducting functionality test**
  - ✓ Testing of electrical components
  - ✓ Testing electrical vehicle charger
  - ✓ Monitoring charging process
  - ✓ Checking metering and billing system
- **Elaborating E-V charging station report**
  - ✓ Reporting method
  - ✓ Recording Data
  - ✓ Draw as built diagram
  - ✓ Detailed report
  - ✓ Commissioning process

Equipment	Personal Protective Equipment (PPE), Insulation tester, First aid, Multi-meter, Frequency meter, Clamp meter, Earth resistance meters, Computer, Fault locator, Office equipment, Voltage Tester, 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 EV charger user interface
Materials	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
Tools	Tape measure, Spirit level, Steel rulers, Screwdrivers, pliers, Crimping tools, Electrician knife, Allen key, drawing tools, spanners, drawing software, Phase tester, cleaning tools and wheelbarrow
Facilitation techniques	• Demonstration • Brainstorming • Individual and group work • Practical exercise • Trainer guided • Group discussion • Etc

Formative assessment methods	● Written assessment ● Oral presentation ● Performance assessment ● Product based assessment ● Project based assessment

Integrated/Summative assessment

Integrated situation

The government of Rwanda has a project to construct a green city in the Kinyinya sector to mitigate climate change by reducing CO2 emissions from petrol vehicles. To achieve this goal, the government has hired contractors with expertise in the electric vehicle business to construct suitable electrical vehicle charging stations. The transportation system will utilize electric vehicles instead of petrol vehicles

For this reason, a private sector 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 at kinyinya sector, Gasharu cell. 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 8 hours.

Resources

Tools	Tape measure, hammers, Spirit level, Steel rulers, Screwdrivers, pliers, Crimping tools, Hack saw, Electrician knife, Allen key, drawing tools, spanners, drawing software, Phase tester, silicon gun and cleaning tools.
Equipment	Personal Protective Equipment (PPE), Insulation tester, First aid, Multi-meter, Frequency meter, Clamp meter, Ladder, Computer, Office equipment, Voltage Tester, Electronic protection unit, EV battery charger electronic filter, EV battery charger rectifier, DC to DC converter, EV charger controller, Distribution board panel, Electrical vehicle charger panel and EV charger user interface
Materials/ Consumables	Circuit breakers (MCCB, MCBO and MCB) outlet, Wires/conductor, PVC pipe and fittings, Papers, Insulating tape, Contactors, Din Rail, Surge arrester, Phase monitor, Cable trunk, Screws, cable ties, Drill bit, bolt and nut, cable lugs and silicon

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1. Prepare electrical vehicle charging station workplace	1.1. Drawings are correctly interpreted based on designer's installation guide	electrical vehicle charging station drawings are interpreted			3
	1.2. Site visit is correctly conducted according to installation requirements	Site vist is conducted			3
	1.3. Hazard and safety control are properly imple0mented according to the installation requirements	Workplace hazards are identified			3
		Safety measures are applied			3
	1.4. Equipment, tools and materials are well selected according to installation requirements	Tools are selected			2
		Materials are selected			2
		Equipments are selected			2
	1.5. Site is correctly set out according to the installation requirements	EV charging station site is set out			3
2. Assemble electrical vehicle charging	2.1. Components of electrical vehicle charging station are properly fixed according to the drawing	Support structures are fixed			3
		Power supply unit is fixed			3
		Voltage Regulator is fixed			3

station components		Electrical vehicle charger is fixed			3
	2.2. Cable of electrical vehicle charging station are properly laid according to the drawing and laying method	Electrical cables and conduits are selected			3
		conduits are fixed			3
		Electrical cables are laid			3
	2.3. Components of electrical vehicle charging station are properly interconnected according to the drawing	Internal component of distribution board are connected			3
		Electronic protection unit of electrical vehicle charger is connected			3
		Electronic filter of electrical vehicle charger is connected			3
		Rectifier of electrical vehicle charger is connected			4
		DC to DC converter of electrical vehicle charger is connected			4
		User interface of electrical vehicle charger is connected			4
		Voltage regulator is connected			3

		Distribution board is connected			3
		EV charger is connected			4
3. Maintain electrical vehicle charging station	3.1. The electrical vehicle charging station user guide is Properly interpreted based on the manufacturer's instructions	Charging Process is interpreted			3
	3.2. Functionality test of electrical vehicle charging station system is properly conducted in accordance to the design performance	Electrical components are tested			3
		Electrical vehicle charger is tested			4
		charging process is monitored			3
	3.2. The report of E-V charging station system is correctly elaborated according to the reporting techniques	Data are recoded			3
		As built diagram is drawn			3
		Detailed report is elaborated			4
		Commissioning is conducted			4
Total marks					
Percentage Weightage					100%
Minimum Passing line % (Aggregate):				70%	

References

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Author's Note Page

Employable Skills for Sustainable Job Creation

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