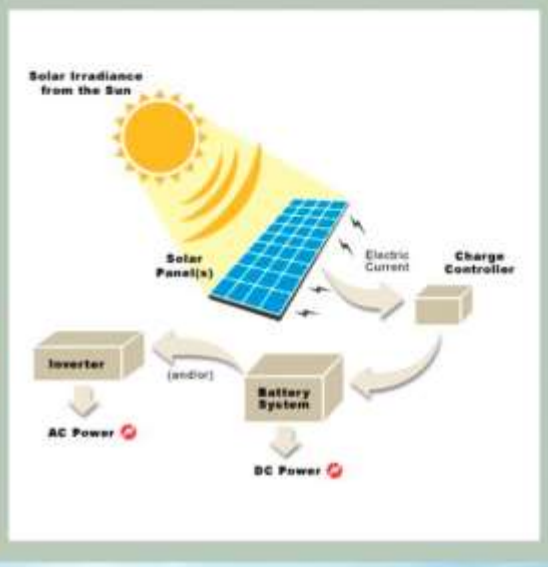
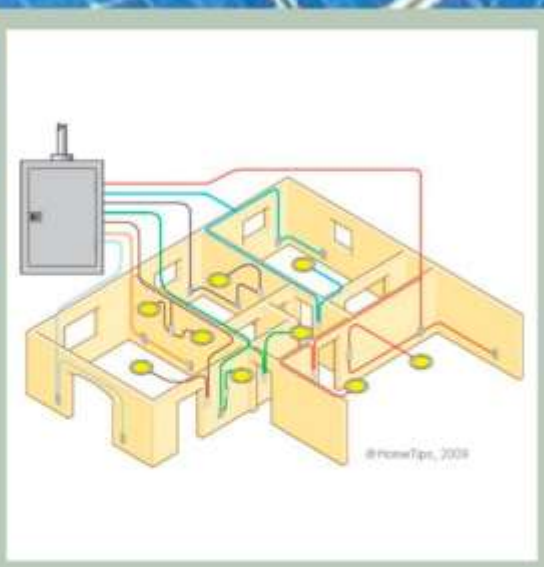
National Vocational Certificate level 4, in
(Electrical Technology)

Building Electrician - Solar PV System Technician





National Vocational and Technical Training Commission (NAVTTC)
Government of Pakistan

Quality Assessed by:

Mr. Muqeem-ul-Islam
Director General (Skills, Standards and Curricula
NAVTTC, Islamabad

Mr. Muhammad Naeem Akhtar
Senior Technical Advisor (QA)
TVET Sector Support Programme, Islamabad.

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Table of Contents

TITLES OF QUALIFICATIONS

i) National Vocational Certificate level 1, in (Electrical Technology) “Building Electrician - Solar PV System Technician”
ii) National Vocational Certificate level 2, in (Electrical Technology) “Building Electrician - Solar PV System Technician”
iii) National Vocational Certificate level 3, in (Electrical Technology) “Building Electrician - Solar PV System Technician”
iv) National Vocational Certificate level 4, in (Electrical Technology) “Building Electrician - Solar PV System Technician”

INTRODUCTION

Solar energy has been making headlines across the world for the last few years. The global installed capacity of solar photovoltaic (PV), also termed solar cells, has grown from 5GW to more than 400GW. This phenomenal success owes to wide-ranging factors; most importantly, conducive policies, technological advancements and economy of scale. Solar PV system is now becoming financially competitive with conventional forms of power generation. Dubai, for example, is currently developing an 800MW through solar PV project with a power purchase agreement signed at less than three US cents per kW hour.

Solar radiation, or level of sunshine, is the resource or fuel for solar energy systems. Accurate measurement and analysis of this resource are fundamental to achieve the anticipated performance. However, there are other important parameters that also need to be taken into account to predict and evaluate a system’s performance and this is often where mistakes are made.

The solar industry of Pakistan has nearly doubled in size every year for the past five years, and this trend is expected to continue in future, so there are opportunities for how to become a Solar PV Technician.

Solar PV System Technician determines the design of the array and performs the installations. The process to become a Solar PV System Technician mostly depends on where an individual wants to install residential solar systems. Internationally becoming a solar energy professional sometimes requires a license specific to solar PV installment. Pakistan regulates its own solar installation and safety processes, it might be different from other world rules and regulations, hence required no license but a certificate in this qualification can provide ample of employment opportunities.

The qualification of Building Electrician – Solar PV System Technician is developed based on solar energy sector’s demand on the pattern of competency based training under national vocational qualification framework (NVQF). It carries a learning volume of 1000 hours i.e. 6 hours per day and five days a week means 33.4 weeks which is almost 8 months and four months is recommended as internship.

Solar PV System Technician plays a vital role in the installation and maintenance of Solar PV System and Electrical appliances. The increased use of solar energy has maximize the demand of Solar PV Technician having the skills to install and maintain solar photovoltaic systems, thus, meeting the ever-growing demand of industry. This course has been design and developed to achieve its objectives of providing appropriate skills. The pass out of this course would be able to:

- Work in small & big construction units as Solar PV Technician
- Work as building electrician in an electrical outfit / company / organization
- Work as building electrician with construction contractor
- Be self employed by having own electrical / wiring workshop

Training in the course is based on defined competency standards, which are industry oriented. The traditional role of a trainer changes and shifts towards the facilitation of training. A trainer encourages and assists trainees to learn for themselves. Trainees are likely to work in groups (pairs) and all doing something different. Some are doing practical tasks in the workshop, some writing, some not even in the classroom or workshop but in another part of the building using specialist equipment, working on computers doing research on the Internet or the library. As trainees learn at different pace they might well be at different stages in their learning, thus learning must be tailored to suit individual needs. The following facilitation methods (teaching strategies) are generally employed:

- **Direct Instruction Method:** This might be effective when introducing a new topic to a larger group of trainees in a relative short amount of time. In most cases this method relies on one-way communication, hence there are limited opportunities to get feedback on the trainee's understanding.
- **Discussion Method:** This allows trainees to actively participate in sharing knowledge and ideas. It will help the trainer to determine whether trainees understand the content of the topic. On the other hand, there is a possibility of straying off topic under discussion and some trainees dominating others on their views.
- **Small Group Method:** Pairing trainees to help and learn from each other often results in faster knowledge/skill transfer than with the whole class. The physical arrangement of the classroom/workshop and individual assessment may be challenging. Analogy method should be in corporate.
- **Problem Solving Method:** This is a very popular teaching strategy for the training. Trainees are challenged and are usually highly motivated when they gain new knowledge and skills by solving problems (Contingency skills). Trainees develop critical thinking skills and the ability to adapt to new learning situations (Transfer skills). It might be time consuming and because trainees sometimes work individually, they may not learn all the things that they are expected to learn.
- **Research Method:** This is used for workshops and laboratory tasks, field experiments, and case studies. It encourages trainees to investigate and find answers for themselves and to critically evaluate information. It however requires a lot of time and careful planning of research projects for the trainee.

The detail of the competency standards included in these qualifications are given below:

National Vocational Certificate level 1, in (Electrical Technology) "Building Electrician - Solar PV System Technician"

A. Maintain safety, health and cleanliness
B. Communicate in different work contexts
C. Apply a problem solving method
D. Apply basic reading, writing and speaking skills in English in different life contexts
E. Apply basic numeracy skills in different life contexts
F. Demonstrate positive workplace attitude and behaviours
G. Carry out maintenance procedures as Building Electrician (Helper)
H. Produce a plan for career options related to a Building Electrician

National Vocational Certificate level 2, in (Electrical Technology) "Building Electrician - Solar PV System Technician"

A. Maintain workplace safety
B. Apply continuing professional development
C. Perform preventive maintenance as part of electrical operations
D. Perform corrective maintenance as part of electrical operations
E. Test electrical and electronic parameters
F. Install solar panel
G. Assemble electrical appliances
H. Perform installation of electrical products and appliances
I. Install domestic wiring
J. Use and maintain electrical tools and equipment
K. Solar PV Fundamentals
L. Off-grid Solar PV Systems with battery storage
M. Operation and maintenance of off-grid solar PV systems

National Vocational Certificate level 3, in (Electrical Technology) "Building Electrician - Solar PV System Technician"

A. Apply knowledge of entrepreneurial ideas
B. Plan work and calculate cost
C. Install three-phase wiring
D. Perform distribution of electrical supply
E. Perform corrective maintenance as part of electrical operations
F. Designing and installation of off-grid solar PV systems

National Vocational Certificate level 4, in (Electrical Technology) "Building Electrician - Solar PV System Technician"

A. Conduct site assessment for solar PV installation
B. Develop basic solar PV system design
C. Interpret job document
D. Install solar PV system
E. Perform PV system wiring
F. Troubleshoot Solar PV system
G. Maintain solar PV system
H. Adopt safety precautions
I. Develop basic entrepreneurial skills

PURPOSE OF THE QUALIFICATION

The purpose of the training is to provide skilled manpower to improve the existing solar PV system related industry. This will improve the quality of solar PV system technician in terms of consumer's acceptability and willingness in Pakistan. The availability of such quality of technician in the local and international markets will ultimately bring economic benefits to the producers and processors.

The core purpose of this qualification is to produce employable Building Electrician with solar PV system, who could provide advanced installation and maintenance services of solar PV system, including off-grid solar photovoltaic (PV) system installation. In addition this qualification will prepare unemployable youth to employee in construction industry or as an entrepreneur. To prepare and train students through skill training and enabling them to earn their living either through employment in industry or be self-employed as an electrician.

MAIN OBJECTIVES OF THE QUALIFICATION

Solar PV System Technician qualification consists of theoretical and practical details required for the conduct of assessment survey, PV System installation, troubleshooting and maintenance of solar photovoltaic and UPS systems. The main objectives of the qualification are as follows:

- Conduct site assessment for Solar PV system installation
- Develop basic solar PV system design
- Interpret job document
- Install Solar PV System
- Perform Solar PV System Wiring
- Troubleshoot Solar PV System
- Maintain Solar PV system
- Perform Safety measure during electric work
- Develop basic Entrepreneurial skills

DATE OF VALIDATION

The level 4 of national vocational qualification on Building Electrician – Solar PV system technician has been validated by the Qualifications Development Committee (QDC) members on 16th and 17th of November 2017 and will remain in currency until December 2020

CODES OF QUALIFICATIONS

The International Standard Classification of Education (ISCED) is a framework for assembling, compiling and analyzing cross-nationally comparable statistics on education and training. ISCED codes for these qualifications are assigned as follows:

ISCED Classification Building Electrician - Solar PV System Technician	
Code	**Description**
0713E&E13	National Vocational Certificate level 1, in (Electrical Technology) "Building Electrician - Solar PV System Technician"
0713E&E14	National Vocational Certificate level 2, in (Electrical Technology) "Building Electrician - Solar PV System Technician"
0713E&E15	National Vocational Certificate level 3, in (Electrical Technology) "Building Electrician - Solar PV System Technician"
0713E&E16	National Vocational Certificate level 4, in (Electrical Technology) "Building Electrician - Solar PV System Technician"

MEMBERS OF QUALIFICATIONS DEVELOPMENT COMMITTEE

The following members participated in the qualifications development and validation of these qualifications:

Sr. No.	Name	Designation	Organization
1.	Engr. Safdar Queshi	CEO	Safroon Energy Services (Pvt.) Ltd. Peshawar
2.	Malik Sameen Khan	CEO	Sky Green Nowshera
3.	Mr. Saeed Khan	Regional Coordinator	REAP Pakistan, Nowshera
4.	Mr. Qasim Sattar	Manager	Total Engineering solutions Peshawar
5.	Engr. Asfandyar Khan	Senior Engineer	SPT Solar Wing Peshawar
6.	Engr. Ashraf Khan	Instructor	GATTC Hayyatabad Peshawar
7.	Mr. Muhammad Sadiq Orakzai	Principal	GATTC Hayyatabad Peshawar
8.	Mr. Wishal Khan	Instructor	GATTC Hayyatabad Peshawar
9.	Engr. Shahab	Project Engineer	Renewable Power, Peshawar
10.	Mr. Muhammad Ayazz Khan	Instructor	GATTC Hayyatabad Peshawar
11.	Mr. Muhammad Sohail	TTO	Trade testing Board Peshawar
12.	Mr.Sajjad Ali	PD	Ali Haider and Co, Peshawar
13.	Engr. Abdul Maqsood	Principal	GPI Mardan
14.	Mr. Naveed Khan	Technician	Safroon Energy (Pvt.) Ltd. Peshawar
15.	Ms. Bisma Sahir	CEO	Akhund Consultant, Faisalabad
16	Mr. Sohaib Fida Khan Tanoli	Technical Advisor	GIZ Pakistan Peshawar

17.	Mr. Muhammad Naeem Akhtar	Sr. Technical Advisor	GIZ, Islamabad
18.	Dr. Faheem Ahmed	Director General	NAVTTC, Regional Office Peshawar

ENTRY REQUIREMENTS

The entry for National Vocational Certificate level 1-4, in (Electrical Technology) "Building Electrician - Solar PV System Technician" are given below:

Title	Entry requirements
National Vocational Certificate level 1, in (Electrical Technology) "Building Electrician - Solar PV System Technician"	Entry for assessment for this qualification is open. However, entry into formal training institutes, based on this qualification may require skills and knowledge equivalent to matric (Grade 10) with some working knowledge of this field.
National Vocational Certificate level 2, in (Electrical Technology) "Building Electrician - Solar PV System Technician"	Entry for assessment for this qualification is open. However entry into formal training institute for this qualification is person having National Vocational Certificate level 1, in (Electrical Technology) "Building Electrician - Solar PV System Technician".
National Vocational Certificate level 3, in (Electrical Technology) "Building Electrician - Solar PV System Technician"	Entry for assessment for this qualification is open. However entry into formal training institute for this qualification is person having National Vocational Certificate level 2, in (Electrical Technology) "Building Electrician - Solar PV System Technician". In addition to this the person must have matriculation with fundamental knowledge of electricity and electronics can also apply. In addition to this he/she must be computer literate and have knowledge of basic concepts of electricity

	and electronics.
National Vocational Certificate level 4, in (Electrical Technology) "Building Electrician - Solar PV System Technician"	Entry for assessment for this qualification is open. However entry into formal training institute for this qualification is person having National Vocational Certificate level 3, in (Electrical Technology) "Building Electrician - Solar PV System Technician". In addition to this the person must have matriculation with fundamental knowledge of electricity and electronics can also apply. In addition to this he/she must be computer literate and have knowledge of basic concepts of solar PV system.

REGULATIONS FOR THE QUALIFICATION

- Net metering Policy of Pakistan
- Net metering laws of Pakistan
- Pakistan's Feed in Tariffs (FITs)
- Pakistan's renewable power policy and regulatory frameworks
- The Management of Health and Safety at Work Regulations 1992.
- Environment Protection Agency.
- National Electric Power Regulatory Authority (NEPRA)

(It is the mandate of NEPRA to prescribe separate performance standards for generation, transmission and distribution for safe, efficient and reliable supply of electric power. There is a provision of penalty in NEPRA act to power service providers not adhering to prescribed standards. According to section 7(2)(c) , 34, 46 (2) & 35 of NEPRA Act (XL of 1997) , the NEPRA has established performance standards for Generation, Transmission, and Distribution Licensees and has also developed Industry Standards & Code of Conduct i.e Grid Code & Distribution Code).

- Performance Standards (Generation) rules 2009

SUMMARY OF COMPETENCY STANDARDS

Code	Competency Standards	Level	Credits	Category
0713E&E13A	Maintain safety, health and cleanliness	1	10	Functional
0713E&E13B	Communicate in different work contexts	1	5	Generic
0713E&E13C	Apply a problem solving method	1	4	Functional
0713E&E13D	Apply basic reading, writing and speaking skills in English in different life contexts	1	5	Generic
0713E&E13E	Apply basic numeracy skills in different life contexts	1	2	Generic
0713E&E13F	Demonstrate positive workplace attitude and behaviours	1	3	Generic
0713E&E13G	Carry out maintenance procedures as Building Electrician (Helper)	1	9	Technical
0713E&E13H	Produce a plan for career options related to a Building Electrician	1	2	Functional
	TOTAL	1	40	3 months
0713E&E14A	Maintain workplace safety	2	8	Functional
0713E&E14B	Apply continuing professional development	2	3	Generic
0713E&E14C	Perform preventive maintenance as part of electrical operations	2	10	Technical
0713E&E14D	Perform corrective maintenance as part of electrical operations	2	10	Technical
0713E&E14E	Test electrical and electronic	2	10	Technical

	parameters			
0713E&E14F	Install solar panel	2	13	Technical
0713E&E14G	Assemble electrical appliances	2	8	Technical
0713E&E14H	Perform installation of electrical products and appliances	2	10	Technical
0713E&E14I	Install domestic wiring	2	10	Technical
0713E&E14J	Use and maintain electrical tools and equipment	2	8	Functional
	TOTAL	2	90	Six months
0713E&E15A	Apply knowledge of entrepreneurial ideas	3	8	Generic
0713E&E15B	Plan work and calculate cost	3	8	Functional
0713E&E15C	Install three-phase wiring	3	20	
0713E&E15D	Perform distribution of electrical supply	3	9	Technical
0713E&E15E	Perform corrective maintenance as part of electrical operations	3	15	Technical
0713E&E15F	Designing and installation of off-grid solar PV systems	3	20	Technical
	TOTAL	3	80	Six months
0713E&E16A	Conduct site assessment for Solar PV system installation	4	10	Technical
0713E&E16B	Develop basic Solar PV system design	4	10	Technical
0713E&E16C	Interpret job document	4	8	Technical
0713E&E16D	Install Solar PV System	4	20	Functional
0713E&E16E	Perform Solar PV System Wiring	4	20	Technical

0713E&E16F	Troubleshoot Solar PV System	4	10	Technical
0713E&E16G	Maintain Solar PV system	4	10	Technical
0713E&E16H	Adopt Safety Precautions	4	2	Functional
0713E&E16I	Develop basic Entrepreneurial skills	4	10	Generic
041600453	Occupational health and safety	2	3	Technical
041600455	Communicate in the workplace to support customers and team	3	6	Technical
041600459	Work effectively in a customer service - sales environment	3	7	Technical
041600460	Develop professionalism	3	3	Technical
041600461	Comply with health and safety regulations	3	2	Technical

Level 1-4 will take two years' time all together. But for those who will be eligible for entry at level 4 will take one year to get their certificate.

Packaging of NVQF

The packaging of competencies is given as follows:

Title	Packages of Competency Standards
National Vocational Certificate level 1, in (Electrical Technology) "Building Electrician - Solar PV System Technician"	0713E&E13A + 0713E&E13B+ 0713E&E13C + 0713E&E13D + 0713E&E13E + 0713E&E13F + 0713E&E13G + 0713E&E13H

National Vocational Certificate level 2, in (Electrical Technology) "Building Electrician - Solar PV System Technician"	0713E&E13A + 0713E&E13B+ 0713E&E13C + 0713E&E13D + 0713E&E13E + 0713E&E13F + 0713E&E13G + 0713E&E13H + 0713E&E14A + 0713E&E14B + 0713E&E14C + 0713E&E14D + 0713E&E14E + 0713E&E14F + 0713E&E14G + 0713E&E14H + 0713E&E14I + 0713E&E14J
National Vocational Certificate level 3, in (Electrical Technology) "Building Electrician - Solar PV System Technician"	0713E&E13A + 0713E&E13B+ 0713E&E13C + 0713E&E13D + 0713E&E13E + 0713E&E13F + 0713E&E13G + 0713E&E13H + 0713E&E14A + 0713E&E14B + 0713E&E14C + 0713E&E14D + 0713E&E14E + 0713E&E14F + 0713E&E14G + 0713E&E14H + 0713E&E14I + 0713E&E14J + 0713E&E15A + 0713E&E15B + 0713E&E15C + 0713E&E15D + 0713E&E15E + 0713E&E15F
National Vocational Certificate level 4, in (Electrical Technology) "Building Electrician - Solar PV System Technician"	0713E&E13A + 0713E&E13B+ 0713E&E13C + 0713E&E13D + 0713E&E13E + 0713E&E13F + 0713E&E13G + 0713E&E13H + 0713E&E14A + 0713E&E14B + 0713E&E14C + 0713E&E14D + 0713E&E14E + 0713E&E14F + 0713E&E14G + 0713E&E14H + 0713E&E14I + 0713E&E14J + 0713E&E15A + 0713E&E15B + 0713E&E15C + 0713E&E15D + 0713E&E15E + 0713E&E15F **+** 0713E&E16A + 0713E&E16B + 0713E&E16C + 0713E&E16D + 0713E&E16E + 0713E&E16F + 0713E&E16G + 0713E&E16H + 0713E&E16I

Competency Standard A: Conduct site assessment for solar PV system installation

Overview

This competency standard covers the skills and knowledge required to carry out load assessment, perform shadow analysis, assess wiring requirements and Identify the south direction for mounting structure.

Competency Units	Performance Criteria
A1: Carryout load assessment	***Trainee will be able to:*** **P1.** Determine nature of load **P2.** Identify rating of load **P3.** Measure running load **P4.** Calculate the load
A2: Perform shadow analysis	***Trainee will be able to:*** **P1.** Conduct physical visit of the site **P2.** Identify path of the shadow **P3.** Use shadow detector **P4.** Enquire about future developmental prospects
A3. Estimate wiring requirements	***Trainee will be able to:*** **P1.** Observe existing condition of wiring (If needed) **P2.** Workout length of the wire **P3.** Select appropriate size of the wire **P4.** Select appropriate type of the wire

	P5. Figure out required safety and control devices
A4. Identify the south direction for mounting structure	***Trainee will be able to:*** **P1.** Observe the location **P2.** Point out south direction by using compass

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

K1 Use of measuring instruments
K2 Measurements techniques
K3 Power rating of equipment
K4 Basic calculations by loads of devices
K5 Basic solar Mapping techniques
K6 Basic solar PV system
K7 Advantages of solar PV system
K8 Disadvantages of solar PV system
K9 Solar tracking system
K10 Basic Geometry
K11 Bore depth measurement techniques for solar pumps
K12 Types of solar pumps

Critical Evidence(s) Required

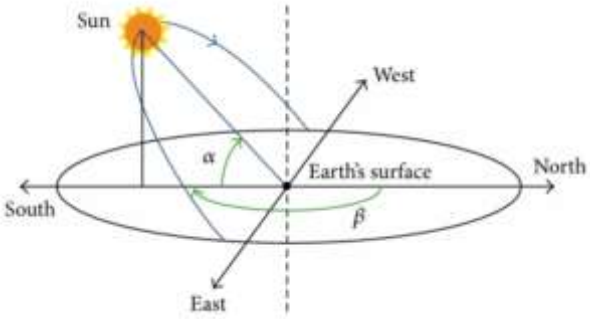
The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Report the observations to the assessor
- Identify south direction to by using appropriate tools
- Perform shadow analysis and explain it

Important points

- Don’t use the compass in presence of any magnetic material

- Site survey must be done at peak sun hours
- Safety precautions must be adopted during site survey
- In case of survey for Solar water pump draw down must be considered



Competency Standard B: Develop basic Solar PV System design

Overview

This competency standard covers the skills and knowledge required to calculate load, select panels, determine backup time, assess working schedule of load and workout of capacity of devices.

Competency Units	Performance Criteria
B1. Calculate load for solar PV system design	***Trainee will be able to:*** **P1.** Enlist the No. of appliances **P2.** Measure the PV system load **P3.** Calculate the PV system load **P4.** Record the PV system load
B2. Assess working schedule of load	***Trainee will be able to:*** **P1.** Inquire the load duty hours from customer **P2.** Determine the peak load hours **P3.** Observe peak sun hours
B3. Select Panels	***Trainee will be able to:*** **P1.** Select the type of PV panel **P2.** Determine the capacity of PV solar panel **P3.** Select number of PV solar panel
B4. Determine backup time	***Trainee will be able to:*** **P1.** Estimate the required backup time of load **P2.** Estimate the capacity of battery bank **P3.** Select the types of batteries for backup

B5. Draw basic design of solar PV System	***Trainee will be able to:*** **P1.** Workout capacities of devices **P2.** Sketch a diagram as per requirements **P3.** Get the design approve by the client

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

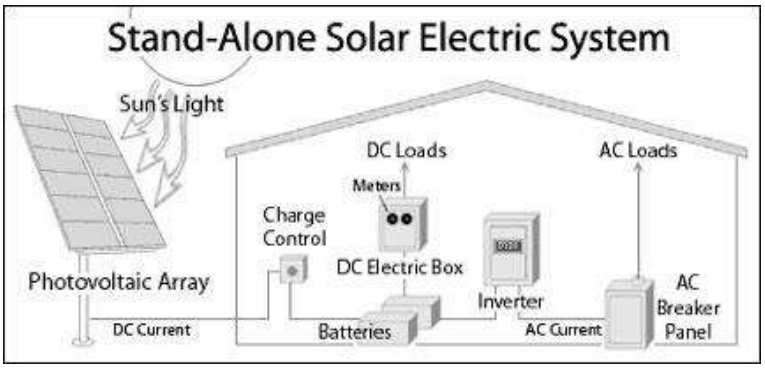
K1 Basic concepts of designing
K2 Types and uses of electrical appliances
K3 Types and uses of various Solar PV systems
K4 Knowledge of all electronics, electrical and mechanical symbols
K5 Basic calculations (Addition, subtraction, division and multiplication)
K6 Series and Parallel circuits
K7 Basic definitions of current and electric circuits
K8 Solar PV system installation

Critical Evidence(s) Required

- The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:
- Define Electricity, resistance and ohms law
- Randomly asked at least three electronics symbols and four electrical
- Calculate the load for a given electric appliances
- Calculate daily power consumption based on design
- Determine backup time for the given load
- Calculate no of solar panels for a given load
- Calculate battery bank for given backup time
- Types and uses of various drawing tools
- Explain schematic diagram with examples

Important points

- Be careful about shadow directions and its movements
- Understand any future developments around the location
- Basic concepts of electricity and electronics
- Complete data of survey must be kept in view while designing
- Design must be endorsed by the client once drafted
- Schematic diagram must be kept in view for designing



Competency Standard C: Interpret job document

Overview

This competency standard covers the skills and knowledge required to prepare checklist for the job, interpret schematic diagram, record the data and prepare log sheet for general maintenance.

Competency Units	Performance Criteria
C1. Prepare checklist for job	***Trainee will be able to:*** **P1.** Prepare list of material required **P2**. Prepare list of tools required **P3**. Prepare list of equipment required
C2. Interpret schematic diagram	***Trainee will be able to:*** **P1.** Read schematic diagram of wiring **P2**. Read schematic diagram of civil work **P3**. Read schematic diagram of mechanical work
C3. Record the data	***Trainee will be able to:*** **P1**. Collect the data **P2**. Enlist the data **P3**. Prepare report
C4. Prepare log sheet for general maintenance	***Trainee will be able to:*** **P1.** Prepare schedule of routine maintenance

P2. Identify the activities for conducting routine maintenance

P3. Prepare list of tools for routine maintenance

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

K1. Basic electrical symbols
K2. Basic electronics symbols
K3. Types of basic wiring diagrams
K4. Basic computer operations
K5. Types and uses of various drawing tools
K6. Methods of recording data

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Draw symbols for three given electrical components of assessors choice
- Draw symbols for three given electronics components of assessors choice
- Prepare a list of required tools and equipment for the given job

Important points

- Perform proper documentation complete in all respects
- Always use standard symbols
- Keep the design in view always while interpreting

Competency Standard D: Install Solar PV System

Overview

This competency standard covers the skills and knowledge required to arrange required tools and equipment, perform PV test, erect the mounting structure, fix PV modules and connect the PV modules as per circuit diagram.

Competency Units	Performance Criteria
D1. Arrange required tools and eqipment	***Trainee will be able to:*** **P1.** Collect the required tools and equipment **P2.** Check physical status of tools and equipment **P3**. Perform transportation of tools and equipment **P4**. Manage safe storing of tools and equipment
D2. Perform PV test	***Trainee will be able to:*** **P1**. Conduct short circuit current test **P2**. Conduct open circuit voltage test
D3. Erect the mounting structure	***Trainee will be able to:*** **P1**. Assemble the structure parts **P2.** Fix mounting structure **P3**. Adjust angles of the mounting structure

D4. Fix PV modules as per circuit design	***Trainee will be able to:*** **P1**. Install PV module on the mounting structure **P2.** Verify angle of the PV module with the help of angle finder/meter **P3**. Ensure shadow overlapping
D5. Install Battery Bank	***Trainee will be able to:*** **P1**. Arrange batteries with accessories as per requirements **P2.** Fix battery bank in the racks **P3**. Make parallel series strings for batteries, as per circuit design
D6. Install invertor / charge controller / variable frequency drive (VFD)	***Trainee will be able to:*** **P1**. Arrange invertor and charge controller in variable frequency drive (VFD) **P2.** Fix invertor and charge controller in variable frequency drive (VFD) **P3**. Ensure fixation as per circuit design
D7. Install Solar PV Pumps	***Trainee will be able to:*** **P1**. Arrange Solar pumps as per desired capacity **P2.** Fix Solar pumps

	P3. Ensure fixation of Solar pumps as per circuit design
D8. Connect the PV modules as per circuit design	***Trainee will be able to:*** **P1**. Make strings as per circuit design **P2.** Make arrays as per circuit diagrams **P3**. Connect arrays with junction boxes

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

K1. Installation related tools and equipment
K2. Types of PV panels
K3. Mounting materials
K4. Installing electronics Components
K5. Types of mounting
K6. Types of solar pumps and their capacities
K7. Uses of installation tools
K8. Effect of shadows on PV Panels
K9. Effect of dust and moisture on PV Panels
K10. Types of solar PV systems (On/off grid, with and without back up, stand alone,)
K11. Net metering (Smart meters)

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify required tools for the given job

- Assemble the mounting structure
- Install PV panel on the mounting structure
- Fix the mounting structure for maximum output power
- Verify PV module specifications test (short circuit current & open circuit voltage test)
- Interconnect the battery bank as per requirement
- Interconnect the battery bank, PV module and utility with invertor for a desired output load
- Configure the invertor according to the given job
- Interpret the circuit diagram
- Prepare solar PV array for a water pump and explain it
- Interconnect the PV array, VFD and pump
- Configure the VFD
- Explain Solar PV system

Important points

- Take care of proper insulation at all stages
    - Cables
    - Accessories
- Tools
- Ensure proper tightening of all nut bolts
- Ensure proper levelling of all items, as per standards

Competency Standard E: Perform wiring of Solar PV System

Overview

This competency standard covers the skills and knowledge required to interpret wiring diagram, lay cables, perform wiring test, carryout battery test, connect PV system with battery and invertor, , configure invertor and verify proper working of the system through load execution test.

Competency Units	Performance Criteria
E1: Interpret wiring diagram	***Trainee will be able to:*** **P1**. Collect the wiring diagram and layout from job documents **P2**. Identify paths and marking for wiring
E2: Connect the PV modules as per circuit diagram	***Trainee will be able to:*** **P1**. Interconnect the strings to make arrays **P2**. Insulate all the arrays as per standard **P3**. Combine all the arrays through combiner box
E3: Lay Cables	***Trainee will be able to:*** **P1**. Install conduits for cables **P2**. Lay cables through the conduits **P3**. Connect the cables to the control and safety boxes
E4. Perform wiring test	***Trainee will be able to:*** **P1**. Perform continuity test

	P2. Perform polarity test **P3**. Perform earth test
E5. Carry out battery test	***Trainee will be able to:*** **P1**. Perform specific gravity test **P2**. Perform internal short circuit test **P3**. Perform terminal voltage test **P4**. Check terminal for carbon contents **P5**. Perform battery bank polarity test
E6: Interconnect the PV system	***Trainee will be able to:*** **P1**. Connect the battery bank to the inverter / charge controller through safety circuits **P2**. Connect the PV modules to the inverters / controllers through safety circuits **P3**. Connect the invertor with the input A.C source **P4**. Connect the load to the invertor through safety circuit
E7: Configure the invertor / charge controller	***Trainee will be able to:*** **P1**. Interpret the invertor manual **P2**. Inquire the customers / site requirements

	P3. Set the parameters as per requirement

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

K1. Types of wires
K2. Sizes of wires
K3. Colour scheme
K4. Types of wiring joints
K5. Types of insulating materials
K6. Wiring tools and their uses
K7. Techniques of Earthling
K8. Safety precautions
K9. Uses of PPE
K10. Various types of wiring tests

Critical Evidence(s) Required

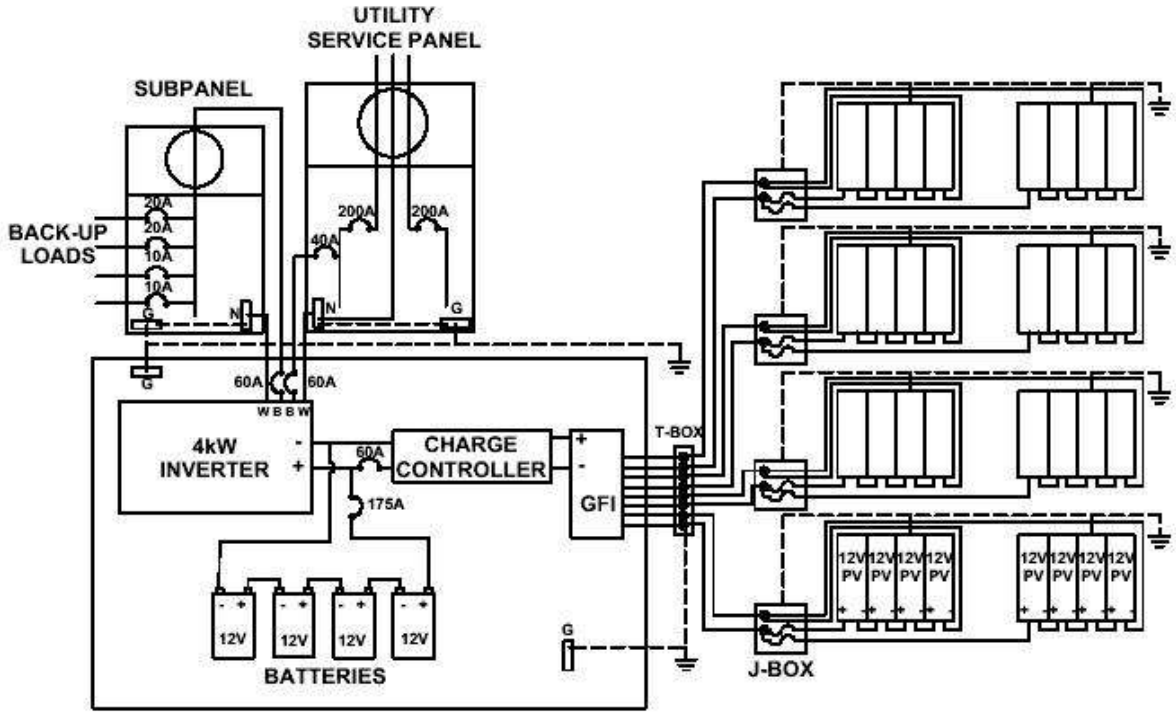
The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Differentiate between various sizes of cables
- Draw wiring diagram of a Solar PV system as per given load
- Prepare a list of wiring materials, for a given circuit diagram
- Interconnect protection devices with solar PV system
- Make any one of the following joint as decided by assessor
  - “Tee – joint” and insolate it as per standard
  - “Married – joint” and insolate it as per standard
  - “Britannia – joint” and insolate it as per standard
  - Western Union – Joint and insolate it as per standard
  - Straight Joint and insolate it as per standard

Important points

- Always wear related personal protective equipment
- Ensure polarities of Solar PV system

- All wiring must be properly insulated



Competency Standard F: Troubleshoot Solar PV system

Overview

This competency standard covers the skills and knowledge required to Diagnose the fault, Identify solution of the faults, rectify the faults, carryout post rectification function test and finally perform wiring test.

Competency Units	Performance Criteria
F1: Diagnose the fault	***Trainee will be able to:*** **P1.** Check invertor for fault code **P2.** Verify safety circuits **P3.** Check status of wiring **P4.** Verify status of battery **P5.** Check status of PV Panels **P6.** Identify nature of the fault (Hardware or software) **P7.** Diagnose the cause of fault **P8.** Document the fault
F2: Identify solution of the faults	***Trainee will be able to:*** **P1.** Trace out solution of fault code with the help of manual **P2.** Estimate cost of rectification **P3.** Report the fault to the concerned persons
F3: Rectify the faults	***Trainee will be able to:*** **P1.** Reset the software for rectification **P2.** Arrange the required tools and equipment **P3.** Arrange the required material and components **P4.** Repair faulty component / equipment **P5.** Replace faulty component / equipment

	P6. Refer irreparable / un-replaceable faults to the concerned lab
F4. Carryout post rectification function test	***Trainee will be able to:*** **P1.** Re connect the system with the load **P2**. Verify function of the system on full load **P3**. Document the services as per instructions **P4**. Clean and pack the store as per sop
F5. Perform wiring tests	***Trainee will be able to:*** **P1**. Perform continuity test **P2**. Perform polarity test **P3**. Perform earth test **P4**. Rectify the problem

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

K1. Types and uses of various testing equipment
K2. Diagnostic Procedures
K3. Use of manual
K4. Costing of rectification
K5. Use of invertor user interface software
K6. Types of faults in Solar PV system
K7. Various diagnostic tests and techniques
K8. Standard operating procedure for troubleshooting

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Perform one of the following tests as per instruction of assessor
    - Continuity test
    - Earth test
- Polarity test
- Identify faulty module in array
- Sort out fault from a given fault code with the help of manual
- Replace the faulty protective devices

Important points

- Follow procedure and sequence of finding faults
- Isolation of system must be ensured
- Ensure tagging out of faulty devices and equipment

Competency Standard G: Maintain Solar PV system

Overview

This competency standard covers the skills and knowledge required to prepare check list for maintenance, follow routine maintenance log sheet, maintain Solar PV modules and perform post verification function of the system.

Competency Units	Performance Criteria
G1. **Prepare check list for maintenance**	***Trainee will be able to:*** **P1.** Prepare list of tools and instruments for maintenance **P2.** Prepare list of materials for maintenance **P3.** Prepare list of activities for maintenance
G2. **Follow routine maintenance log sheet**	***Trainee will be able to:*** **P1.** Collect maintenance log sheet **P2.** Arrange required tools / instruments for maintenance **P3.** Perform activities as per schedule **P4.** Place equipment after maintenance as per SOP
G3. **Maintain Solar PV modules**	***Trainee will be able to:*** **P1.** Arrange cleaning materials **P2.** Wash the panels as per instructions (Avoid washing during peak sun hours). **P3.** Check connections and joints of solar PV modules

	P4. Check the physical and mechanical health of modules as per standard **P5.** Adjust the seasonal tilt angle
G4. **Maintain invertor / Charge controller / Protection circuits**	***Trainee will be able to:*** **P1.** Arrange servicing equipment **P2**. Check the status of cooling fans **P3**. Check input output terminals of invertors **P4**. Perform servicing with electrical blower **P5**. Maintain connection status as per standards
G5. **Maintain battery bank**	***Trainee will be able to:*** **P1.** Clean terminals of battery with sand paper **P2.** Maintain level of electrolytes **P3.** Maintain gravity of electrolytes **P4**. Maintain battery connections **P5**. Apply grease to terminal to avoid corrosion / sulphation **P6**. Verify the operations of battery bank
G6. **Perform post verification function of the system**	***Trainee will be able to:*** **P1.** Switch on the system

P2. Observe display reading of inverter / charge controller

P3. Perform full load test

P4. Prepare the report of maintenance activities performed

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

K1. Procedure of inspection
K2. Service procedures
K3. Panel washing techniques
K4. Uses of washing materials
K5. Appropriate timings of service
K6. Types of corrosions
K7. Procedure of battery maintenance and level of electrolyte
K8. Types of batteries and their maintenance processes
K9. Difference of service materials
K10. Use of testing instruments
K11. Maintenance techniques of invertor / charge controller / VFD

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Prepare a maintenance schedule as per standard
- Determine the level and gravity of electrolyte solution in battery bank
- Perform cleaning procedure of solar PV modules
- Perform cleaning procedure for invertor

Important points

- Post maintenance test must be performed for proper operation of system
- Housekeeping must be adopted at every stage



Competency Standard H: Adopt safety precautions

Overview

This competency standard covers the skills and knowledge required to protect from all security threats by ensuring personal saftey, workplace safety prepare and saftey of all tools and equipment.

Competency Units	Performance Criteria
H1**. Ensure Personal saftey**	***Trainee will be able to:*** **P1**. Arrange PPEs as per requirements **P2**. Wear proper PPE as per nature of job **P3**. Store PPEs at appropriate place after use P4. Ensure availability of first aid box
H2. **Ensure workplace safety.**	***Trainee will be able to:*** **P1**. Ensure cleaning of workplace properly **P2**. Avoid hazardous (electric / chemical) by adopting safety precautions **P3**. Ensure availability of emergency exit **P4**. Ensure lighting and ventilation **P5**. Ensure availability of Firefighting equipment **P6**. Report to the concerned immediately in case of emergency **P7.** Ensure safe access to the system

H3**. Ensure saftey of tools and equipment**	***Trainee will be able to:*** **P1**. Ensure insulation of tools and equipment **P2**. Store safely tools and equipment **P3**. Clean tools on a regular basis as per schedule

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

K1. Types of physical hazards
K2. Types of chemical hazards
K3. Types of electrical hazards
K4. Differentiate between physical, chemical and electrical hazards
K5. Treatments of various hazards
K6. Types and use of PPEs
K7. Types of Risks
K8. Risk Management
K9. Risk assessment
K10. Monitor and risk control measures
K11. First Aid Treatment
K12. Use of safety equipment
K13. Importance of tools safety
K14. Reporting risks and hazards

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Prepare a list of PPEs
- Demonstrate the use of at least one of the PPEs in front of assessor as per assessors directions
- Perform first aid treatment against electric shock
- Explain safety procedure at workplace
- Differentiate between safe and unsafe tools

Important points

- Focus on personal tasks
- Personal Safety first
- Ensure safety of co-workers
- Health of PPEs must be ensured

Competency Standard I: Develop basic professional skills

Overview

This competency standard covers the skills and knowledge required to develop basic computer operating skills, develop basic communication skills, develop basic marketing skills.

Competency Units	Performance Criteria
I1. Develop basic computer operating skills	***Trainee will be able to:*** **P1.** Perform Microsoft basic commands in MS word a. Open File b. Format a file i. Font (Type/size/bold/Italic) ii. Header Footer iii. Page number iv. Insert pics/table/hyperlink c. Save a File d. Save a folder **P2.** Perform basic commands in Microsoft MS Excel a. Open a worksheet b. Sum functions c. If functions d. Basic calculations e. Table and graphs f. Save a worksheet/folder **P3.** Prepare Microsoft power point presentation by using basic commands a. Make a power point file b. Insert pics/table/hyperlink

	c. Design a theme for slides d. Save a power point file **P4.** Perform browsing on the internet as per needs **P5.** Perform research online on new trends in the market with the help of internet
I2. Develop basic communication skills.	***Trainee will be able to:*** **P1.** Negotiate with a client to understand the demand **P2.** Plan product supply as per clients requirements **P3.** Set price(s) according to clients requirements **P4.** Communicate the plan to the client **P5.** Take feedback from client on understanding of the exact job with timeline and cost
I3. Develop basic marketing skills	***Trainee will be able to:*** **P1.** Present a design to the client as per requirement **P2.** Finalize the business deal **P3.** Purchase the equipment/tools and consumables as per agreed design **P4.** Adopt correct means of transportation **P5.** Select promotional means, according to target needs of clients
I4. Identify needs of the market.	***Trainee will be able to:*** **P1.** Analyse upcoming market trends. **P2.** Develop Professional network. **P3.** Demonstrate behavioural skills. **P4.** Develop sound interpersonal skills **P5.** Develop new designs.
I5. Follow Environmental, Health and Safety	***Trainee will be able to:***

standards.	**P1.** Follow Health and Safety Rules **P2.** Ensure environmental safety **P3.** Ensure compliance of net metering policy **P4.** Ensure workplace safety by following safety standards **P5.** Ensure safety while operating wires and electricity. **P6.** Store all tools and equipment properly in a safe area.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

K1. Basic computers
K2. Importance and uses of MS Word
K3. Importance and uses of MS Excel
K4. Importance and uses of MS Power Point
K5. Basic concepts of communication
K6. Seven Cs in communication
K7. Basic concepts of marketing
K8. Trends of markets (Demand and supply etc.)
K9. Knowledge of 4Ps

- Product
- Price
- Promotion
- Placement

K1. Service Product knowledge for Solar PV System
K2. Net metering Policy of Pakistan
K3. Net metering laws of Pakistan
K4. Pakistan’s Feed in Tariffs (FITs)
K5. Pakistan's renewable power policy and regulatory frameworks
K6. The Management of Health and Safety at Work Regulations 1992.
K7. Environment Protection Agency.
K8. National Electric Power Regulatory Authority (NEPRA)
K9. Performance Standards (Generation) rules 2009
K10. Professionalism (meaning, attitude, output, timely delivery, networking)
K11. Importance of trends and market research.
K12. Significance of workplace cleanliness.

K13. Handling of Electric Supply and Appliances
K14. Process to handle emergency situations.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Performed role playing properly as Buyer and Seller and they will negotiate to finalize a realistic business deal
- Explain net metering Policy of Pakistan and its laws
- Describe Pakistan’s Feed in Tariffs (FITs)
- Write note on key features of Pakistan's renewable power policy and regulatory frameworks
- Describe functions of National Electric Power Regulatory Authority (NEPRA)
- Make a list of material which can catch fire
- Explain the importance of health and safety
- Brief about types of hazards at workplace

Important points

- Must be conscious about health and safety measures at work place
- Can communicate professionally with outsiders and within organisation
- Can download new laws and policies from internet

Occupational health and safety

Purpose

It is for the safety of persons working in that environment.

Classification ISCED

0416 Wholesale and retail sales

Available grade

Competent / Not yet competent

Modification history

N/A

Unit of Competency	Performance Criteria	Knowledge
I1. Identify and implement safe working practices	You must be able to: P1. Study of facility layout design and operations P2. Implement the health and safety measures	You must know and understand: K1. Knowledge of health and safety precautions

Communicate in the workplace to support customers and team

Purpose

This Competency standard identifies the competencies required to communicate in the workplace to support customers and team as per organization's approved guidelines and procedures. You will be expected to communicate face-to-face with customers, use technology to communicate with customers, communicate with customers and colleagues from diverse backgrounds, work in a team, ask appropriate probing / questioning from customers and provide continuous feedback to customers / colleagues. Your underpinning knowledge about basic communication tools and correspondence tactics will be sufficient for you to provide the basics of the work.

Classification ISCED

Available grade

Competent / Not yet competent

Modification history

N/A

Unit of Competency	Performance Criteria	Knowledge
B1. Communicate face-to-face with customers.	**You must be able to:** P1. Maintain welcoming customer environment that reflects company branding and market position and is in line with the company policy and procedures. P2. Greet customer warmly according to company policy and procedures. P3. Create effective service environment through verbal	**You must be able to:** K1. Explain different techniques that can be applied when communicate with customer face to face K2. Describe types of customer behavior and dealings K3. Explain different communication skills and techniques K4. Explain the basic key elements of the

	and non-verbal interaction according to company policy and procedures. P4. Use questioning and active listening to determine customer needs. P5. Use positive and inclusive language. P6. Recognize personal factors impact on customer service delivery	communication process. K5. Describe a range of communication methods that can be used to effectively communicate with customers and identify the most appropriate to use in different situations. K6. Explain how 'body language' impacts on the communication process.
B2. Use technology to communicate with customers.	**You must be able to:** P1. Answer telephone according to the company procedures. P2. Questioning and active listening to identify caller and establish and confirm requirements. P3. Use telephone system functions according to instructions. P4. Use email, social networking sites and other technologies to receive and process information and customer requests in line with company policy and procedures. P5. Record and promptly pass on messages or information. P6. Inform customer of any problems and relevant action being taken. P7. Perform follow-up action as necessary.	**You must be able to:** K1. Identify the recognized principles of communicating electronically, by telephone and in writing. K2. Describe the different methods of collecting customer feedback on telephone. K3. Explain the importance of collecting customer feedback and how this can be used to improve customer service. K4. Describe how technology can affect and enhance the service delivery process.
B3. Communicate with customers and colleagues from diverse backgrounds.	**You must be able to:** P1. Treat customers and colleagues from diverse backgrounds with respect and sensitivity. P2. Consider cultural differences in verbal and non-verbal communication. P3. Use gestures or simple words to communicate where	**You must be able to:** K1. Identify the barriers to effective communication that can arise and how best to deal with these. K2. Identify and explain when it is necessary to seek advice or assistance from colleagues and when to take own initiative.

	language barriers exist. P4. Obtain assistance from colleagues or supervisors when required to facilitate communications.	K3. Describe different types of dealings techniques with different types of behaviors
B4. Work in a team.	**You must be able to:** P1. Display a courteous and helpful manner at all times. P2. Complete allocated tasks willingly, according to set timeframes. P3. Actively seek or provide assistance by approaching other team members when difficulties arise. P4. Identify and use lines of communication with supervisors and peers according to company policy. P5. Encourage, acknowledge and act upon constructive feed-back provided by other team members. P6. Use questioning to minimise misunderstandings. P7. Identify signs of potential workplace conflict wherever possible and take action to resolve the situation using open and respectful communication. P8. Participate in team problem solving. P9. Interpret organization's goals and objectives and translate them into individual targets P10. Prepare plan of action to achieve individual as well as team goals	**You must be able to:** K1. Define team work. K2. Explain the importance of team work. K3. Define company goals and objectives as well as SOPs of the company K4. Explain different concepts and techniques of problem solving K5. Describe systematic decision making process K6. Describe characteristics of a successful teamwork experience.
B5. Ask appropriate probing / questioning from customers	**You must be able to:** P1. Use different types of questions when appropriate. P2. Allow the other person to answer freely. P3. Collect facts, information and data about the other person's	**You must be able to:** K1. Explain: • Open-ended questions • Close-ended questions • High gain questions • Mirror questions • Probing questions

	situation. P4. Focus on the necessary information (information that links directly to product or service)	• Situation questions
B6. Provide continuous feed-back	**You must be able to:** P1. Give and receive feed-back with customers. P2. Apply appropriate body language and read customers body language. P3. Give and receive feed-back with internal departments. P4. Design a communication system / process and share information. P5. Gain commitment from others to work together in the interest of the customers. P6. Conduct meetings. P7. Utilize the feed-back to identify opportunities for product / service improvement.	**You must be able to:** K1. Explain how to use customer feed-back to improve your business K2. Define importance of body language. K3. Explain communication ethics. K4. Define organizational Jargon.

Work effectively in a customer service/ sales environment

Purpose

This Competency standard identifies the competencies required Work Effectively in a Customer Service/Sales Environment as per Organization's approved guidelines and procedures. You will be expected to work within organizational requirements, support the work team, maintain personal presentation, develop effective work habits, portray ethical behaviour and acquire up to date product / service knowledge. Your underpinning knowledge about Work Effectively in a Customer Service/Sales Environment will be sufficient for you to provide the basics of the work.

Classification ISCED

0416 Wholesale and retail sales

Available grade

Competent / Not yet competent

Modification history

N/A

Unit of Competency	Performance Criteria	Knowledge
F1. Work within organizational requirements.	**You must be able to:** P1. Identify and read organisation's requirements and responsibilities and seek advice from appropriate people where necessary. P2. Interpret staff rosters and provide sufficient notice of unavailability	**You must be able to:** K1. Define industry awards and agreements that relate to personal job role and terms and conditions of employment. K2. Differentiate between employer and employee responsibilities. K3. Explain different relevant legislation and statutory requirements.

	for rostered hours according to workplace policy and procedures. P3. Develop and use a current working knowledge and understanding of employee and employer rights and responsibilities. P4. Comply with relevant duty of care and legal responsibilities, and support organisational culture. P5. Identify roles and responsibilities of colleagues and immediate supervisors. P6. Identify standards and values considered to be detrimental to the organisation and communicate this through appropriate channels. P7. Identify, recognise and follow behaviour that contributes to a safe and sustainable work environment.	
F2.Support the work team.	**You must be able to:** P1. Display courteous and helpful behaviour at all times. P2. Take opportunities to enhance the level of assistance offered to colleagues and meet all reasonable requests for assistance within acceptable workplace timeframes. P3. Complete allocated tasks as required. P4. Seek assistance when	**You must be able to:** K1. Explain the importance of team work K2. Define workplace relations K3. Explain workplace policies, plans and procedures, including: • Dealing with grievances • Discriminatory behavior • Equal opportunity issues. • Staff rosters and notification of shift • Availability or non-attendance

	difficulties arise. P5. Use questioning techniques to clarify instructions or responsibilities. P6. Identify and display a non-discriminatory attitude in all contacts with customers and other staff members.	• Providing customer service to colleagues and customers.
F3. Maintain personal presentation.	**You must be able to:** P1. Observe appropriate dress code and presentation as required by the workplace, job role and level of customer contact. P2. Follow personal hygiene procedures according to organisational policy and relevant legislation.	**You must be able to:** K1. Explain hygiene and personal presentation K2. Explain the importance of workplace ethics
F4. Develop effective work habits.	**You must be able to:** P1. Interpret, confirm and act on workplace information, instructions and procedures relevant to the particular task. P2. Ask questions to seek and clarify workplace information. P3. Plan and organise daily work routine within the scope of the job role. P4. Prioritise and complete tasks accordin g to required timeframes. P5. Identify work and personal priorities and achieve a balance between competing priorities	**You must be able to:** K1. Explain staff counseling and disciplinary procedures K2. Describe workplace organizational structure.

F5. Portray ethical behavior	**You must be able to:** P1. Follow ethical code of conduct. P2. Understand your costumer's code of ethics. P3. Declare conflict of interest. P4. Maintain confidentiality. P5. Honour your commitments (timeframe, deliverables etc.) P6. Use internet for business only on company time.	**You must be able to:** K1. Explain the importance of ethical behavior. K2. Explain the importance of commitment in sales and customer services.
F6. Acquire up to date product / service knowledge	**You must be able to:** P1. Gather information about your product / services. P2. Identify the components of your product and services. P3. Recognize the essential selling features of your products and services. P4. Translate all essential features of your product and services. P5. Analyze product success. P6. Identify your market position. P7. Familiar with all product promotions, sales manuals and product literature. P8. Keep information of latest technology advances and seek ways to use these technologies in your work.	**You must be able to:** K1. Explain: • Price per product. • Profit per product / service. • Price flection • Product strengths • Product weaknesses. • Warranty / guarantee policies. • Packaging facilities and potential. K2. Explain how your product/service fits into your customers overall operations, business plan, sales success, operation cost etc.

Develop professionalism

Purpose

This Competency standard identifies the competencies required to Develop Professionalism as per Organization's approved guidelines and procedures. You will be expected to create a personal vision / mission, manage your attitude, practice self-discipline, manage time, manage your professional development, and participate in trainings and performance review. Your underpinning knowledge about Develop Professionalism will be sufficient for you to provide the basics of the work.

Classification ISCED

0416 Wholesale and retail sales

Available grade

Competent / Not yet competent

Modification history

N/A

Unit of Competency	Performance Criteria	Knowledge
G1. Create a personal vision / mission	**You must be able to:** P1. Clarify / prioritize self-values and consider the value of others. P2. Clarify expectations of yourself and expectations others have of you. P3. Identify what you need to do to be successful (personal standards, targets, goals, principals) P4. Set specific short and long term goals. P5. Translate the vision into	**You must be able to:** K1. Explain long and short term goals. K2. Explain why personal vision and mission is important for success. K3. Describe the advantages of personal vision and mission.

	actionable steps. P6. Integrate the vision into daily practice. P7. Recount frequently with your vision and change accordingly.	
G2. Manage your attitude.	**You must be able to:** P1. Challenge yourself, break old habits, and move out of your comfort zone. P2. Practice innovative techniques for out of the box creative thinking. P3. Seek out support and feedback from others on the team, in the organization / community etc. P4. Identify daily, weekly accomplishments. P5. Read inspirational material, audiotapes etc.	**You must be able to:** K1. Explain the importance of personal and professional motivation K2. Identify your positive attitude. K3. Explain the advantages of innovative ideas and techniques during job.
G3. Practice self-discipline	**You must be able to:** P1. Accountable for your performance. P2. Identify what you need to do to be successful. P3. Communicate your priorities to others. P4. Make and honour appointments with yourself and others. P5. Practice relaxation and energizing techniques.	**You must be able to:** K1. Explain the importance of communication. K2. Explain the advantages of self-discipline.
G4. Manage time	**You must be able to:** P1. Isolate key success activities and prioritize them. P2. Breakdown large tasks down into manageable action steps (set time frame). P3. Create or adopt action plans and follow it. P4. Set aside appropriate blocks of time for goal-related activities.	**You must be able to:** K1. Explain the importance of time management to achieve different tasks.

	P5. Make the best possible use of support people / recourses to accomplish tasks.	
G5.Manage your professional development	**You must be able to:** P1. Take inventory of your personal interests, abilities, skills, knowledge etc. P2. Identify and prioritize the strengths and gaps. P3. Use available assessment tools. P4. Create a personal growth strategy / career path. P5. Set personal goals and timeframe for achieving them. P6. Learn from your mistakes.	**You must be able to:** K1. Explain the importance and need of professional development.
G6.Participate in trainings and performance review	**You must be able to:** P1. Analyse, evaluate and improve performance, and report significant issues/problems to senior management P2. Demonstrate to-do attitude in profession P3. Demonstrate understanding of skills requirements P4. Use the competences acquired in trainings	**You must be able to:** K1. Define concept about performance standards. K2. Explain policies, procedures and regulations regarding human resources of the organization. K3. Explain self-planning and management techniques K4. Define goals and strategies of self- development. K5. Explain relevant knowledge about training / job requirements

Comply with health and safety regulations

Purpose

This Competency standard identifies the competencies required to comply with health and Safety Regulations as per Organization's approved guidelines and procedures. You will be expected to interpret health and safety regulations, apply basic safety procedures and apply basic emergency procedures. Your underpinning knowledge about comply with health and safety regulations will be sufficient for you to provide the basics of the work.

Classification ISCED

0416 Wholesale and retail sales

Available grade

Competent / Not yet competent

Modification history

N/A

Unit of Competency	Performance Criteria	Knowledge
H1.Interpret health and safety regulations, standards and guidelines of an organization.	**You must be able to:** P1. Identify, understand and apply health and safety regulations at workplace P2. Assess risk of injury and equipment damages in common work situations and report to department concerned for timely response P3. Participate in quality enhancement of products or services of the	**You must be able to:** K1. Explain concepts and principles of health, safety, quality and environment regulations. K2. Define types of risk of injuring and equipment damages. K3. Describe types of risk and injury at workplace. K4. Explain the procedure of dealing with risk and injury situation.

	organization P4. Comply with quality and safety standards effectively P5. Handle toxic and hazardous material and product with caution P6. Assess risk of injuries and accidents and report it to senior management for avoiding serious injuries	K5. Explain health and safety policies and guidelines of the organization. K6. define characteristics and types of toxic and hazardous material or products offered by company and their impact on environment.
H2. Apply basic safety procedures.	**You must be able to:** P1. Follow safety procedures to achieve a safe work environment, according to all relevant WHS legislation, including codes of practice relating to particular hazards in the industry or workplace. P2. Identify and report unsafe work practices , including faulty plant and equipment according to company policy and procedures P3. Manage dangerous goods and substances according to company policy and relevant legislation. P4. Identify potential manual handling risks and manage manual handling tasks according to company policy. P5. Report work-related incidents and accidents to designated personnel. P6. Participate in consultative processes and procedures for WHS.	**You must be able to:** K1. Explain appropriate use of personal protective clothing. K2. Explain the procedure to eliminating hazards. K3. Explain first aid procedures.

H3. Apply basic emergency procedures.	**You must be able to:** P1. Follow fire and emergency procedures, including evacuation, according to company policy and legislation. P2. Identify designated personnel responsible for first aid and evacuation procedures. P3. .Accurately identifies safety alarms.	**You must be able to:** K1. Define fire, chemical and electrical hazards K2. Explain slip, trips and falls K3. Explain the procedure of storage of dangerous goods and hazardous substances and waste. K4. Define communication and consultation processes. K5. Explain manual handling procedures.

COMPLETE LIST OF TOOLS AND EQUIPMENT

List of Tools

Sr. #	Description	Specifications
1.	Combination plier	180mm
2.	Long nose Plier	
3.	Cable Cutter	180mm
4.	Cable Cutter	12"
5.	Cable Cutter	18"
6.	Claw Hammer	1 pound
7.	Hammer	Cross pin 200g
8.	Screw Driver Set	
9.	Mini Screw Driver Set	
10.	Screw Driver Set (metal head type)	
11.	Hammer	1 kg
12.	Cable Knife/paper cutter	
13.	Wire Striper/insulation remover	
14.	Soldering Iron with Stand	60W , 80W, 120W

15.	Sucker	For Soldering Iron
16.	Tool box	18"
17.	Bench vice	6"
18.	Angle Grinder	5"
19.	Mini Drill machine	for PCB drilling with bits
20.	Drill Machine Rotary Hammer	
21.	Drill Machine	Reverse Forward 13mm
22.	Cordless Drill machine	18V
23.	Extension board	multi Sockets With 10 Meters Wire
24.	Chisel	8"
25.	Chisel	12"
26.	Torpedo level / spirit level	Different size
27.	Compass	
28.	Adjustable Wrench	8"
29.	Adjustable Wrench	12"
30.	Richet Set	72 Pcs
31.	Spanner Set	12 pcs

32.	Torque wrench with deep sockets	Small 12"
33.	Pipe wrench	16"
34.	Welding plant With holder and lead	300 Amp
35.	Thimble press	16mm to 240mm
36.	Electric blower	
37.	Heat gun	
38.	Measuring Tape	3m
39.	Measuring Tape	5m
40.	Measuring Tape	50m
41.	Hack Saw With blades	
42.	File Set	Small size
43.	File Set	large Size
44.	L-key Set	
45.	Fish Tape	100ft
46.	Wood Saw	
47.	Hole Saw For panel	25mm
48.	Hole Saw For panel	50mm

49.	Hole Saw For panel	70mm
50.	Wooden Bit Set	
51.	Twist Drill bit Set	HSS 0.5mm to 16mm
52.	Tap and Die Set	32 pcs Set
53.	Hand Tin Scissors	18"
54.	Pipe vice with Stands	4"
55.	Scissor	8" for fabric
56.	Tuser	6", 8", 12"
57.	Gas Cutting torch with Oxygen And LPG Cylinders	Oxygen LPG & Oxy Gas Cutting Torch 520mm
58.	Magnetic wristband for holding bits and parts	
59.	Hot Melt Glue Gun 20W	20 watt with 50 glue Sticks
60.	Tool Belt	18 pcs

List of Equipment

Sr. #	Description	Specifications
1.	Digital Oscilloscope	Tektronix TDS 3000
2.	Digital Oscilloscope	Tektronix TBS 2000

3.	Synchronizing meter /smart energy meter	For Grid Tied
4.	DC Power Supply	Tektronix keithly 2268
5.	Phase Sequence Meter	kyoritsu kew 8031F
6.	Function Generator	Tektronix AFG 1000
7.	Clamp On meter	kyoritsu 2432
8.	Clamp on meter	Uni-T ut203
9.	DC volt Meter Digital	0 to 250 VDC 10Amp panel type Small Size
10.	DC ampere Meter Digital	100 amp with CT(current Transformer)
11.	AC volt Meter Digital	0 to 50 Amp 0 to 600 VAC panel type Small
12.	AC ampere Meter Digital	0 to 50 Amp 0 to 600 VAC panel type Small
13.	Digital multi meter	Tecpel 8062
14.	Analog multi meter	Sunwa
15.	megger meter/insulation tester	Analog
16.	megger meter/insulation tester	digital MIT 300
17.	Earth Tester	Digital

18.	Micro meter	Digital
19.	Vernier Caliper	Digital
20.	Watt Ampere meter For Solar	thermodin System 130 amps
21.	Tachometer	Digital
22.	Tachometer	Analog
23.	Frequency Meter	AC 80-300V/30-70HZ 3 in1 LCD Time Voltage
24.	Hydro meter	Digital
25.	Hydro meter	Analog
26.	Variable AC power Supply	Super world 1KVA
27.	Battery tester	Original Launch BST-460 6V & 12V Battery Tester for Battery
28.	battery level indicator	DC 3.5-30V Mini LED Battery level voltage monitor meter indicator
29.	Watt meter	EU Plug-In Electricity Power Energy Meter Monitor Analyzer KWh Watt Volt Amps
30.	Hour Meter	digital 220v
31.	Hour Meter	digital 12v

32.	Energy meter	Digital single phase
33.	Lux meter	Digital Light Meter,Tester200,000 LUX,FC Photo Camera
34.	Inductive and Capacitive meter	digital Hp-4070L
35.	Temperature gun	Non-Contact IR Infrared Digital Temperature Temp Thermometer Laser Point Gun
36.	Temperature controller	With thermocouple
37.	Digital Camera	Sony Cyber-shot DSC-H300 35x Optical Zoom Digital Camera - Black
38.	digital angle Finder	Sprit Level type
39.	Stud Finder	Zircon
40.	PC	HP COMPAQ,COR i7-1TB-8GB-3.40 GHZ-2600 QUAD CORE-WIN 7 P1GB GRAPHICS-DVD-RW
41.	Printer	HP LaserJet P1102
42.	Scanner	HP
43.	Multimedia projector	Sony VPL-DX147 3200 Lumens XGA

44.	Charge Controller	PWM 15 amp
45.	Charge Controller	PWM 40 amp
46.	Charge Controller	MPPT 20 amp
47.	Charge Controller	MPPT 50 amp
48.	Solar Hybrid Inverter On/Off Grid	MPPT 10 kW 3 phase
49.	Solar Hybrid Inverter	MPPT 5 KVA
50.	solar Hybrid Inverter	MPPT 3 KVA
51.	solar Hybrid Inverter	PWM 3 KVA
52.	Inverter	1500 watt sine wave
53.	Inverter	1000 watt sine wave
54.	Submersible Solar pumps	3hp And 5hp 3phase
55.	VFD	5 HP 3 phase for solar pump
56.	Inverter	500 watt Sine wave
57.	DRY Batteries	200amp 12 v
58.	DRY Batteries	12amp 12 v
59.	DRY Batteries	100amp 12 v
60.	DRY cell	2V 200amp

61.	Solar panel	polycrystalline 250 watt YINGLI solar
62.	Solar panel	polycrystalline 150 watt
63.	Solar panel	polycrystalline 100 watt
64.	Solar panel	monocrystalline 100 watt
65.	Solar panel	Thin film 50 watt
66.	Solar panel	monocrystalline 50 watt
67.	Solar panel	monocrystalline 20 watt
68.	Solar panel	monocrystalline 10 watt
69.	Solar panel	Polycrystalline & Monocrystalline 5 watt
70.	Solar Photovoltaic Cells	3 watt
71.	Battery Charger	20 ampere Transformer Less
72.	DC power Supply	12 to 24 volt Omron
73.	DC solar Pump	24VDC 400 watt China
74.	Solar panel Stands	For 250 watt
75.	Infrared camera	Flir instruments
76.	Solar power meter	Tes-1333r solar power meter

77.	Irradiance meter	TN-2340
78.	3 phase inverter for solar water pump	5KVA
79.	3 phase inverter for solar water pump	7KVA
80.	Solar installation tester	SEAWARD PV150
81.	Solmetric pv analyzer	PVA 1000 PV analyzer kit

List of Personal Protective Equipment

Sr. #	Description	Specifications
1.	First AID Box	
2.	Fire Extinguisher Cylinder	Co2- 5 Kg
3.	Fire Blanket	
4.	Fire Bucket	
5.	Safety Gloves	Leather
6.	Safety Gloves	Rubber for 1000 volt
7.	safety googles	White
8.	Safety Helmet	Yellow

9.	Safety Helmet	White
10.	Safety mask	
11.	Formal Uniform For Work	
12.	Safety Shoes	
13.	Safety Belt	
14.	Ear Protector	

List of Trainers Kit

Sr. #	Description	Specifications
1.	EPH3 professional photovoltaic trainer	Lucas Nulla
2.	IGBT chopper inverter trainer	Labvolt mode No 8857-1
3.	AC/DC training system	Labvolt mode No 3351
4.	VFD training system	Labvolt mode No 3356
5.	solar power training system	Labvolt mode No 8010-2
6.	lead acid batteries training system	Labvolt mode No 8010-4
7.	Dc fundamental 1&2	Labvolt mode No 91001-20
8.	Ac fundamental 1&2	Labvolt mode No 91003-2

9.	Semiconductor devices	Labvolt mode No 91005-2
10.	Transistor amplifier	Labvolt mode No 91006-2
11.	Transistor feed back	Labvolt mode No 91008-24
12.	Power supply regulation	Labvolt mode No 91009-25
13.	FET fundamental	Labvolt mode No 91010-2
14.	Thyristor and power control	Labvolt mode No 91011-2
15.	Operational amplifier	Labvolt mode No 91012-2
16.	Power transistor and GTO thyristor	Labvolt mode No 91013-2
17.	Starter usb for pic	Mikro electronica
18.	Pic kit2 starting kit	MP Lab