

SOLAR PV SYSTEMS INSTALLATION

UNIT CODE: 0713 351 08A

TVETCDACC UNIT CODE: ENG/CU/SPV/CR/02/4/MA

UNIT DURATION: 140 HOURS

Relationship to Occupational Standards

This unit addresses the Unit of Competency: install solar PV systems

Unit Description

This unit covers the competences required in Install Solar PV Systems. Competences include; applying electrical concepts, constructing Solar PV support structures, installing Solar PV system components and maintaining solar PV system.

Summary of Learning Outcomes

By the end of this unit of learning the trainee will be able to:

S/NO	Learning Outcome	Duration (Hours)
1.	Apply basic electrical concepts	20
2.	Construct Solar PV support structures	40
3.	Install Solar PV system component	60
4.	Maintain solar PV system	20
	TOTAL	140

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply basic electrical concepts	1.1 The meaning of SI unit 1.2 SI unit of various types of Electrical parameters 1.2.1 Power – Watts (W) 1.2.2 Current – Amperes (A) 1.2.3 Resistance – Ohms(Ω) 1.2.4 Voltage – Volts (V) 1.3 Identification of Quantities of Charge, force, work and power 1.4 Ohm's law 1.5 Calculations involving parallel and series circuits 1.6 Calculations involving various Electrical parameters e.g. Power, Current, Voltage, Resistance	• Practical demonstration • Projects • Written tests Oral test
2. Construct Solar PV support structures	2.1 Safety Procedures 2.2 Tools and equipment 2.2.1 Hydrometer 2.2.2 Inclinator 2.2.3 Compass 2.3 Types of mounting structures 2.3.1 Rooftop 2.3.2 Ground 2.3.3 Solar roof system 2.3.4 Steel ground racks 2.3.5 Pole mounting 2.4 Solar PV Battery structures	• Practical demonstration • Projects • Written tests • Oral Questioning
3. Install Solar PV system components	3.1 Planning to install 3.2 Pre-installation checks 3.3 Solar Panel Mounting positioning 3.4 security of the panels	• Practical demonstration • Projects • Written tests

	3.5 Methods of solar panel connection 3.5.1 Parallel and series 3.6 Components of solar system mounting and installation 3.6.1 Charger controller 3.6.2 Inverters 3.6.3 Solar batteries e.g Maintenance free, Flooded type, Series connection up to 24v/1000wp, Parallel connection up to 24v/1000wp, Series-parallel connection up to 24v/1000wp 3.7 Cables 3.8 Lay Electrical cables 3.8.1 Cable laying tools 3.8.2 Cable segregation 3.8.3 Cable labelling 3.9 Mount Solar panel 3.9.1 Installation of Solar panel 3.9.1.1 Slanting angle/tilt angle 3.9.1.2 Panel Ratings 3.10 Terminate solar Electrical cables 3.10.1 Meaning of terms 3.10.2 Cable lugging 3.10.3 Solar Cable connectors 3.11 Lightening arrestors base installation 3.11.1 Rod gap arrester 3.11.2 Earth Rod 3.11.3 Surge arrestor (SPD) 3.12 Housekeeping 3.12.1 Waste disposal 3.12.2 Recycle 3.12.3 Reuse	• Oral Questioning
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	3.12.4 Reduce	
4. Maintain solar PV system	4.1 Materials e.g pure water, soft bristle brushes, microfiber cloths or sponges, calcium, grease 4.2 Tests 4.2.1 Continuity test 4.2.2 Insulation resistance test 4.2.3 Polarity test 4.2.4 Short circuit systems (Isc) 4.2.5 Open circuit voltage (Voc) 4.2.6 Battery voltage and current 4.3 Maintenance of; 4.3.1 Solar modules 4.3.2 Solar batteries maintenance 4.3.3 Inverter maintenance 4.3.4 Charge controller maintenance 4.4 Maintenance records 4.4.1 Maintenance checklist 4.4.2 Maintenance reports	• Practical • demonstration • Projects • Written tests • Oral Questioning

Suggested Methods of Instruction

1. Practical
2. Projects
3. Demonstrations
4. Group discussion
5. Direct instructions
6. Field trips
7. On-job-training

Recommended Resources for 25 Trainees

S/No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
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A	Learning Materials			
1.	Textbooks	Solar Electric Handbook by Solar energy International B. Scaddan Electrical installation work J. Hyde Electrical installation Principles and Practices	5 pcs	1:5
2.	Installation manuals	Solar PV manuals	5 pcs	1:5
3.	Charts	Single line diagram Solar PV layout Circuit diagrams Colour codes	1 pc for each	1:25
4.	Power point presentations	For trainer's use	1	1:25
B	Learning Facilities & infrastructure			
5.	Lecture/theory room	50m ²	1	1:25
6.	Workshop	150m ²	1	1:25
7.	Laboratory	100m ²	1	1:25
8.	Site			
C	Consumable materials			
9.	Electrical wires	1.5mm ² (red, black green)	5 rolls	1:5
		2.5mm ² (red, black green)	5 rolls	1:5
		4.0 mm ² (red, black green)	3 rolls	1:10
		6.0 mm ² (red, black green)	2 rolls	1:12

		10 mm ² (red, black green)	2 rolls	1:12
10.	Insulation tapes		25 pcs	1:1
11.	Accessories	Switches, sockets, Junction boxes, Consumer units, Lamp holders, Patrice boxes, Circuit breakers	25 pcs	1:1
12.	Solar Panels		10	1:3
13.	Charge controller		10	1:3
14.	Batteries		10	1:3
15.	Inverter		10	1:3
16.	Mounting racks		10	1:3
17.	Pipes and trunkings	PVC conduits, Steel conduits, Mini trunking	25 pcs	1:1
18.	Materials and supplies	Clamp clips, Cable ties, Conduits, Bolt and nuts, Wall plug, Mounting brackets, cable lugs, racks, solar spacer, mounting spacer, ground mount pipe caps, cleaning kit, Locking tool clip, Permanent roof anchor	10	1:3
D	Tools and Equipment			
19.	Hacksaws		25 pcs	1:1
20.	Striping knives		25 pcs	1:1
21.	Side cutters		25 pcs	1:1
22.	Pliers		25 pcs	1:1
23.	Tape measure		25 pcs	1:1

24.	Try Square		25 pcs	1:1
25.	Spirit level		25 pcs	1:1
26.	Assorted Screw driver		25 pcs	1:1
27.	Assorted hammers		25 pcs	1:1
28.	MC4 Crimping tools		5 pcs	1:5
29.	PPEs		25 pcs	1:1
30.	Multimeters		5 pcs	1:5
31.	Irradiance meter		5 pcs	1:5
32.	Insulation resistance tester		5 pcs	1:5
33.	Polarity tester		5 pcs	1:5
34.	Clamp meter		5 pcs	1:5
35.	Thermal camera		5 pcs	1:5
36.	Inclinometer		5 pcs	1:5
37.	Ladder		5 pcs	1:5
38.	ballast block carrier		5 pcs	1:5
39.	Module mover		5 pcs	1:5
40.	Vent pipe cutter		5 pcs	1:5
41.	Flat pry bar		5 pcs	1:5
42.	Battery operated drill		5 pcs	1:5
43.	Safety harness		25 pcs	1:1