

National Vocational Certificate

Level 2 in

Electrical Technology (Building Electricity)

Competency Standards



Version 1

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Qualification Code: 0713E&E12

National Vocational & Technical Training Commission

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Table of Contents

Competency Standards

A	Maintain workplace safety	04
B	Apply continuing professional development	05
C	Perform preventive maintenance as part of electrical operations	06
D	Perform corrective maintenance as part of electrical operations	07
E	Test electrical and electronic parameters	08
F	Install solar panel	09
G	Assemble electrical appliances	10
H	Perform installation of electrical products and appliances	11
I	Install domestic wiring	12
J	Use and maintain electrical tools and equipment	14
K	Solar PV Fundamentals	16
L	Off-grid Solar PV Systems with battery storage	17
M	Operation and maintenance of off-grid solar PV systems	19
Documents, policies, guidelines		21
Tools and Equipment		21
Consumables		25

Competency Standards: Building Electrician cum PV Cell Installer (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	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	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 the likely to be worn out or damaged parts	K1- Measurement and calculation of electrical parameters K2- Basic operation of appliance and settings to adjust performance K3- Proper communicate the preventive maintenance procedure 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	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	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 before & after correction 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	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	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	K1- Interpretation of drawings and circuit diagrams; product knowledge K2- Product knowledge; Testing procedures and equipment

Competency Standard F: Install solar panel

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 solar photovoltaic array; carry out operational checks; and complete work

Competency Unit	Performance Criteria	Knowledge and Understanding
F1: Plan and prepare for installation	P1- Identify and obtain safety and other regulatory requirements for installation P2- Determine location P3- Set PV angles	K1- Safety requirements; Specifications; Hazard identification (Proper space requirement, load requirement) K2- Factors influencing the efficiency of solar panels; Physical structur, shading effects K3- Summer and winter requirements K4- Load analysis K5- Existing combined distribution BUTU (Average & Maximum Angle)
F2: Install solar photovoltaic array	P1- Interpret and confirm installation P2- Connect PV panels and electrical components P3- Arrange earthing P4- Confirm installation	K1- Installation requirements K2- Series and parallel circuit setup; Cable sizing; Forward and reverse diodes K3- Requirements for properly bonded earthing K4- Supervisor and/or client communication
F3: 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; Basic knowledge and calculation of open circuit voltage, on load voltage, short circuit current, maximum current load; Basic function of relay change over K2- Basic operation of appliance and settings to adjust performance K3- Communication skills (communicate with seniors or client after check up)
F4:	P1- Complete work related documents and procedures	K1- Importance of documentation; Customer care procedures and techniques

Complete work	P2- Perform final quality inspection	K2- Importance of quality; handing over to client
Work Completion	P3- Clean up and store tools, equipment and materials	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 machine / Electrical Equipments	P1- Confirm assembling specifications P2- Assemble and connect electrical circuit with ports P3- Join cables and connections P4- Confirm assembling / confirmation report	K1- Assembling requirements K2- Concept of neutral, phase and earth; Input and Output Safety precautions K3- Types and application of different methods of joints - 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(Q&C) 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- Selecton and termination of 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 K4- Earthing requirements (Methods, conductor specification)
H2: Install electrical products and appliances	P1- Confirm installation specification P2- Position and configure product or appliance P3- Join cables and connections P4- Confirm installation	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	K1- Importance of documentation; customer care procedures and techniques K2- Importance of quality; handing over to client (Q&C) K3- Waste disposal procedures; care of tools and equipment

Competency Standard I: 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
I1: Plan wiring layout	P1- Draw wiring layout P2- Measure distance to connection points P3- Estimate material P4- 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
I2: Lay cables	P1- Prepare installation of cable P2- Install conduit, GI pipes, PVC pipes and/or ducts P3- Pull-in cables 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
I3: 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

I4: 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
I5: 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: 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
J1: 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
J2: 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
J3: Maintain batteries	P1- Determine state of charge P2- Maintain electrolyte level P3- Charge batteries	K1- Types of batteries K2- Role of electrolyte K3- Charging procedures
J4: 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

Competency Standard K: Solar PV Fundamentals

Overview: This competency standard is intended for those who carry out installation of off-grid solar PV system. People holding credit for this module are able to describe Solar PV basics (photovoltaic history and today's market) and different types of solar PV cells, their characteristic and techniques (polycrystalline, monocrystalline and Thin Film)

Competency Unit	Performance Criteria	Knowledge and Understanding
A1: Basic concepts of solar PV system(History and today market)	P1- Define the basic photovoltaic terms P2- Importance of renewable energy P3- Identify today's needs of solar technology	K1- Semiconductor, diodes and their functions K2- Energy, kind of energy and sources of energy K3- Load demand, loads heeding and solar technology
A2: Types and characteristics of solar PV system	P1: Identify and select solar cell P2: Plan and prepare for solar panel installation techniques P3- Identify the types of photovoltaic cells P4- Measure the distance for solar array P5 - Estimate the solar power demand	K1- Identify the characteristics of different solar cells k2- Methods of solar cells manufacturing, materials and properties of materials K3- Mono technology, ploy technology and amphibious technology K4- Interpretation of drawing scale, basic measuring units and conversion of units K5- Calculation for energy and load demand

Competency Standard L: Off-grid Solar PV Systems with battery storage

Overview: This competency standard is intended for those who carry out installation of off-grid solar PV system. People holding credit for this module are able to describe, Off-grid Solar PV Systems, Backup (UPS) systems, Batteries (Characteristics, handling, maintenance, safety, life time, autonomy, recycling) and Charge controllers

Competency Unit	Performance Criteria	Knowledge and Understanding
B1: Off grid solar PV system	P1- Follow safety and other regulatory requirements for off-grid solar PV system. P2- Interpret circuit diagram P3- Identify and select tools and equipment for off- grid PV system P4- Perform connection of PV panels and electrical components.	K1- Safety requirements and hazards identification K2- Interpretation of drawings and specifications K3- Tools and equipment for installation K4- Jointing techniques ,specifications and safety requirements
B2: Plan and prepare for backup system	P1- Follow safety and other regulatory requirements for backup system P2- Plan and prepare electrical tools and equipment for backup system P3- Performs connections for backup system P4- Monitor load specifications for backup system	K1- Safety requirements and hazards identification K2- Tools and equipment for backup system K3- Methods and techniques of connections K4- Calculation of load, method of electrical measuring parameters and load management
B3: Maintain batteries	P1- Identify the characteristics of different types of batteries P2- Perform battery connections P2: Plan and prepare for charging of batteries P3- Maintain electrolyte level P4- Testing procedures for batteries P-5 Recycling of batteries	K1- Types of batteries K2- Connection techniques and requirements K3- Battery charging techniques K4- Role of electrolyte K5- Recycling and repairing procedures
B4: Use electrical tools and charge controller	P1- Follow safety and other regulatory requirements for use of electrical tools. P2- Interpret circuit diagram	K1- Safety requirements and hazards identification K2- Interpretation of drawings and specifications

	P3- Identify and select tools and equipment for charge controller P4- make connections of charge controller with components	K3- Tools and equipment for charge controller system K4- Methods of connection and specifications
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Competency Standard M: Operation and maintenance of off-grid solar PV systems

Overview: This competency standard is intended for those who carry out Installation of off-grid solar PV system. People holding credit for this module are able to describe Commissioning procedures and Operation and maintenance of off-grid solar PV systems

Competency Unit	Performance Criteria	Knowledge and Understanding
C1: Commissioning procedures	P1- Follow safety and other regulatory requirements for commissioning. P2- Interpret circuit diagram. P3- Plan and prepare electrical tools and equipment for commissioning. P4- Performs connections for commissioning. P5- Perform commissioning	K1- Safety requirements and hazards identification K2- Interpretation of drawing and specifications K3- Tools and equipment for commissioning procedures K4- Connection techniques, and requirements for commissioning K5- Dismantling, replacing and commissioning procedures
C2: Monitor operation And maintainers of Off-Grid Solar PV System	P1- Monitor electrical loads P2- Analyze system faults P3- Check out electrical parameters P4- Carryout preventive maintenance P5- Replace and repair faulty parts or components	K1- Methods of calculation of load ,measuring techniques of current and voltage K2- Identification of faults and measurement of electrical parameters K3- Methods of fault identification and troubleshooting K4- Inspection requirement, safety requirements and hazards identification K5- Dismantling and replacing procedures
C4: 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 K3- Handing over procedure to client K4- Waste disposal procedures K5- Care of tools and equipment

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

Should comply to the
standrds used in Pakistan

Tools and Equipment:

No.	Description	Quantity
1	Personal protective equipment	Industry code of practice
2	Fire extinguishers	
3	First aid box	
4	Adjustable wrench	
5	Amp meter	
6	AVO meter	
7	Batteries	
8	Battery charger	
9	Bench vice	
10	Ceiling hole cutter	

11	Charge controller	
12	Chisel	
13	Clamp on meter	
14	Compass	
15	Cutter	
16	Drill machine	
17	Earth tester meter	
18	Extension board	
19	File set	
20	First Aid box	
21	Gloves	
22	Goggles	
23	Grinder	
24	Hammer	
25	Hand drill machine	
26	Helmet	
27	Herts meter	
28	Hacksaw	
29	Knife (cable)	
30	Level	

31	L-key set	
32	Lock plier	
33	Measuring tape	
34	Mega meter (Analog & Digital)	
35	Micrometer	
36	Multimeter	
37	Number punch	
38	Phase sequence meter	
39	Pipe cutter	
40	Pipe vice	
41	Pipe wrench	
42	Plier set	
43	Punching tool (Networking /Telephone)	
44	Ratchet set	
45	Safety boots	
46	Scissor	
47	Screw driver set	
48	Soldering iron	
49	Spanner set	
50	Steel scale	

51	Steel wire	
52	synchronizing meter	
53	Tachometer	
54	Tester	
55	Thimble press	
56	Tong tester (clamp-on meter) AC/DC	
57	Torch	
58	Vernier caliper	
59	Volt meter	
60	Wire gauge	
61	Wood saw	

Consumables:

No.	Description	Quantity
1	Cable 3 / .029"	As Required
2	Cable 7 / .029"	As Required
3	Cable 1 / .036"	As Required
4	Cable 23 / .0076"	As Required
5	Cable 40 / .0076"	As Required
6	Switch Single Way	As Required
7	Switch Two Way	As Required
8	Push Button	As Required
9	Bulb Holder Piano Type	As Required
10	Bulb Holder Button Type	As Required
11	Ceiling Rose	As Required
12	Fan Dimmer	As Required
13	Socket Two Pin	As Required
14	Socket Three Pin	As Required
15	Light Plug	As Required
16	Power Plug	As Required
17	PVC Pipe	As Required
18	PVC Elbow	As Required
19	PVC Band	As Required

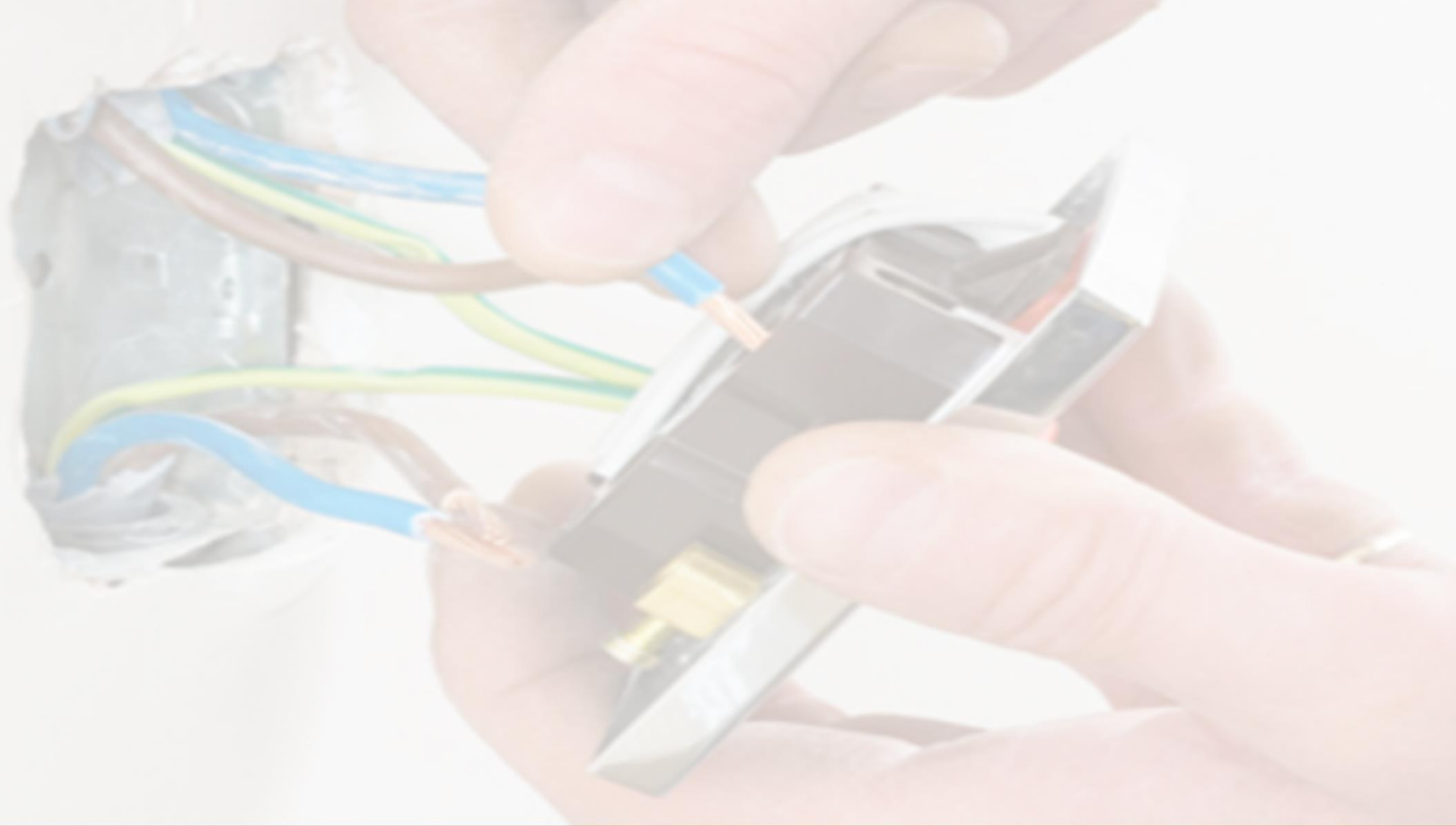
20	Junction Box	As Required
21	Fan Box	As Required
22	Raval Plug	As Required
23	Pipe Shaddle	As Required
24	Cable Shaddle	As Required
25	Board 4 x 4	As Required
26	Board 7 x 4	As Required
27	Board 8 x 10	As Required
28	TV Pin	As Required
29	Telephone Pin	As Required
30	Insolation Tape	As Required
31	PVC Duct Plain 3/4"	As Required
32	PVC Duct Slotted 1"	As Required
33	PVC Duct Plain 3/4"	As Required
34	PVC Duct Slotted 1"	As Required
35	Fuse Piano Type	As Required
36	Main Switch	As Required
37	Breaker Single Poll	As Required
38	Breaker Double Poll	As Required
39	Volt meter Panel	As Required
40	Ampere Meter Panel	As Required

41	DB Box	As Required
42	DB Switch	As Required
43	PG Connector	As Required
44	Neutral Terminal	As Required
45	Screw Different Size	As Required
46	Steel Nail Different Size	As Required
47	Blub 100 Watt	As Required
48	Bulb 200 Watt	As Required
49	Nut Bolt Different Size	As Required
50	Electric Bell	As Required
51	Two Pin Shoe	As Required
52	Three Pin Shoe	As Required
53	Cable Tube Connection	As Required
54	Tube Rod	As Required
55	Choke 20w, 40w	As Required
56	Tube Starter	As Required
57	Choke Patti Fitting	As Required
58	Winding Wire Different Size	As Required
59	Slat Paper Different Size	As Required
60	Cotton Tape	As Required

61	Sleeve Different Size	As Required
62	Varnish	As Required
63	Cable Three Core 40/ .0076	As Required
64	Cable Four Core 7/ .036	As Required
65	Cable Three Core 7/ .029	As Required
66	Connection Plate	As Required
67	Clutch Plate	As Required
68	Breaker Fitting Patti (Din Ray)	As Required
69	Relay 12V, 5A	As Required
70	Resistor Different Types	As Required
71	Transistor Different Types	As Required
72	LED	As Required
73	Diode	As Required
74	Rectifier Bridge	As Required
75	Carbon Brush	As Required
76	Battery 6v	As Required
77	Breaker Stripe	As Required
78	Flout Switch	As Required
79	Magnetic Connector	As Required
80	Cut Out	As Required

81	Breaker Cartridge Fuse	As Required
82	ON / OFF Push Button	As Required
83	Timer	As Required
84	Relay AC – 220V	As Required
85	Relay DC- 12V	As Required
86	Selector Switch Volt Meter	As Required
87	Selector Switch Ampere Meter	As Required
88	Emergency Switch	As Required
89	Soldering Wire	As Required
90	Paste	As Required
91	Light Indicator	As Required
92	Limit Switch (MEM Inter Locking)	As Required
93	Motor Driven Selector Switch (Water Tank)	As Required
94	Speaker	As Required
95	Acid	As Required
96	Hydro Metter	As Required
97	Multi Metter (Analogue / Digital)	As Required
98	Cam Starter (single phase & three phase)	As Required
99	Generator Switch	As Required
100	Star Delta Manual	As Required

101	Capacitor Different Size	As Required
102	Intercom Bell	As Required
103	Over Load Relay	As Required
104	Forward Reverse Switch	As Required
105	Tai Different Size	As Required
106	Magnetic Connector	As Required
107	Current Transformer	As Required
108	8 Pin type & 11 Pin type relay with base	As Required
109	Timer Circuit	As Required
110	Relay Circuit	As Required
111	Boben Transformer	As Required
112	Core Transformer	As Required
113	Coal	As Required
114	Calcium Carbonate	As Required
115	Petrol	As Required
116	Heat Sleeve Tube	As Required
117	Changer Over Switch	As Required
118	Timer 0-60 second	As Required
119	Time 1-6 minute	As Required
120	Babon 1 ¼", 1 ½", 2", 2x3"	As Required
121	UPS Card	As Required



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