

# MICRO HYDRO POWER PLANT TECHNOLOGY

Competency Standards

National Vocational  
Certificate Level 4

Version 1 - July 2015



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## Competency Standards: Micro Hydel Power Plant operations (Technician) - Level 4

### Competency Standard A: Apply entrepreneurial skills

**Overview:** This competency standard is intended to assist people in applying entrepreneurial skills. People holding credit for this competency standard are able to: Demonstrate knowledge of the requirements of entrepreneurs; conduct business start-up activities; develop a financial strategy; develop a marketing strategy; and implement and control business financial strategy

Competency Unit	Performance Criteria	Knowledge and Understanding
<b>A1: Introduction to entrepreneurship</b>	<p>Trainees will be able to:</p> <p><b>P1-</b> Identify the importance of entrepreneurs for Pakistan</p> <p><b>P2-</b> Identify challenges of being an entrepreneur</p> <p><b>P3-</b> Confirm and implement strategies for improving personal entrepreneurship qualities</p>	<p><b>K1-</b> Types of verbal and non-verbal messages</p> <p><b>K2-</b> Requirements and benefits of becoming an entrepreneur</p> <p><b>K3-</b> Features of personal entrepreneurial assessment tools</p>
<b>A2: Conduct business start-up activities</b>	<p>Trainees will be able to:</p> <p><b>P1-</b> Select and secure business premises</p> <p><b>P2-</b> Secure business operating clearance</p> <p><b>P3-</b> Secure business support service</p>	<p><b>K1-</b> Business premises requirements</p> <ul style="list-style-type: none"> <li>• Size</li> <li>• Location</li> <li>• Cost</li> </ul> <p><b>K2-</b> Municipal guidelines and regulations</p> <p><b>K3-</b> Application procedures</p>
<b>A3: Develop a financial strategy</b>	<p>Trainees will be able to:</p> <p><b>P1-</b> Estimate total cost of set up</p> <p><b>P2-</b> Identify sources of funding</p> <p><b>P3-</b> Estimate business expenses</p> <p><b>P4-</b> Project profit and loss and cash flow</p> <p><b>P5-</b> Establish and follow bank requirements</p>	<p><b>K1-</b> Financial budgeting</p> <p><b>K2-</b> Resource mobilization</p> <p><b>K3-</b> bank/tax requirement</p> <p><b>K4-</b> Basic accounting principles</p> <p><b>K5-</b> General bank requirements</p>

<p><b>A4:</b> <b>Develop a marketing strategy</b></p>	<p>Trainees will be able to:</p> <p><b>P1-</b> Identify potential profitable opportunities and target markets</p> <p><b>P2:</b> Plan service and product delivery</p> <p><b>P3:</b> Identify competitors operating in the market</p> <p><b>P4:</b> Identify methods of promotion</p>	<p><b>K1-</b> market budgeting</p> <p><b>K2-</b> Customer expectations and satisfaction</p> <p><b>K3-</b> Principles of a competitive market</p> <p><b>K4-</b> Basic promotional and/or marketing concepts</p> <p><b>K5-</b> Marketing strategy and analysis</p>
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**Competency Standard B: Manage work and personnel in a MHP plant**

**Overview:** This competency standard is intended for people in a senior position who manage work teams in a Micro Hydel Power (MHP) plant. People holding credit for this competency standard are able to: Induct new employees; receive and disseminate information; motivate employees and monitor performance; and provide technical support to individual or team.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p><b>B1:</b> <b>Induct new employees</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Communicate workplace operational and safety procedures, and policies to employees</p> <p><b>P2-</b> Induct staff on MHP design and structure, and technical operations</p>	<p><b>K1-</b> Operational and safety procedures, policies</p> <p><b>K2-</b> MHP design and structure, technical operation requirements</p>
<p><b>B2:</b> <b>Receive and disseminate information</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Receive and disseminate information and instructions</p> <p><b>P2-</b> Communicate instructions to employees</p> <p><b>P3-</b> Assign roles and responsibilities</p> <p><b>P4-</b> Ensure instructions, roles and responsibilities are understood</p>	<p><b>K1-</b> Means of communication</p> <p><b>K2-</b> Roles and responsibilities of employees</p> <p><b>K3-</b> Time and quality requirements</p>
<p><b>B3:</b> <b>Motivate employees and monitor performance</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Maintain a positive and challenging working climate</p> <p><b>P2-</b> Monitor performance of employees and teams, and take corrective actions</p> <p><b>P3-</b> Provide constructive feedback</p> <p><b>P4-</b> Assist staff in identifying their development needs</p>	<p><b>K1-</b> Methods to motivate individual and a team</p> <p><b>K2-</b> Performance appraisal</p>

<p><b>B4:</b> <b>Provide technical support to individual or team</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Analyse report or other feedback from individual or team</p> <p><b>P2-</b> Identify and analyse backlog or problem</p> <p><b>P3-</b> Identify problem-solving method</p> <p><b>P4-</b> Solve problem in collaboration with individual or team</p>	<p><b>K1-</b> Problem-solving methods, troubleshooting, fault-finding</p> <p><b>K2-</b> Methods of effective teamwork</p>
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**Competency Standard C: Control MHP plant shutdown for emergency standby electrical systems**

**Overview:** This competency standard is intended for people in a senior position who are responsible for controlling MHP plant shutdown for emergency standby electrical systems. People holding credit for this competency standard are able to: Prepare emergency standby electrical system; shut down and isolate emergency standby electrical system; service emergency standby electrical system; monitor emergency standby electrical system and stabilise transient condition.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p><b>C1:</b> Prepare emergency standby electrical system</p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Ensure pre-conditions for plant preparation are met</p> <p><b>P2-</b> Prepare plant for service</p> <p><b>P3-</b> Document preparation for plant shut-down procedures</p>	<p><b>K1-</b> Safety requirements; Specifications; Hazard identification</p> <p><b>K2-</b> Impact of decision on plant operation</p> <p><b>K3-</b> Pre-condition procedures</p>
<p><b>C2:</b> Shut down and isolate emergency standby electrical system</p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Carry out pre-condition for shutdown procedure</p> <p><b>P2-</b> Isolate emergency standby electrical system</p> <p><b>P3-</b> Document plant shutdown and isolation</p>	<p><b>K1-</b> Shutdown procedure</p> <p><b>K2-</b> Isolation procedure</p> <p><b>K3-</b> Documentation process</p>
<p><b>C3:</b> Service emergency standby electrical system</p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Apply hazard and risk identification</p> <p><b>P2-</b> Conduct servicing procedures</p> <p><b>P3-</b> Document servicing procedure</p>	<p><b>K1-</b> Problem solving process</p> <p><b>K2-</b> Energy conversion process</p> <p><b>K3-</b> Mechanical plant component application and interrelation</p> <p><b>K4-</b> Electrical plant component application and interrelation</p> <p><b>K5-</b> Function of instrumentation components</p> <p><b>K6-</b> Documentation process</p>

<p><b>C4:</b> <b>Monitor emergency standby electrical system and stabilise transient condition</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Monitor plant operating condition</p> <p><b>P2-</b> Identify and react upon out of normal conditions</p> <p><b>P3-</b> Compare actual output values against expected requirements</p> <p><b>P4-</b> Document transient conditions, actions and results</p>	<p><b>K1-</b> Priority setting</p> <p><b>K2-</b> Documentation process</p>
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**Competency Standard D: Analyze faults in MHP plant operation**

**Overview:** This competency standard is intended for people in a senior position who analyse faults in MHP plant operations. People holding credit for this competency standard are able to: Plan and prepare for fault analysis; test plant and auxiliary equipment operation; analyse plant and auxiliary equipment faults; and record findings.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p><b>D1:</b> <b>Plan and prepare for fault analysis</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Identify and obtain safety and other regulatory requirements</p> <p><b>P2-</b> Obtain and interpret specifications and/or drawings regarding civil structure components</p> <p><b>P3-</b> Identify and select tools and equipment</p>	<p><b>K1-</b> Safety requirements; Specifications; Hazard identification</p> <p><b>K2-</b> Drawing and symbol specifications</p> <p><b>K3-</b> Tools and equipment and calibration meter thereof</p>
<p><b>D2:</b> <b>Test plant and auxiliary equipment operation</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Perform tests according to defined procedures</p> <p><b>P2-</b> Observe plant and equipment for correct operational response</p> <p><b>P3-</b> Take corrective action when response is not in accordance with documentation, plant integrity or personal safety requirements</p> <p><b>P4-</b> Return plant and equipment to required operation status on completion of test</p>	<p><b>K1-</b> Test procedures</p> <p><b>K2-</b> Dealing unplanned events</p> <p><b>K3-</b> Operation of plant components</p> <p><b>K4-</b> Safe working procedures</p>
<p><b>D3:</b> <b>Analyse plant and auxiliary equipment faults</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Analyse the technical and operational information in a logical and sequential manner to identify causes of abnormal operating conditions</p> <p><b>P2-</b> Determine necessary actions to rectify fault</p> <p><b>P3-</b> Maintain plant integrity and personnel safety through</p>	<p><b>K1-</b> Analysing plant faults</p> <p><b>K2-</b> Monitoring plant operation</p> <p><b>K3-</b> Safe working procedures</p>

	<p>consultation with appropriate personnel, and reference to plant, technical and operational documentation</p> <p><b>P4-</b> Notify appropriate personnel for repair when defects are detected</p>	
<p><b>D4:</b></p> <p><b>Record findings</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Update and maintain documentation in terms of equipment problems, movements, abnormalities and status</p>	<p><b>K1-</b> Work completion details</p>

**Competency Standard E: Plan and design MHP plant**

**Overview:** This competency standard is intended for those who are involved in the initial planning and design of MHP plants. People holding credit for this competency standard are able to: Conduct site assessment; estimate power demand and hydropower potential; conduct initial planning of civil construction work; and determine physical requirements of MHP plant.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p><b>E1:</b> <b>Conduct site assessment</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Perform basic head measurements</p> <p><b>P2-</b> Perform basic flow measurements</p> <p><b>P3-</b> Collect other data relevant for planning MHP plant</p>	<p><b>K1-</b> Basic head measurement</p> <p><b>K2-</b> Basic flow measurement</p> <p><b>K3-</b> Relevant site data</p>
<p><b>E2:</b> <b>Estimate power demand and hydropower potential</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Perform basic power calculations</p> <p><b>P2-</b> Apply knowledge in power demand estimation and daily load curves</p> <p><b>P3-</b> Apply knowledge of productive 'end-use' of electricity</p> <p><b>P4-</b> Apply knowledge of tariff related issues</p> <p><b>P5-</b> Match power demand and hydropower potential</p>	<p><b>K1-</b> Power calculations</p> <p><b>K2-</b> Prepare demand estimates for community</p> <p><b>K3-</b> Productive use of electricity in rural communities</p> <p><b>K4-</b> Basic tariff calculations</p>
<p><b>E3:</b> <b>Conduct initial planning of civil construction works</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Dimension main civil construction structure of MHP plant</p> <p><b>P2-</b> Prepare initial cost estimate</p>	<p><b>K1-</b> Basic MHP analysis and design</p> <p><b>K2-</b> Civil construction structure</p> <p><b>K3-</b> Cost estimation</p>

<p><b>E4:</b> <b>Determine physical requirements of MHP plant</b></p>	<p>Trainee will be able to:</p> <p><b>P1-</b> Identify procurement requirements for mechanical and electrical equipment of MHP plant</p> <p><b>P2-</b> Prepare powerhouse floor plan to arrange for electro-mechanical equipment</p> <p><b>P3-</b> Carry out initial planning of distribution network layout</p>	<p><b>K1-</b> Specifications and application range of MHP equipment</p> <p>- Generator; Turbine; Control system; distribution network</p> <p><b>K2-</b> Design of LV community grid</p>
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**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
	<b>Tools</b>	
	<b>Mechanical</b>	
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	

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



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

8	Safety Goggles	
9	Steel Toe Shoes	
<b><u>EQUIPMENT</u></b>		
<b>Civil</b>		
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	
<b>Electrical</b>		
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	
	<b>Mechanical</b>	
1	Angle Iron [Cross Arm]	
2	Butterfly Valve	
3	Coupling [Flexible/Rigid]	

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

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