

MICRO HYDRO POWER PLANT TECHNOLOGY

Competency Standards

National Vocational
Certificate Level 3

Version 1 - July 2015

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Competency Standards: Micro Hydel Power Plant operations (Operator) - Level 3

Competency Standard A: Operate and monitor Micro Hydel Power (MHP) Plant

Overview: This competency standard is intended for those who operate and monitor a Micro Hydel Power (MHP) plant. People holding credit for this competency standard are able to: Conduct pre-start checks; operate and monitor power plant; and complete documentation.

Competency Unit	Performance Criteria	Knowledge and Understanding
A1: Conduct pre-start checks	Trainee will be able to: P1- Identify and obtain safety and other regulatory requirements P2- Check safety equipment for correct operation P3- Carry out plant and auxiliary equipment inspections and pre-operational tests P4- Observe safe working procedures	K1- Safety requirements; Specifications; Hazard identification K2- Safety equipment for pre-start operation K3- Pre-start procedures
A2: Control and monitor power plant operation	Trainee will be able to: P1- Adjust and monitor water intake P2- Operate and monitor water conveyance system P3- Operate and monitor turbine, generator and control system P4- Operate and monitor auxiliary equipment P5- Detect deviations from normal operating conditions and system requirements	K1- Operating principles and procedures of plant components and auxiliary equipment including: - Turbine, generator, control system, water conveyance system, spillway gates, valves, instruments and gauges, K2- Common faults in electrical, mechanical systems K3- Corrective measures of all above(K1 & K2)
A3: Finalize documentation	Trainee will be able to: P1- Document irregularities in plant operation P2- Report status of plant	K1- Common malfunctions in MHP plant K2- Reporting forms K3- Reporting procedure

Competency Standard B: Carry out corrective maintenance procedures on electrical components in a MHP plant

Overview: This competency standard is intended for those who perform corrective maintenance on electrical components in a Micro Hydel Power plant. People holding credit for this competency standard are able to: Plan and prepare for corrective maintenance; perform troubleshooting; carry out corrective maintenance; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p>B1: Plan and prepare for corrective maintenance</p>	<p>Trainee will be able to:</p> <p>P1- Identify and obtain safety and other regulatory requirements</p> <p>P2- Obtain and interpret electrical component specifications and/or circuit diagrams</p> <p>P3- Identify and select tools and equipment</p>	<p>K1- Safety requirements; Specifications; Hazard identification</p> <p>K2- Drawing and symbol specifications</p> <p>K3- Tools and equipment and calibration thereof</p>
<p>B2: Perform troubleshooting</p>	<p>Trainee will be able to:</p> <p>P1- Carry out safe diagnostic procedures for electrical components</p> <p>P2- Identify faulty components</p> <p>P3- Follow safe working procedures</p> <p>P4- Report findings</p>	<p>K1- Troubleshooting procedures (visual inspection, testing)</p> <p>K2- Condition assessment for electrical components</p> <p>K3- Methods of fault identification on electrical components</p> <p>K4- Safe working procedures</p>
<p>B3: Carry out corrective maintenance</p>	<p>Trainee will be able to:</p> <p>P1- Dismantle/Remove faulty electrical component</p> <p>P2- Replace/Repair faulty electrical component</p> <p>P3- Perform post-repair testing of electrical component/system</p> <p>P4- Follow safe working procedures</p>	<p>K1- Dismantling/Removal procedures</p> <p>K2- Replacing/Repairing procedures</p> <p>K3- Post-repair testing procedures</p> <p>K4- Safe working procedures</p>

B4: Perform Final Check	Trainee will be able to: P1- Complete work related documents and procedures P2- Perform final quality inspection P3- Clean up and store tools, equipment and material	K1- Importance of documentation K2- Importance of quality K3- Waste disposal procedures; Care of tools and equipment
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Competency Standard C: Carry out corrective maintenance procedures on mechanical components in a MHP plant

Overview: This competency standard is intended for those who perform corrective maintenance on mechanical components in a Micro Hydel Power Plant. People holding credit for this competency standard are able to: Plan and prepare for corrective maintenance; perform troubleshooting; carry out corrective maintenance; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p>C1: Plan and prepare for corrective maintenance</p>	<p>Trainee will be able to:</p> <p>P1- Identify and obtain safety and other regulatory requirements</p> <p>P2- Obtain and interpret mechanical component specifications and/or drawings</p> <p>P3- Identify and select tools and equipment</p>	<p>K1- Safety requirements; Specifications; Hazard identification</p> <p>K2- Drawing and symbol specifications</p> <p>K3- Tools and equipment and calibration thereof</p>
<p>C2: Perform troubleshooting</p>	<p>Trainee will be able to:</p> <p>P1- Carry out safe diagnostic procedures for mechanical components</p> <p>P2- Identify faulty components</p> <p>P3- Follow safe working procedures</p> <p>P4- Report findings</p>	<p>K1- Troubleshooting procedures (visual inspection, testing)</p> <p>K2- Condition assessment for mechanical components</p> <p>K3- Methods of fault identification on mechanical components</p> <p>K4- Safe working procedures</p>
<p>C3: Carry out corrective maintenance</p>	<p>Trainee will be able to:</p> <p>P1- Dismantle/Remove faulty mechanical component</p> <p>P2- Replace/Repair faulty mechanical component</p> <p>P3- Perform post-repair testing of mechanical component/system</p> <p>P4- Follow safe working procedures</p>	<p>K1- Dismantling/Removal procedures</p> <p>K2- Replacing/Repairing procedures</p> <p>K3- Post-repair testing procedures</p> <p>K4- Safe working procedures</p>

C4: Perform final Check	Trainee will be able to: P1- Complete work related documents and procedures P2- Perform final quality inspection P3- Clean up and store tools, equipment and material	K1- Importance of documentation K2- Importance of quality K3- Waste disposal procedures; Care of tools and equipment
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Competency Standard D: Carry out corrective maintenance procedures on civil structure components in a MHP plant

Overview: This competency standard is intended for those who perform corrective maintenance on civil structure components in a Micro Hydel Power plant. People holding credit for this competency standard are able to: Plan and prepare for corrective maintenance; perform troubleshooting; carry out corrective maintenance; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p>D1: Plan and prepare for corrective maintenance</p>	<p>Trainee will be able to:</p> <p>P1- Identify and obtain safety and other regulatory requirements</p> <p>P2- Obtain and interpret specifications and/or drawings regarding civil structure components</p> <p>P3- Identify and select tools and equipment</p>	<p>K1- Safety requirements; Specifications; Hazard identification</p> <p>K2- Drawing and symbol specifications</p> <p>K3- Tools and equipment and calibration thereof</p>
<p>D2: Perform troubleshooting</p>	<p>Trainee will be able to:</p> <p>P1- Carry out assessment on civil structure components</p> <p>P2- Assess deviations in civil structure components</p> <p>P3- Follow safe working procedures</p> <p>P4- Report findings</p>	<p>K1- Assessment procedures (visual inspection)</p> <p>K2- Condition assessment for civil structure component</p> <p>K3- Methods of fault identification on civil structure components</p> <p>K4- Safe working procedures</p>
<p>D3: Carry out corrective maintenance</p>	<p>Trainee will be able to:</p> <p>P1- Repair/Fix/Amend/Build civil structure component</p> <p>P2- Perform post-repair testing of civil structure component/system</p> <p>P3- Follow safe working procedures</p>	<p>K1- Repair/Fix/Amend/Build procedures</p> <p>K2- Post-repair testing procedures</p> <p>K3- Safe working procedures</p>

D4: Perform Final Check	Trainee will be able to: P1- Complete work related documents and procedures P2- Perform final quality inspection P3- Clean up and store tools, equipment and material	K1- Importance of documentation K2- Importance of quality K3- Waste disposal procedures; Care of tools and equipment
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Competency Standard E: Maintain records in MHP operations

Overview: This competency standard is intended for those who carry out operations in a Micro Hydel Power (MHP) plant. People holding credit for this competency standard are able to: maintain log book and forms; and store and communicate information.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p>E1: Maintain log book and forms</p>	<p>Trainee will be able to:</p> <p>P1- Confirm on-site recording requirements</p> <p>P2- Record required information from operations and maintenance, including personal observations</p> <p>P3- Record material requirements, deviations and interpretation based on personal observations and professional judgement</p>	<p>K1- Record keeping procedures</p>
<p>E2: Store and communicate information</p>	<p>Trainee will be able to:</p> <p>P1- Store and care for log book and other records in line with workplace procedures</p> <p>P2- Pass-on information to supervisor according to workplace procedures</p>	<p>K1- Storing requirements</p>

Competency Standard F: Carry out preventive maintenance procedures as part of MHP operations

Overview: This competency standard is intended for those who carry out preventive maintenance as part of MHP operations. ‘Preventive maintenance’ in this context refers to the systematic care and servicing of machinery, equipment and infrastructure by inspection, detection, and correction of early failures either before they occur or before they develop into major defects. People holding credit for this competency standard are able to: Plan and prepare for preventive maintenance; perform daily routine checks; perform preventive maintenance; and complete work.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p>F1: Plan and prepare for preventive maintenance</p>	<p>Trainee will be able to:</p> <p>P1- Obtain safety and regulatory requirements for maintenance</p> <p>P2- Interpret specifications and drawings</p> <p>P3- Identify and select tools and equipment</p>	<p>K1- Safety requirements; Specifications; Hazard identification</p> <p>K2- Drawings and symbols specifications</p> <p>K3- Tools and equipment and calibration thereof</p>
<p>F2: Perform daily routine checks</p>	<p>Trainee will be able to:</p> <p>P1- Check for suspended trash or material at screens</p> <p>P2- Check for water leakage or overflow</p> <p>P3- Check for sand sedimentation</p> <p>P4- Check for deformation or crack</p> <p>P5- Check for mechanical malfunction, sound, vibration, temperature, oil leakage</p>	<p>K1- Inspection requirements</p> <p>K2- Facilities and equipment to be checked include but are not limited to:</p> <p>- Intake and waterway; Sedimentation basin, headrace, tailrace, fore bay; penstock; turbine; generator; load stabiliser; transformer; transmission and distribution lines</p>
<p>F3: Perform preventive maintenance</p>	<p>Trainee will be able to:</p> <p>P1- Remove debris</p> <p>P2- Flush out sand sedimentation</p> <p>P3- Remove sand and rocks</p> <p>P4- Reduce water intake</p>	<p>K1- Maintenance procedures</p> <p>K2- Hazards and risks associated with maintenance</p> <p>K3- Consequences of not performing preventive maintenance</p> <p>K4- Checklists and reports, and importance thereof</p>

	<p>P5- Remove/Replace worn or faulty components</p> <p>P6- Record maintenance procedures, and report subsequent actions</p>	
<p>F4:</p> <p>Perform Final Check</p>	<p>Trainee will be able to:</p> <p>P1- Complete work related documents and procedures</p> <p>P2- Perform final quality inspection</p> <p>P3- Clean up and store tools, equipment and materials</p>	<p>K1- Importance of quality</p> <p>K2- Waste disposal procedures</p> <p>K3- Care of tools and equipment</p>

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
	Tools	
	Mechanical	
1	7 pieces screwdriver set	
2	Adjustable wrench set	
3	Allen Keys Set	
4	Aluminum Spirit Level (leveling instrument)	
5	Bastard File with wood handle (Flat)	
6	Bastard File with wood handle (Round)	
7	Bench Vice	
8	Bench Workstation	
9	Chisel	
10	Clamp Meter	
11	Claw hammer with wood handle	
12	Combination Pliers	

13	Crimping Tool	
14	Hack Saw with Blades	
15	Hand Drill [1/8" – 1/8"]	
16	Hand Grease Gun	
17	Hand Grinding Machine	
18	Hot Air Blower	
19	Measuring tape	
20	Micro Meter [Screw Gauge]	
21	Nose Plier	
22	Oil Can	
23	Pedestal Drill	
24	Pen Grinder	
25	Pipe Wrench [18" & 24"]	
26	Portable Welding Plant [100 – 300 Amperes]	
27	Puller	
28	Punch Set	
29	Retched Block with Grip	
30	Screw Driver Set (-)[6"-18"]	
31	Screw Driver Set (+) [6"-18"]	
32	Side Cutting Plier	
33	Spanner Set (Open)	
34	Spanner Set (Ring)	
35	Stainless Steel Slogging Ring Spanner	
36	Thread Gauge	

37	Tong/Monkey Plier	
38	Vernier Calliper	
39	Wheel Grinder	
40	Wire Gauge	
41	Welding Plant	
	Electrical	
1	Clamp Meter	
2	Combination Plier	
3	Earth Tester	
4	Line Tester	
5	Megger	
6	Multi Meter	
7	Nose Plier	
8	Pin Plier	
9	Screw Driver Set	
10	Side Cutter	
	Safety Tools	
1	Fire Extinguisher	
2	First Aid Box	
3	Hand Gloves	
4	Hard top Hat	
5	Mask	
6	Overall combination [Dress]	
7	Safety Belt	

8	Safety Goggles	
9	Steel Toe Shoes	
<u>EQUIPMENT</u>		
Civil		
1	Air Vent Pipe	
2	Bell Mouth	
3	Control Gates	
4	Control Valves	
5	Expansion Joint	
6	Flanges	
7	Flushing Gates	
8	Flushing Pipe	
9	Penstock	
10	Reducer	
11	Rubber Seal	
12	Trash Rack	
Electrical		
1	Ballast Tank with Heaters	
2	Binding wire	
3	Cable Shoe	
4	Channel Iron	
5	Conductors	
6	D-Iron Set	
7	Disc Insulator [With Tension Set]	

8	Earth Wire	
9	Earthing Plate	
10	Electrical Panels	
11	Electronic Load Controller	
12	Energy Meter	
13	Generator[Brushed and Brush-less]	
14	Metal Clad Main Switch	
15	Pin Insulator	
16	Pole	
17	Power Cable	
18	Pressure Transducer	
19	Shackle Insulator	
20	Stay Insulator	
21	Stay Plate	
22	Stay Rod	
23	Stay Wire	
24	Thimble	
25	Transformer	
26	Turn Buckle	
27	Ultra Sonic Flow Meter	
	Mechanical	
1	Angle Iron [Cross Arm]	
2	Butterfly Valve	
3	Coupling [Flexible/Rigid]	

4	Crossflow Turbine	
5	Flat Belt	
6	Flat Pulleys	
7	Fly Wheel	
8	Francis Turbine	
9	Gate Valve	
10	Gear Box	
11	Governor	
12	Hydraulic Jack	
13	Operating Rod	
14	Pelton Turbine	
15	Propeller/Kaplan Turbine	
16	Single Phase Variac [Auto Transformer]	
17	Tachometer	
18	V Belt	
19	V-Pulleys	

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