

**NATIONAL COMPETENCY STANDARDS FOR
ELECTRICIAN
(Level-2,3&4)**

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INTRODUCTION

An electrician is a multidimensional tradesperson who specializes in electrical wiring of buildings, stationary machines, and related equipment. Electricians can be employed in the installation of new electrical equipment or the maintenance and repair of existing electrical infrastructure. In order to meet the demand for electricians, National Vocational and Technical Training Commission (NAVTTTC) in collaboration with TVET Sector Support Programme (TVET-SSP) has developed national vocational qualifications comprising of generic, functional and technical competency standards for an electrician occupation. To facilitate the process of developing national qualifications for electrician, a Qualification Development Committee (QDC) was established under NVQF Operational Manual-1.

Competency standards, which are benchmarks for the performance, cover both the domestic and commercial aspects of an electrician's job. While setting the standards for the performances, required skills, underpinning knowledge and attitudes expected of an electrician have been inculcated in these competency standards.

Sector Skills Council (SSC) for Construction and experts from related industries have thoroughly reviewed and validated the competency standards as proposed by the QDC in terms of their relevancy and currency to the requirement of the job. The validated competency standards will provide the basis for the development of curricula, assessment and instructional materials that will support competency based training and assessment activities.

PURPOSE OF THE QUALIFICATION

The primary objective of these qualifications is to set high professional standards for electricians. The development and implementation of these national qualifications will subsequently improve the quality of professional training and assessment in Pakistan. The specific objectives of developing these qualifications are as under:

- Improve the overall quality of training delivery and setting national benchmarks for training of electricians in the country
- Provide flexible pathways and progressions to learners enabling them to acquire relevant and current skills set
- Provide basis for competency based assessment which is recognized and accepted by employers
- Establish a standardized and sustainable system of training for electricians in the country

DATE OF VALIDATION

These national qualifications have been validated by the Qualifications Validation Committee (QVC) on 07.02.2018 and they will remain in currency until 06.02.2023.

CODE OF QUALIFICATION

Qualification Title	Code
National Vocational Certificate Level-2 in Electrical Technology (Domestic Electrician)	0713E&E18
National Vocational Certificate Level-3 in Electrical Technology (Industrial Electrician)	0713E&E19
National Vocational Certificate Level-4 in Electrical Technology (Instrumentation and Automation Electrician)	0713E&E20

ENTRY REQUIREMENTS

Minimum requirements for entry National Vocational Certificate Level-2 in Electrical Technology (Domestic Electrician) is Middle or Matric.

QUALIFICATIONS DEVELOPMENT COMMITTEE

The Qualifications Development Committee consisted of following members:

S.No.	Name & Designation	Organization
1.	Abdul Basit Malik CEO	Business Track Solutions Pvt. Limited - Islamabad
2.	Engr. Muhammad Aamir Dy. Manager Electrical	Punjab Industrial Estates Development & Management Company - Lahore
3.	Engr. Muhammad Saim Dilawar Manager Technical	Wise Engineering & Business Solutions – Lahore
4.	Engr. Zamir-ul-Hassan Gardezi MEP Manager	MIDJAC Construction Pvt. Limited - Islamabad

QUALIFICATIONS VALIDATION COMMITTEE

The Qualifications Validation Committee consisted of following members:

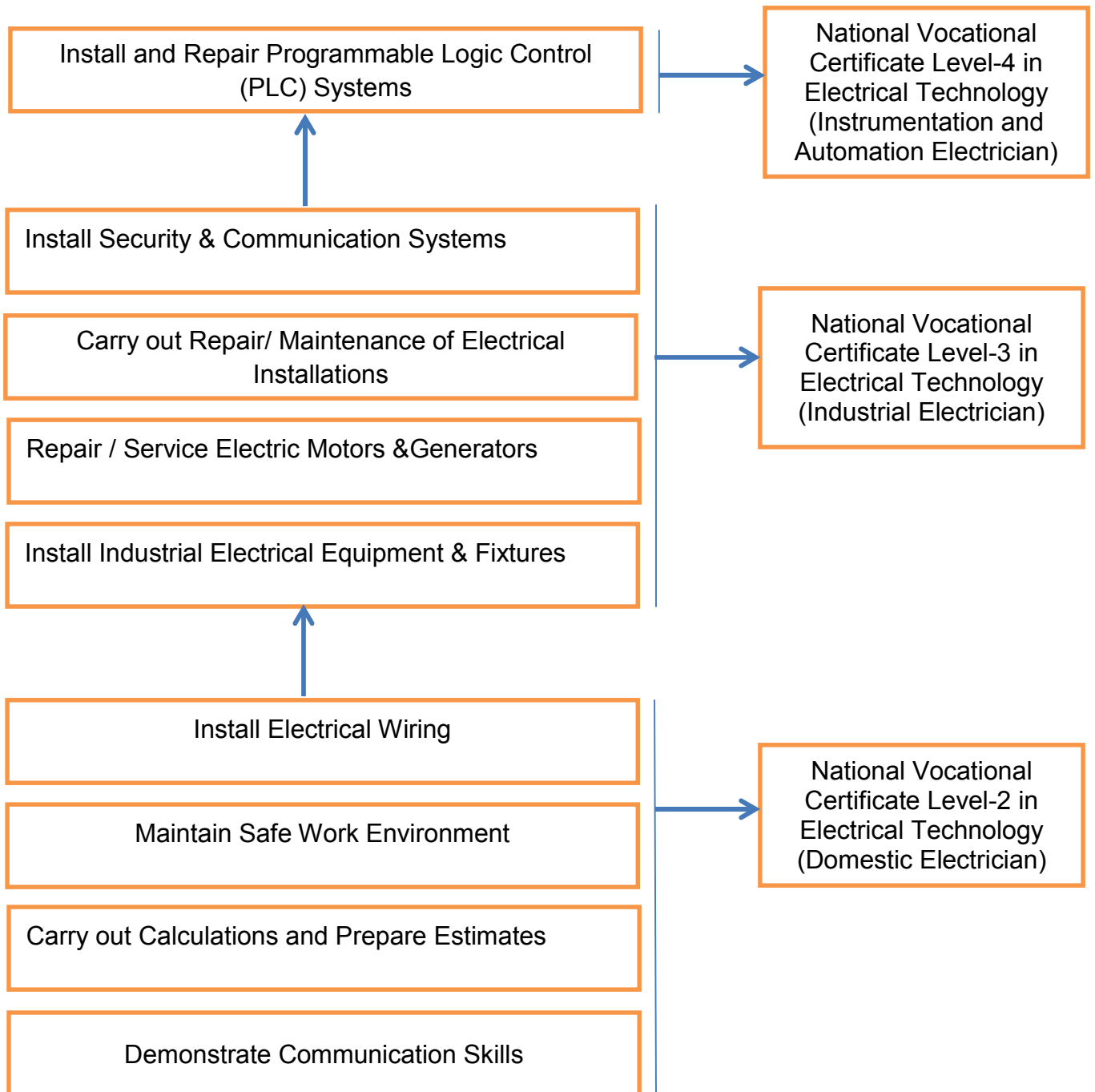
S.No.	Name & Designation	Organization
1.	Mr. Muhammad Asghar Deputy General Manager	Habib Rafiq Pvt. Ltd., Islamabad
2.	Mr. Abubakar Abid Butt Director	AA Business Systems, Islamabad
3.	Mr. Mehmood Ahmed Khan MEP Engineer	Project Development Department, Bahria Town Pvt. Ltd., Rawalpindi
4.	Mr. Zameer UI Hassan Gardezi Manager MEP	MIDJAC Construction Pvt. Ltd., Islamabad
5.	Mr. Muhammad Imran Manager	Capital Engineering Pvt. Ltd., Islamabad

REGULATIONS FOR THE QUALIFICATION AND SCHEDULE OF UNITS

Not Applicable

SUMMARY OF COMPETENCY STANDARDS

Code	Competency Standards	Level	Credits	Category
	Demonstrate Communication Skills - Faisal	2	3	Generic
	Carry out Calculations and Prepare Estimates for Electrical Work - Faheem	2	4	Functional
	Maintain Safe Work Environment - Faheem	2	3	Generic
	Install Electrical Wiring - Atif	2	10	Technical
	Install Industrial Electrical Equipment & Fixtures - Arslan	3	15	Technical
	Carry out Repair/ Maintenance of Electrical Installations - Usama	3	20	Technical
	Repair / Service Electric Motors & Generators – Gardezi sb	4	20	Technical
	Install Security & Communication Systems - Faisal	2	6	Technical
	Install and Repair Programmable Logic Control (PLC) Systems - Shahbaz	4	20	Technical



Code:

Demonstrate Communication Skills

Overview

This Competency Standard identifies the competencies required to apply communication skills at workplace in accordance with the organization's guidelines and procedures. You are expected to work in a team to achieve common organizational goals and avoid conflicts. This competency standard would also enable you to use basic computer skills to communicate effectively and prepare work related documents and reports.

<i>Competency Units</i>	<i>Performance Criteria</i>
1. Work in Team	<p>P1. Treat team members with respect and maintain positive relationships to achieve common organizational goals</p> <p>P2. Listen to instructions carefully comply with those instructions</p> <p>P3. Provide work related information to team members and identify interrelated work activities to avoid confusion</p> <p>P4. Adopt communication skills appropriate to work activities and company procedures</p> <p>P5. Identify problems and resolve them through discussion and mutual agreement</p>
2. Deal with Clients	<p>P1. Collect and confirm work requirements from clients using appropriate communication procedures</p> <p>P2. Provide clear information to clients about work requirements including costs and time needed to accomplish the task</p> <p>P3. Negotiate with clients regarding wages, time, labour requirements etc.</p>
3. Demonstrate Basic IT Skills	<p>P1. Create folders and files and learn major commands of operating system/windows</p> <p>P2. Type text and use major commands such as printing, editing, creating tables, header footer, footnotes, table of contents and page number etc.</p> <p>P3. Make the document as per work specifications and client's requirement</p> <p>P4. Generate reports for clients using appropriate computer applications</p> <p>P5. Use internet for sending/receiving emails and connecting through social or other media</p>

Knowledge & Understanding

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

- Principles of effective and interactive communication
- 7 C's of communication and their importance
- Cultural and organizational practices for effective communication
- Effective negotiation skills
- Role of team members and functionality of the teams
- Team dynamics and stages of team development
- Conflict resolution strategies
- Negotiation techniques
- Basic architecture of computer system
- Input / output devices of computer and their functions
- Basic computer skills using MS Word, MS Excel, use of internet, sending and receiving emails etc.
- Preparing relevant documents and reports

Critical Evidence(s) Required

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

- Communicate effectively with colleagues and clients
- Develop a job completion report for the work using computer technology

Code:

Carry out Calculations and Prepare Estimates for Electrical Work

Overview

This competency standard identifies the competencies required to prepare estimates in accordance with client's guidelines. You will be expected to estimate, ensuring cost effectiveness, conforming to standards and regulations. The underpinning knowledge regarding calculations and estimation will be sufficient to provide the basis for your work.

Competency Units	Performance Criteria
1. Develop Basic Drawing	P1. Take accurate measurements and collect information regarding work specifications P2. Develop drawing according to job requirement P3. Use relevant electrical symbols and signs as per standards P4. Confirm the job specifications and drawing from client or supervisor and make necessary adjustments, where required P5. Calculate electrical load based on the electrical installations provided in the specifications
2. Perform Estimation of Materials	P1. Identify requirements of the material(s) to be utilized for the work in accordance with the job specifications and drawing P2. Check and confirm the requirement of the materials from the client or supervisor for accurate estimation. Quantify the material as per drawing P3. Use appropriate methods to calculate the of cost of material and accessories keeping in view the current market prices P4. Check and present the cost estimate to the client or supervisor for agreement P5. Make necessary adjustments in estimates, where required
3. Calculate Labour Cost	P1. Calculate hours required for the task in accordance with the job requirements P2. Prepare labour cost for the task using appropriate procedures

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:

- Basic electrical terminologies
- Electrical Circuit Characteristics

- Basic electric formulas & numeracy
- Norms in interacting & negotiating with customers/clients
- Interpretation of layout plans/wiring diagrams, service manuals and manufacturer's specifications, technical sketches, graphic symbols etc
- Types of electrical control and protective switchgear and accessories used in electrical circuits
- Types of electrical wires and cables and their ratings
- Types of electrical conduits, casing & capping etc.; their applications and their cutting/jointing/fixing methods
- Types of insulation material used in electrical installations
- Types of earth electrodes and their applications
- Local authority/enterprise policies related to electrical installations
- Electrical legislation and regulations related to electrical wiring
- Method of calculating labour cost/overheads/profit margin etc.
- Norms and standard formats of preparing estimates
- Record keeping and reporting

Critical Evidence(s) Required

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

- Provide cost effective and quality oriented Bill of Quantity (BOQ)
- Make the rate analysis according to market prices
- Provide the estimate in accordance with the BOQ

Code:

Maintain Safe Work Environment

Overview

This Competency Standard identifies the competencies required to apply occupational safety and health at workplace in accordance with the organization's approved guidelines and procedures. You will be expected to identify and use Personal Protective Equipment (PPE) according to the job requirement and potential hazards at workplace. The underpinning knowledge regarding OSH will be sufficient to provide the basis for your work.

Competency Units	Performance Criteria
1. Identify Hazards at Workplace	P1. Read and interpret work processes and procedures correctly to identify risk of hazards at workplace P2. Recognize engineering processes, tools, equipment and consumable materials that have the potential to cause harm P3. Identify any potential hazards and take appropriate action to minimize the risk
2. Observe Occupational Safety and Health (OSH)	P1. Work safely at all times, complying with health and safety precautions, regulations and other relevant guidelines P2. Identify health and safety hazards in the workplace, so that the potential for personal injury, damage to equipment or the workplace is prevented, and corrective action is taken P3. Deal with problems which are within your control, and report to the safety officer those problems that cannot be resolved P4. Wear, adjust, and maintain personal protective equipment to ensure correct fit and optimum protection in compliance with company procedures P5. Keep work area clean and clear of obstructions, and storing tools or equipment, so that the risk for accident or injury is prevented

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:

- Types of hazards that are most likely to cause harm to health and safety
- Health and safety precautions
- Health and safety signs and symbols
- Techniques and methods to identify the risks of hazards at workplace
- Dealing with hazards to avoid any accident or injury

- Safety reporting procedures and documentation
- Use of Personal Protective Equipment
- First aid treatment methods including methods of resuscitation
- Fire-fighting methods
- Safe methods of handling heavy loads

Critical Evidence(s) Required

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

- Identify possible hazards at workplace
- Use correct Personal Protective Equipment (PPE) for the assigned job

Code:

Install Electrical Wiring

Overview

This Competency Standard identifies the competencies required to install electrical wiring at work place in accordance with the drawing and client's requirement. You are expected to use electrical symbols, signs, government regulations, tools and equipment correctly while installing the electrical wiring in domestic as well as commercial settings. The underpinning knowledge regarding electrical wiring will be sufficient to provide the basis for your work.

<i>Competency Units</i>	<i>Performance Criteria</i>
1. Prepare Materials for Wiring	<p>P1. Select cables and wires required for each circuit considering current ratings, and conforming with standards and regulations</p> <p>P2. Select PVC conduit, trunk and related accessories according to requirements</p> <p>P3. Select electrical fittings, wiring accessories, switchgear, UPS, solar system, generator and other required materials as specified in the layout plan/wiring diagram</p>
2. Install Conduit, Trunk and Wiring	<p>P1. Mark locations of the electrical points, PVC conduit / trunk according to the wiring diagram</p> <p>P2. Chisel walls as required for burying of conduit according to its size and number</p> <p>P3. Select conduits and cut/bend/join them as necessary; fix in the walls; clamp firmly; ensure correct clearance from the wall surface according to sizes and number of wires to be accommodated</p> <p>P4. Select PVC trunk and cut as necessary, fix firmly and neatly on the wall surfaces according to the wiring diagram and number of wires to be accommodated</p> <p>P5. Select wires and cables according to the wiring diagram in accordance with current ratings, voltage drop and switch gear</p> <p>P6. Lay wires / cables according to the circuit requirements ensuring safety of the wires / cables</p> <p>P7. Install wiring for fixture and distribution boards according to wiring diagram</p>
3. Install Electrical Fixtures and Appliances	<p>P1. Fix electrical appliances and fixtures at standard height and stipulated location etc.</p> <p>P2. Install UPS/solar panel/generator for backup power as per standard practices</p> <p>P3. Terminate cables and flexible cords to appliances in accordance with the standard practice</p> <p>P4. Carry out testing of electrical fixtures and appliances to ensure proper functioning</p>

4. Perform Earthing for Wiring	P1. Select earth electrode to suit the soil conditions and according to standard practices P2. Prepare Earth electrode and bury it into the ground at the identified location as per wiring diagram P3. Terminate Earth continuity wire/cable at the earth electrode by using specified connecting/fixing accessories P4. Test the Earth resistance in accordance with the standard practices P5. Construct and mark suitable earth electrode cover pit for identification
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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:

- Layout plans/wiring diagrams and manufacturer's specifications, and electrical symbols etc.
- Types of domestic wiring methods and circuits and their applications
- Types of electrical control and protective switchgear and accessories used in domestic wiring
- Types of electrical wires/ cables and their ratings
- Types of electrical accessories used in domestic installations
- Types of electrical conduits, casing & capping etc. and their applications and their cutting/jointing /fixing methods
- Type and application of UPS, Solar system and generators
- Electrical tools & measuring instruments used in domestic electrical installation work
- Methods of joining terminating electric wires /cables and types of insulation material used in domestic wiring
- Techniques for installation of Earthing electrodes
- Regulations for domestic electrical wiring under Electricity Act, 1937
- Regulations of Institute of Electrical and Electronics Engineers (IEEE)Standards Associations
- Testing procedures in electrical circuits
- Record keeping and reporting

Critical Evidence(s) Required

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

- Install wiring of a room on a wiring board
- Install the conduit and trunks
- Install the appliances/ fixture
- Test Run the circuit

Code:

Install Industrial Electrical Equipment and Fixtures

Overview

This Competency Standard identifies the competencies required to apply industrial wiring and installation skills at workplace in accordance with the organizations' / clients' guidelines. The underpinning knowledge regarding installation of equipment & fixtures will be sufficient to provide the basis for your work.

<i>Competency Units</i>	<i>Performance Criteria</i>
1. Install Wiring (HT/LT)	<p>P1. Interpret electrical drawing/layout plan for installation of HT/LT wiring</p> <p>P2. Select PVC/steel conduit, trunk, runways and related accessories according to requirements</p> <p>P3. Select cables and wires required for each circuit considering current ratings, and conforming with standards and regulations</p> <p>P4. Select electrical fittings, wiring accessories, switchgear and other required materials as specified in the layout plan/wiring diagram</p> <p>P5. Select and use the appropriate personal protective equipment (PPE) to avoid injury or accident at work place</p>
2. Install Conduit, Trunk, Runways and Wiring	<p>P1. Mark locations of the electrical points, PVC/steel conduit / trunk according to the wiring diagram</p> <p>P2. Check and clean the conduit before wiring</p> <p>P3. Chisel walls as required for burying of conduit according to its size and numbers</p> <p>P4. Select conduits and cut/bend/join them as necessary; fix in the walls; clamp firmly; ensure correct clearance from the wall surface according to sizes and number of wires to be accommodated</p> <p>P5. Select PVC trunk and cut as necessary, fix firmly and neatly on the wall surfaces according to the wiring diagram and as per number of wires to be accommodated</p> <p>P6. Select wires and cables according to the wiring diagram in accordance with current ratings, voltage drop and switch gear</p> <p>P7. Lay wires / cables according to the circuit requirements ensuring safety of the wires / cables.</p> <p>P8. Install wiring for fixture and distribution boards according to wiring diagram</p> <p>P9. Erect electrical accessories and fittings at standard heights and stipulated locations etc.</p> <p>P10.</p>

<p>3. Install Fixtures, Equipment and Machinery</p>	<p>P1. Fix the electrical fixtures, equipment and machinery as per manufacturer's instructions P2. Connect the fixtures, equipment and machinery with Earth point as per standard practice(s) P3. Carry out Earth testing according to the power rating of the electrical fixtures, equipment and machinery P4. Terminate the electrical fixtures, equipment and machinery with main power supply as per manufacturer's instructions P5. Perform testing and commissioning of the electrical fixtures, equipment and machinery to ensure proper functioning</p>
<p>4. Install Wiring for Stand-by Power Supplies</p>	<p>P1. Install trunk /conduit/ducts etc. for laying of power cables according to wiring diagrams P2. Install and connect Earth electrodes for the standby power supply, as per manufacturer's instructions P3. Install power changeover switchgear/ control and protective switchgear required for standby power supply, and lay cables and terminate as per manufacturer's instructions P4. Check power changing over system for correct phase sequence and performance</p>

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:

- Electrical layout plans/wiring diagrams
- Regulations for industrial electrical wiring under Electricity Act, 1937
- Regulations of Institute of Electrical and Electronics Engineers (IEEE) Standards Associations
- Use of personal protective equipment for High Transmission/Low Transmission systems
- Types of electrical control and protective switchgear and accessories used in industrial electrical circuits
- Types of electrical wires and cables, including underground cables, their ratings and its applications
- Types of electrical accessories used for industrial electrical installations and their applications
- Types of electrical conduits/ducts, casing & capping etc., and their cutting/joining /fixing methods
- Methods of cutting, drilling, filing and grinding etc.
- Types of electrical tools & measuring instruments used in industrial electrical installation work
- Types of insulation material used in electrical installations
- Types of earth electrodes and their applications in electrical installations

- Testing procedures in electrical circuits with proper instruments
- Record keeping and reporting

Critical Evidence(s) Required

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

- The candidate will install the following accessories in a simulated environment or in an industrial/commercial building to provide evidence of competency:
 - Lighting circuits
 - Ring & radial Circuits for socket outlets
 - Circuits for fixed electrical equipment/appliances
 - Circuits for high current rated electrical machinery
 - Circuits for industrial socket outlets and equipment
 - Circuits for special locations and hazardous areas
 - Circuits for standby power supply

Code:

Carry out Repair/ Maintenance of Electrical Installations

Overview

This Competency Standard identifies the competencies required to carry out repair and maintenance of electrical installations at workplace in accordance with the manufacturer's instructions and organizational requirements. The underpinning knowledge regarding carrying out repair and maintenance of electrical installations will be sufficient to provide the basis for your work.

<i>Competency Units</i>	<i>Performance Criteria</i>
1. Identify Fault in Electrical Installations	P1. Inspect visually the electrical wiring, fixtures, equipment, appliances and machinery for discovering the faults and defects P2. Check the installation for consistency with the electrical drawing P3. Check the fault indication at relay for HT installation P4. Test electrical equipment as specified in the manufacturer's manual and record the results
2. Perform Troubleshooting	P1. Prepare a list of items/material(s) required for repair /replacement as per specifications P2. Make necessary adjustments in the control and protective switchgear P3. Replace defective control & protective switch gear, cables and accessories with standard items P4. Replace defective earth electrode & faulty/damaged earthing conductors P5. Test installed electrical equipment for safe and optimum performance according to standards & regulations P6. Record the results of the test performed on a standard format
3. Perform Preventive Maintenance	P1. Carry out Preventive maintenance as specified by the manufacturers P2. Update Maintenance/service records 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:

- Interpretation of layout diagrams, technical sketches, graphic symbols and wiring diagrams, and manufacturer's specifications etc.

- Types of electrical tools used for troubleshooting and preventive maintenance purposes
- Types of electrical measuring instruments used in testing electrical installations
- Types of electrical wiring systems for domestic & industrial purposes
- Methods of tracing the fault
- Types of electrical control and protective switchgear and accessories used in electrical circuits
- Types and principles of operation of circuit breakers used in electrical installations and their applications
- Types of electrical wires and cables and their ratings
- Types of electrical accessories and their application on electrical installations
- Types of earthing systems used in domestic & industrial electrical installations
- Importance of testing electrical installations
- Importance of corrective & preventive maintenance

Critical Evidence(s) Required

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

- The candidate will perform the following activities in an industrial/commercial building to provide evidence of competency:
 - Trace out the fault and take corrective action
 - Carry out the preventive maintenance
 - Update the service/repair record

Code:

Repair / Service Electric Motors and Generators

Overview

This Competency Standard identifies the competencies required to carry out repair and maintenance of motors and generators in accordance with the manufacturer's instructions. The underpinning knowledge regarding repair and maintenance of electrical motor & generators will be sufficient to provide the basis for your work.

<i>Competency Units</i>	<i>Performance Criteria</i>
1. Diagnose Fault in Electric Motor	<p>P1. Identify the type of electric motor from data / name plate or manual</p> <p>P2. Inspect visual mechanical defect such as, tight bearings, bent shaft, noisy running, temperature etc.</p> <p>P3. Check the motor by using specified test instruments to detect electrical defects such as loose/or burnt electrical connections, defective capacitors, burnt windings, low insulation resistance etc.</p> <p>P4. Check the tripping of protective device using specified test instruments, while the motor is running with power supply connected with suitable control and protective device, the difficulty in starting/low RPM/ unusual noises/ excessive heat/ grounded winding etc.</p>
2. Carry out Service/Repair Electric Motor	<p>P1. Dismantle the electric motor for internal tests/servicing/repairs according to manufacturer's instructions</p> <p>P2. Clean the parts of the motor with specified cleaning agents/tools & material</p> <p>P3. Check the windings insulation resistance with insulation tester</p> <p>P4. Repair the motor as per diagnosed fault</p> <p>P5. Check the insulation resistance of repaired motor as per standard</p> <p>P6. Carry out the No load and load tests as per standard practices</p>
3. Carry out Service/ Maintenance of Generators	<p>P1. Carry out routine maintenance of the generator as specified in the manufacturer's manual</p> <p>P2. Update the maintenance/service records</p>

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:

- Type and Construction of Motors (Induction, Servo, Synchronous, DC motors etc.)
- Servicing of motors and standby generators
- Types of electrical measuring instruments used in testing electric motors & generators
- Fundamentals of electrical rotating machines
- Auto Transfer switch (ATS)/Auto Main Failure (AMF) module
- Maintenance procedures on standby generators
- Working principles of electric motors & generators
- Types of electrical control and protective devices
- Disassembling & re-assembling of electric motors
- Common faults found in electric motors/generators and troubleshooting methods
- Electrical legislation and regulations related to electric motors and allied motor control switchgear
- Preventive maintenance work on motors and stand by generators
- Record keeping and reporting

Critical Evidence(s) Required

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

- The candidate will repair /service the motor & generator to provide evidence of competency. The scope of work includes the following activities:
 - Perform insulation, frequency, no-load, load testing etc.
 - Troubleshooting of starting system of motor & generator
 - Replacement of capacitor and bearings of motor
 - Configure the ATS/AMF module

Code:

Install Security & Communication Systems

Overview

This Competency Standard identifies the competencies required to install security & communication system in domestic and commercial buildings. The underpinning knowledge regarding the installation of Security & Communication System will be sufficient to provide the basis for your work.

Competency Units	Performance Criteria
1. Select the type of Safety / Security & Communication System	P1. Inspect the premises for installation of safety / security and communication system as per requirement P2. Select the most appropriate safety / security/ communication system considering the practicality of the system, cost and client requirements
2. Install Safety / Security & Communication System	P1. Select Tools, test instruments & material as needed for the work P2. Select Conduits/ trunk, cables, wire & switch gear and accessories according to the requirements P3. Mark the Location for safety / security and communication fixtures for installation, Conduits / casing and capping laid / fixed according to the wiring diagram avoiding possible electrical interferences on other systems P4. Lay the Wires / cables according to wiring diagram P5. Mount the safety / security and communication fixtures at the specified locations as per manufacturer's specifications and considering client's requirements P6. Install the standby power back up system as per requirement
3. Test the Installed Security, Safety and Communications System	P1. Connect the system to the power source as recommended by the manufacturer P2. Adjust Settings, directions where necessary for correct functioning of the system P3. Check the standby power backup for its proper functioning P4. Perform testing and commissioning of the system P5. Inform the client on the operating procedure and periodic testing of the system

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:

- Circuit diagrams, service manuals, technical sketches, graphic symbols and wiring diagrams and manufacturer's specifications etc.
- Types of electrical tools and its applications
- Types of electronic test instruments used for testing safety/security and communication systems
- Types of communication and power wires and cables used for safety /security and communication systems and their ratings
- Types of security video cameras and sensing devices etc., used in safety/security and communication systems/devices
- Importance of testing industrial safety/security and communication systems/devices after completion, and regular periodical inspections thereafter.
- Telecommunications Industry Association (TIA)/Pakistan Telecommunication Authority (PTA) regulations
- Radio interference suppression techniques
- Record keeping and reporting

Critical Evidence(s) Required

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

- The candidate will install the following accessories in an industrial/commercial building to provide evidence of competency:
 - Safety /security and communication circuits
 - Ring & radial Circuits for socket outlets
 - Circuits for fixed Safety /security and communication equipment/fixture

Code:

Install and Repair Programmable Logic Control (PLC) Systems

Overview

This Competency Standard identifies the competencies required to install, service & repair programmable logic control systems. The underpinning knowledge regarding the Install, Service & Repair Programmable Logic Control Systems will be sufficient to provide the basis for your work.

Competency Units	Performance Criteria
1. Install Programmable Logic Control System	P1. Interpret manufacturer's instructional/service manual and machine functional diagram P2. Install and connect the PLC system according to the functional diagram P3. Ensure the PLC programme is correct and meets the requirement P4. Check the machine performance as per requirement
2. Service and Repair Programmable Logic Control (PLC) Systems/ Machines	P1. Interpret manufacturer's service manuals/software and machine / system tested P2. Locate the fault in the PLC system as per manufacturers manual P3. Repair/replace the faulty components of PLC system as per requirement
3. Service and Repair Input/ Output Devices	P1. Interpret manufacturer's service manuals/software and machine / system tested, and the locations of faults identified P2. Locate the faults in the input/output device according to manufacturer's manual P3. Repair/replace the faulty components, as per requirements P4. Carry out the functional tests on the control devices and final working as per manual

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:

- Interpretation of circuit diagrams, service manuals, technical sketches, graphic symbols, wiring diagrams and manufacturer's specifications etc.
- Fundamentals of Digital Electronics

- Fundamentals of ladder logic diagram
- Types of PLC system
- Types of PLC based machines and their applications
- Trouble shooting techniques in PLC based machines
- Cyber control system
- Motor control switchgear and its applications with PLC
- Common faults in industrial PLC based machines
- Documentation related to inspection and testing of PLC based control systems and machines
- Safety procedures
- Sensors and proximity switches

Critical Evidence(s) Required

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

- The candidate will install/repair the following accessories in an industrial/commercial building to provide evidence of competency:
 - Install and connect the PLC components according to the manual
 - Troubleshoot the faults in the PLC system and input/output devices according to manufacturer's manual
 - Carry out the functional tests on the control devices and final working as per manual

LIST OF TOOLS AND EQUIPMENT

Reno.	Items
1.	AC & DC Motors
2.	Ammeter
3.	Battery Charger
4.	Battery Cleaning Kit
5.	Bearing Puller
6.	Bench Vice
7.	Cable / Wire Gauge
8.	Cable Cutter
9.	Cable Knife
10.	Cells tester
11.	Chisel
12.	Circuit Boards
13.	Clamp Meter
14.	Combination Plier Set
15.	Disk Grinder
16.	Duct Rod
17.	Earth Tester
18.	Files (set)
19.	Filler gauge
20.	Flux
21.	Generator
22.	Gloves
23.	Grinder
24.	Hacksaw
25.	Hammer
26.	Handsaw
27.	Hole saw
28.	Hydrometer
29.	IR Temperature Gun
30.	L Scale
31.	Lugs Punching Machine (Hydraulic and Manual)
32.	Lux Meter
33.	Magnetic Conductor
34.	Megger (Insulation Tester)
35.	Micron Meter
36.	Mini Hydraulic Press Machine
37.	Multimeter
38.	OTDR Meter
39.	Overall Combination
40.	Phase Sequence Meter
41.	Philips Screw drivers Set
42.	Ring Spanner Set

43.	RPM Meter
44.	Safety Belt
45.	Safety Goggles
46.	Safety Helmet
47.	Safety Shoes
48.	Set of Nose Pliers
49.	Set of Screw Drivers
50.	Soldering Iron
51.	Soldering Lead
52.	Specific Gravity Chart
53.	Splicing Machine
54.	Spring tension checking meter
55.	Tachometer
56.	Test lamp
57.	Thermometer
58.	Thimble Press Plier
59.	Torque Wrench
60.	Transformer
61.	Vernier Caliper
62.	Voltmeter
63.	Wire Striper