ELECTRICAL EQUIPMENT INSTALLATION AND REPAIR

Competency Standards

National Vocational Certificate Level 2

Version 1 - December 2014

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Competency Standards: Electrical Equipment Installer & Repairer (Assistant) - Level 2

Competency Standard A: Maintain workplace safety

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Follow safe work procedures; apply tools and equipment safety measures; and follow workplace emergency procedures.

Competency Unit	Performance Criteria	Knowledge and Understanding
A1: **Follow safe work procedures**	**P1-** Organise and arrange duties, tools, equipment materials and work area **P2-** Use and store PPE **P3-** Perform tasks in a safe manner	**K1-** Company safety SOP/policy; Housekeeping practices; Factors that may influence safety at the workplace, such as anger and stress **K2-** Types of personal protective equipment **K3-** Safety signs and symbols; Isolation and lockout procedures
A2: **Apply tools & equipment safety measures**	**P1-** Check earthing for safety of equipment **P2-** Store tooling and equipment securely **P3-** Check insulation of equipment cables	**K1-** Method of earthing and its effects on safety **K2-** Storage and stacking methods of tools & equipment
A3: **Follow workplace emergency procedures**	**P1-** Follow safe workplace procedures for dealing with accidents, fires and emergencies within scope of responsibility	**K-** Scope of responsibility; First aid procedures; Fire safety and fire fighting procedures; Risk control measures

Competency Standard B: Apply continuing professional development

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Identify professional development needs; develop professional knowledge, skills and attitudes, and maintain professional proficiency.

Competency Unit	Performance Criteria	Knowledge and Understanding
B1: **Identify professional development needs**	**P1-** Discuss professional development needs **P2-** Identify professional development programmes	**K1-** Reasons for professional development **K2-** Access to programmes; Career guidance
B2- **Develop professional knowledge, skills and attitudes**	**P1-** Participate in training programmes **P2-** Document training outcome **P3-** Drawings reading skills	**K1-** Outcomes and relevance of training **K2-** Report and portfolio writing
B3- **Maintain professional proficiency**	**P1-** Identify and use self-study sources **P2-** Implement self-study plan	**K1-** Research methods; Access to sources **K2-** Planning your career

Competency Standard C: Perform preventive maintenance as part of electrical operations

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for preventive maintenance; perform routine inspections; carry out preventive maintenance; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
C1: **Plan and prepare for preventive maintenance**	**P1-** Identify and obtain safety and other regulatory requirements for maintenance **P2-** Interpret circuit diagrams **P3-** Identify and select tools and equipment	**K1-** Safety requirements; Specifications; Hazard identification **K2-** Drawings and symbols specifications **K3-** Tools and equipment and calibration thereof
C2: **Perform routine Inspection**	**P1-** Check for safety hazards **P2-** Carry out procedures for routine checks **P3-** Document results	**K1-** Inspection requirements **K2-** Maintenance of electrical instruments and equipment **K3-** Types of common faults of wiring; Load balance; Safety precautions **K4-** Test and preventive reports
C3: **Carry out preventive maintenance**	**P1-** Perform basic measurements tests **P2-** Perform minor adjustments and calibrations **P3-** Replace worn out or damaged parts **P4-** Follow equipment manufacturer instructions	**K1-** Measurement and calculation of electrical parameters **K2-** Basic operation of appliance and settings to adjust performance **K3-** Communication skills
C4: **Complete work**	**P1-** Complete work related documents and procedures **P2-** Perform final quality inspection **P3-** Clean up and store tools, equipment and materials **P4-** Keep record of test & inspection	**K1-** Importance of documentation; Customer care procedures and techniques **K2-** Importance of quality; handing over to client **K3-** Waste disposal procedures; Care of tools and equipment

Competency Standard D: Perform corrective maintenance as part of electrical operations

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for corrective maintenance; perform troubleshooting; carry out corrective maintenance procedures; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
D1: **Plan and prepare for corrective maintenance**	**P1-** Identify and obtain safety and other regulatory requirements for maintenance **P2-** Interpret circuit diagrams **P3-** Identify and select tools and equipment	**K1-** Safety requirements; Specifications; Hazard identification **K2-** Drawings and symbols specifications **K3-** Tools and equipment and calibration thereof
D2: **Perform troubleshooting**	**P1-** Check for safety hazards **P2-** Carry out diagnostic procedures **P3-** Identify faulty parts and/or equipment **P4-** Analyse system fault **P5-** refer to O&M manuals for subjected problems	**K1-** Troubleshooting requirements **K2-** Identification of electrical faults by checking shape, size and colour of components and parts; Measurement of electrical parameters; Safety precautions **K3-** Methods of fault identification in electrical components **K4-** System operations in an electrical environment
D3: **Carry out corrective maintenance procedures**	**P1-** Dismantle faulty parts or components **P2-** Replace or repair faulty parts or components **P3-** Perform commissioning	**K1-** Dismantling procedures **K2-** Replacing and repairing procedures **K3-** Electrical load management; commissioning procedures
D4: **Complete work**	**P1-** Complete work related documents and procedures **P2-** Perform final quality inspection **P3-** Clean up and store tools, equipment and materials **P4-** Keep record of replace & repaired parts	**K1-** Importance of documentation; Customer care procedures and techniques **K2-** Importance of quality; handing over to client **K3-** Waste disposal procedures; Care of tools and equipment

Competency Standard E: Test electrical and electronic parameters

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Perform testing; diagnose faults; and remove faults.

Competency Unit	Performance Criteria	Knowledge and Understanding
E1: **Perform Testing**	**P1-** Conduct visual inspection **P2-** Implement testing procedures **P3-** Check testing equipment calibration	**K1-** Damage identification in terms of cracks, disorder in shape and structure, broken parts **K2-** Process of different tests; Electrical parameters
E2: **Diagnose fault**	**P1-** Interpret test results **P2-** Implement troubleshooting procedures and identify fault	**K1-** Interpretation of drawings and circuit diagrams **K2**- Troubleshooting procedures; Electrical and electronic parameters
E3: **Remove faults**	**P1-** Repair or replace component parts **P2-** Carry out operational testing **P3-** Maintain SOPs	**K1-** Interpretation of drawings and circuit diagrams; product knowledge **K2-** Product knowledge; Testing procedures and equipment

Competency Standard F: Assemble electrical machines

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for assembling; assemble machine and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
F1: **Plan and prepare for assembling**	**P1-** Identify and obtain safety and other regulatory requirements for assembling **P2-** Prepare tools and equipment	**K1-** Safety requirements; Specifications; hazard identification **K2-** Types of tools, equipment and material
F2: **Assemble machine**	**P1-** Confirm assembling specifications **P2-** Assemble and connect electrical circuit with ports **P3-** Joint cables and connections **P4-** Confirm assembling	**K1-** Assembling requirements **K2-** Concept of neutral, phase and earth; Input and Output Safety precautions **K3-** Types and application of different jointing methods - tin (solder), crimped terminals - ferrules and shrinking nut - bolt & screw terminal **K4-** Supervisor and/or client communication
F3: **Complete work**	**P1-** Complete work related documents and procedures **P2-** Perform final quality inspection **P3-** Clean up and store tools, equipment and materials	**K1-** Importance of documentation; customer care procedures and techniques **K2-** Importance of quality; handing over to client **K3-** Waste disposal procedures; care of tools and equipment

Competency Standard G: Assemble electrical appliances

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for assembling; assemble appliances; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
G1: **Plan and prepare for assembling**	**P1-** Identify and obtain safety and other regulatory requirements for assembling **P2-** Prepare tools and equipment	**K1-** Safety requirements; Specifications; hazard identification **K2-** Types of tools, equipment and material
G2: **Assemble appliances**	**P1-** Confirm assembling specifications **P2-** Assemble and connect electrical circuit with ports **P3-** Joint cables and connections **P4-** Confirm assembling	**K1-** Assembling requirements **K2-** Concept of neutral, phase and earth; Input and Output Safety precautions **K3-** Types and application of different jointing methods - tin (solder), crimped terminals - ferrules and shrinking nut - bolt & screw terminal **K4-** Supervisor and/or client communication
G3: **Complete work**	**P1-** Complete work related documents and procedures **P2-** Perform final quality inspection **P3-** Clean up and store tools, equipment and materials	**K1-** Importance of documentation; customer care procedures and techniques **K2-** Importance of quality; handing over to client **K3-** Waste disposal procedures; care of tools and equipment

Competency Standard H: Perform installation of electrical products and appliances

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for installation; install electrical products and appliances; carry out operational checks; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
H1: **Plan and prepare for installation**	**P1-** Identify and obtain safety and other regulatory requirements for installation **P2-** Interpret circuit diagram **P3-** Select and termination electrical cables **P4-** Arrange earthing	**K1-** Safety requirements; Specifications; hazard identification **K2-** Drawing and symbol specifications **K3-** Types and size of cables; mounting of cables; tools for cable works **K3-** Earthing requirements
H2: **Install electrical products and appliances**	**P1-** Confirm installation specifications & drawings **P2-** Position and configure product or appliance **P3-** Joint cables and connections **P4-** Confirm installation as per instruction of manufacturer	**K1-** Installation requirements **K2-** Importance of correct position and location; Safety precautions **K3-** Types and application of different jointing methods - tin, crimped terminals - ferrules and shrinking nut - bolt & screw terminal **K4-** Supervisor and/or client communication
H3: **Carry out operational checks**	**P1-** Test and adjust component and/or parts **P2-** Confirm operation of electrical product or appliance **P3-** Explain operation of product or appliance to customer	**K1-** Functional tests and adjustments **K2-** Machine features **K3-** Communication skills
H4: **Complete work**	**P1-** Complete work related documents and procedures **P2-** Perform final quality inspection **P3-** Clean up and store tools, equipment and materials **P4-** Maintain data bank	**K1-** Importance of documentation; customer care procedures and techniques **K2-** Importance of quality; handing over to client **K3-** Waste disposal procedures; care of tools and equipment

Competency Standard I: Install electrical machines

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for installation; perform machine installation; carry out operational testing; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
I1: **Plan and prepare for installation**	**P1-** Identify and obtain safety and other regulatory requirements for installation **P2-** Review layout plan and confirm location for installation **P3-** Arrange tools and equipment **P4-** Acquire work	**K1-** Safety requirements; Specifications; Hazard identification **K2-** Importance of correct position and location – consequences of wrong position and location; Physical structure **K3-** Tools and equipment requirements **K4-** Purpose of work permit
I2: **Perform machine installation**	**P1-** Interpret and confirm installation specifications **P2-** Perform installation **P3-** Perform pre-commissioning Test **P4-** Confirm installation	**K1-** Installation requirements **K2-** Installation requirements **K3-** Pre-commissioning procedures **K4-** Supervisor and/or client communication
I3: **Carry out operational testing**	**P1-** Test and adjust component and/or parts **P2-** Commission machine **P3-** Perform permit closing	**K1-** Functional tests and adjustments **K2-** Basic operation of machine and settings to adjust performance **K3-** Safety procedures
I4: **Complete work**	**P1-** Complete work related documents and procedures **P2-** Perform final quality inspection **P3-** Clean up and store tools, equipment and materials	**K1-** Importance of documentation; customer care procedures and techniques **K2-** Importance of quality; handing over to client **K3-** Waste disposal procedures; care of tools and equipment

Competency Standard J: Perform installation of electrical machines

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan and prepare for installation; install electrical machine; carry out operational checks; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
J1: **Plan and prepare for installation**	**P1-** Identify and obtain safety and other regulatory requirements for installation **P2-** Select and termination electrical cables **P3-** Arrange earthing	**K1-** Safety requirements; Specifications; hazard identification **K2-** Types and size of cables; mounting of cables; tools for cable works **K3-** Earthing requirements
J2: **Install electrical machine**	**P1-** Confirm installation specification & drawings **P2-** Arrangements for loading & unloading of electric equipment **P3-** Position and configure machine **P4-** Joint cables and connections **P5-** Confirm installation	**K1-** Installation requirements **K2-** Importance of correct position and location; Safety precautions **K3-** Types and application of different jointing methods - tin - crimped lug, cable shoes, eyelets and tunnel terminals - ferrules and shrinking nut - bolt & screw terminal **K4-** Supervisor and/or client communication
J3: **Carry out operational testing**	**P1-** Test and adjust component and/or parts **P2-** Confirm operation of electrical machine **P3-** Explain operation of machine to customer	**K1-** Functional tests and adjustments **K2-** Machine features **K3-** Communication skills
J4: **Complete work**	**P1-** Complete work related documents and procedures **P2-** Perform final quality inspection **P3-** Clean up and store tools, equipment and materials	**K1-** Importance of documentation; Customer care procedures and techniques **K2-** Importance of quality; handing over to client **K3-** Waste disposal procedures; Care of tools and equipment

Competency Standard K: Install domestic wiring

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Plan wiring layout; lay cable; perform wiring test; install electrical appliances; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
K1: **Plan wiring layout**	**P1-** Draw wiring layout **P2-** Discuss with home owner **P3-** Measure distance to connection points **P4-** Estimate material **P5-** Prepare tools, equipment and materials	**K1-** Interpretation of drawings, symbols, cable number according to load, and colour coding **K2-** Measuring of units and conversion **K3-** Quality of different conductor and insulator types **K4-** Application of tools, equipment and materials
K2: **Lay cables**	**P1-** Prepare installation of cable **P2-** Install conduit, **GI** pipes, **PVC** pipes and/or ducts **P3-** Pull cables in conduits **P4-** Connect cables **P5-** Connect fixtures	**K1-** Chiselling, ducting, **PVC** and **GI** pipe wiring procedures **K2-** Properties of materials **K3-** Application of cables and tools **K4-** Types of joints **K5-** Types and purpose of fixtures
K3: **Perform wiring test**	**P1-** Inspect wiring and distribution board **P2-** Conduct tests **P3-** Document test results	**K1-** Importance of continuity and factors of loose fittings **K2-** Application of equipment and tools used for testing; Importance of earthing **K3-** Importance of documenting compliance and noncompliance of test results and subsequent steps to be taken

K4: **Install electrical appliances**	**P1-** Interpret and confirm installation specifications **P2-** Install, position and secure appliances **P3-** Connect appliance and test for correct operation **P4-** Confirm completed installation	**K1-** Interpretation of installation requirements and specifications **K2-** Importance of correct position and location; Safety precautions **K3-** Basic operation of appliance and settings to adjust performance; Requirements for good, properly bonded earth **K4-** Client communication
K5: **Complete work**	**P1-** Complete work related documents and procedures **P2-** Perform final quality inspection **P3-** Clean up and store tools, equipment and materials	**K1-** Importance of documentation; Customer care procedures and techniques **K2-** Importance of quality; handing over to client **K3-** Waste disposal procedures; Care of tools and equipment

Competency Standard L: Use and maintain electrical tools and equipment

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: Use electrical tools and equipment; maintain electrical tools, equipment and instruments; maintain batteries; and calibrate measuring equipment.

Competency Unit	Performance Criteria	Knowledge and Understanding
L1: **Use electrical tools and equipment**	**P1-** Identify and select tools, equipment and instruments **P2-** Demonstrate safe use of tools, equipment and instruments	**K1-** Purpose of electrical tools, equipment and instruments **K2-** Use of electrical tools, equipment and instruments
L2: **Maintain electrical tools, equipment and instruments**	**P1-** Describe preventive maintenance procedures **P2-** Maintain and/or replace tool insulation **P3-** Clean and store electrical tools, equipment and instruments	**K1-** Preventive maintenance; Types of maintenance schedules or programmes for: - Tools - Equipment - Instruments - Machinery - Facilities **K2-** Types of insulation and reports **K3-** Storage requirements
L3: **Maintain batteries**	**P1-** Determine state of charge **P2-** Maintain electrolyte level **P3-** Charge batteries	**K1-** Types of batteries **K2-** Role of electrolyte **K3-** Charing procedures
L4: **Calibrate measuring instruments**	**P1-** Check calibration of measuring instruments **P2-** Document and interpret calibration procedure **P3-** Calibrate measuring instrument	**K1-** Types and methods of calibration **K2-** Types of calibration reports **K3-** Types and methods of calibration

Documents, policies, guidelines:

- International Labour Organisation (ILO) Standards on Occupational Health and Safety
- Pakistan Electricity Act, 1910 and subsequent amendments
- Institute of Electrical and Electronics Engineers Standards Association (IEEE-SA)
- Industry code of practice

Tools and Equipment:

No.	Description	Quantity
1	Personal protective equipment	
2	Tools and equipment for cable works	
3	Hand tools and Powered handheld machine tools	
4	Adjustable wrench	
6	Bench vice	
7	Blower	
8	Cable knife	
9	Chisel set	
10	Clamp on meter	

11	Combination nose plier	
12	Component chart	
13	Crimping tool	
14	Cutter plier	
15	Drill machine	
16	Earth tester	
17	Electrical welding plant	
18	File set	
19	Gloves	
20	Greasing gun	
21	Grinder	
22	Grip plier	
23	Hacksaw	
24	Hammer	
25	Hammer drill	
26	Hand drill machine	
27	IR gun	
28	Jiri set	
29	L scale	
30	Level meter	

31	L-key set	
32	Measuring tape	
33	Megar	
34	Multimeter	
35	Plier set	
36	Puller set	
37	Richet spanner set	
38	Safety belt	
39	Screw driver set	
40	Sequence meter	
41	Shoot gun	
42	Soldering gun	
43	Soldering iron	
44	Soldering sucker	
45	Star kit set	
46	Tagging machine	
47	Tap set	
48	Torque wrench	
49	Tester	
50	Vernier callipers	

Consumables:

No.	Description		Quantity
1	Flexible wire	40/0.076 blue	200m
2	Flexible wire	40/0.076Yellow	200m
3	Two core twist wire cable	40/0.076	100m
4	single way switch	5 Amp	24
5	Two way switch	5 Amp	24
6	Two pole main switch	10 Amp	24
7	Two pin socket	5 Amp	24
8	Lamp Holder	Piano Type	24
9	Lamp Holder	Round Type	24
10	Cable 3/0.029		2 Roll
11	Cable 7/0.029		1 Roll
12	Bulb	100W	24
13	Bulb	200W	24
14	PVC Pipe &fittings	"1/2x10Ft	6
15	Junction Box	4 Way,2 way	24
16	Ceiling Rose	10 Amp	24
17	Iron Screw	3/16x3/8,3/16x2	2 Pak
18	Wooden Screw	"1,"3/4	2 Pak
19	Wooden Screw	1x1/2,"2	2 Pak

20	Plug shoe	10 Amp	12
21	Tube Rod	40w	6
22	Tube starter	220V	12
23	Timer Washing Machine	220V	6
24	Selector switch	220V	6
25	Indicator	220V	12
26	Insulation Tap	Neeto	24
27	Fan Capacitor	(3.5uf)	6
28	Motor capacitor	(80/110 uf)	6
29	Connecter	(15A)	12
30	Element	(750w)	12
31	Fibre Washers	7/16 inch	2 Pak
32	Iron Screws different size	½, ¾, 1”, 1.5”	4 Pak
33	Soldering wire	60/40	6
34	Paste for soldering	Local	6 Pak
35	Wiring &Winding Material	Wooden, PVC Board, Ducts, etc	As required
36	Varnish		30 Pak
37	Cotton Tap		30 Rolls
38	Winding Wire#30		5 Kg
39	Winding Wire#32		5 Kg
40	Winding Wire#34		1 Kg

41	Winding Wire#35		1 Kg
42	Winding Wire#36		1 Kg
43	Winding Wire#21		
44	Winding Wire#19		
45	Winding Wire#20		
46	Transformer Bobn (Chose Size)		30
47	Leathried Paper#7		15 Feet
48	Leathried Paper#10		25 Feet
49	Salvees (Different Size)		50 No.
50	LED		120
51	Diode		120
52	Carbon Resistor		150
53	Resister 5 Watt		30
54	Capacitor	16 Volt 1000 uf	30
55	Transistor	NPN, PNP	60
56	Photo Diode		15
57	Rod & Stator Holder		10 each
58	Hydro Meter		04
59	Float Switch		05
60	Energy Saver	24 W	12
61	Transformer Core	Different size	As per required
62	Transformer bobbin	Different size	As per required
63	Winding Wire for Transformer Winding	Different size	As per required
64	Cable Ties	Different size	

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