

National Vocational Certificate Level 2 in Electro Mechanical Technology



Competency Standards

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Date of approval by NCRC:

29th -30th October 2014

Date of Notification:

10th December 2014, vide notification no F.2-1/2013-DD(VT)

This curriculum has been produced by the National Vocational & Technical Training Commission (NAVTTCC) with the technical assistance of TVET Reform Support Programme, which is funded by the European Union, the Embassy of the Kingdom of the Netherland, Federal Republic of Germany and the Royal Norwegian Embassy. The Programme has been commissioned by the German Federal Ministry for Economic Cooperation and Development and is being implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

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

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 worn out or damaged parts	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	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 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: 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: 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
G1: 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
G2: 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
G3: 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
G4: 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 H: Test 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: Perform testing; diagnose faults; and remove faults.

Competency Unit	Performance Criteria	Knowledge and Understanding
H1: 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
H2: Diagnose faults	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
H3: 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 I: Rewind 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 rewinding	P1- Identify and obtain safety and other regulatory requirements for rewinding P2- Arrange tools and equipment	K1- Safety requirements; Specifications; Hazard identification K2- Tools and equipment requirements
I2: Perform troubleshooting	P1- Interpret and confirm rewinding specifications P2- Carry out testing procedures P3- Determine fault P4- Document and report results	K1- Rewinding requirements K2- Testing procedures K3- Fault identification; Analysis of test results K4- Supervisor and/or client communication
I3: Perform rewinding operations	P1- Remove and replace faulty winding P2- Rewind machine P3- Perform winding tests	K1- Replacement procedures K2- Rewinding procedures K3- Types of winding tests
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: 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
J1: 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
J2: 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
J3: 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
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: 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
K1: 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
K2: Install electrical machine	P1- Confirm installation specification P2- Position and configure machine P3- Joint 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 lug, cable shoes, eyelets and tunnel terminals - ferrules and shrinking nut - bolt & screw terminal K4- Supervisor and/or client communication
K3: 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
K4: 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: 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
L1: 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
L2: 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
L3: 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

<p>L4: Install electrical appliances</p>	<p>P1- Interpret and confirm installation specifications P2- Install, position and secure appliances P3- Connect appliance and test for correct operation P4- Confirm completed installation</p>	<p>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</p>
<p>L5: Complete work</p>	<p>P1- Complete work related documents and procedures P2- Perform final quality inspection P3- Clean up and store tools, equipment and materials</p>	<p>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</p>

Competency Standard M: Perform distribution of electrical supply

Overview: This competency standard is intended for those who carry out electrical operations. People holding credit for this competency standard are able to: review electrical load schedule, set distribution priority, monitor electrical load.

Competency Unit	Performance Criteria	Knowledge and Understanding
M1: Review electrical load schedule	P1- Check layout plan P2- Check input & output voltages P3- Check voltage drops	K1- Interpretation of drawings, symbols, cable number, colour coding and electrical load schedule K2- Maintenance of input and output voltages K3- Methods of calculation of voltage drops, overloading and load balance
M2: Set distribution priority	P1- Review distribution priority plan P2- Reschedule electrical load as per distribution priority	K1- Interpretation of distribution priority plan K2- Methods of rescheduling of electrical loads
M3: Monitor electrical load	P1- Monitor electrical load (current) P2- Monitor power consumption (energy) P3- Monitor voltage drops P4- Perform logout/tag out	K1- Methods of current measurement (Amperes) K2- Methods of energy measurement in (KWH) K3- Methods of voltage drop measurement (Volt) K4- Methods of log out / tag out and labelling

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	as per required
2	Tools and equipment for cable works	as per required
3	Hand tools and Powered handheld machine tools	as per required
4	Adjustable power supply	6
5	Barricade kit	12
6	Battery tester	12
7	Bench vice	3
8	Chisel bradawl	6
9	Clamp on meter	12
10	Crimping tool	12

11	Drill machine	2
12	Earthing / discharging set	2
13	Electrician tool kit	24
14	File set	6
15	Fire-fighting equipment	3
16	First Aid kit	1
17	Grinder	1
18	Hacksaw	12
19	Hammer set	6
20	Hipot tester	24
21	Hole saw	2
22	Hydraulic cable cutter	1
23	Hydro meter	6
24	Insolation tester	2
25	IR temperature gun	6
26	Level	6
27	L-scale	12
28	Lugs punch hydraulic	2
29	Magnifier galas	24
30	Magnifier lamp	2

31	Mega meter	2
32	Mili ohm meter	12
33	Mircometer	6
34	Motor test bench	6
35	Motor winding machine	3
36	Multi meter	12
37	Personal protective equipment (PPE)	as per required
38	Phase sequence tester	6
39	Pipe wrench	2
40	Power factor meter	2
41	Screw wrench	12
42	Solder sucker	12
43	Soldering gun	12
44	Sound scope	6
45	Techo meter	3
46	Thimble press plier	2
47	Vernier calliper	6
48	Vibro meter	2
49	Weighing machine	1
50	Winding die set	1
51	Wire gauge	12

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 "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



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