NATIONAL COMPETENCY STANDARDS
FOR
HYDROPOWER PLANT OPERATOR
(CERTIFICATE 3)

HYDROPOWER SECTOR

TECHNICAL & VOCATIONAL EDUCATION AND TRAINING QUALITY COUNCIL
BHUTAN QUALIFICATIONS AND PROFESSIONALS CERTIFICATION AUTHORITY
THIMPHU, BHUTAN
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FOREWORD

The TVET Quality Council, BQPCA, is pleased to present the National Competency Standards (NCS) for Hydropower Plant Operator, Certificate 3, developed in collaboration with industry experts and trainers. These standards establish a nationally recognized qualification aligned with international best practices, setting a benchmark for TVET qualifications in Bhutan.

The NCS ensures that trainees acquire the necessary skills, knowledge, and attitude required by industries. Developed through close consultation with experts, it enhances the relevance of training to labor market needs, equipping graduates to meet industry expectations and improving their employability. A strong and responsive TVET system will also make vocational education more attractive to youth.

The Council acknowledges the valuable contributions of industry experts and trainers in the development of these standards. We urge employers and training providers to continue their support in implementing the NCS, fostering a skilled and productive workforce that contributes to national socio-economic development. Moving forward, we look forward to enhanced industry engagement and collaborative efforts in building a quality-assured, demand-driven TVET system.

Director
BQPCA

ACKNOWLEDGEMENT

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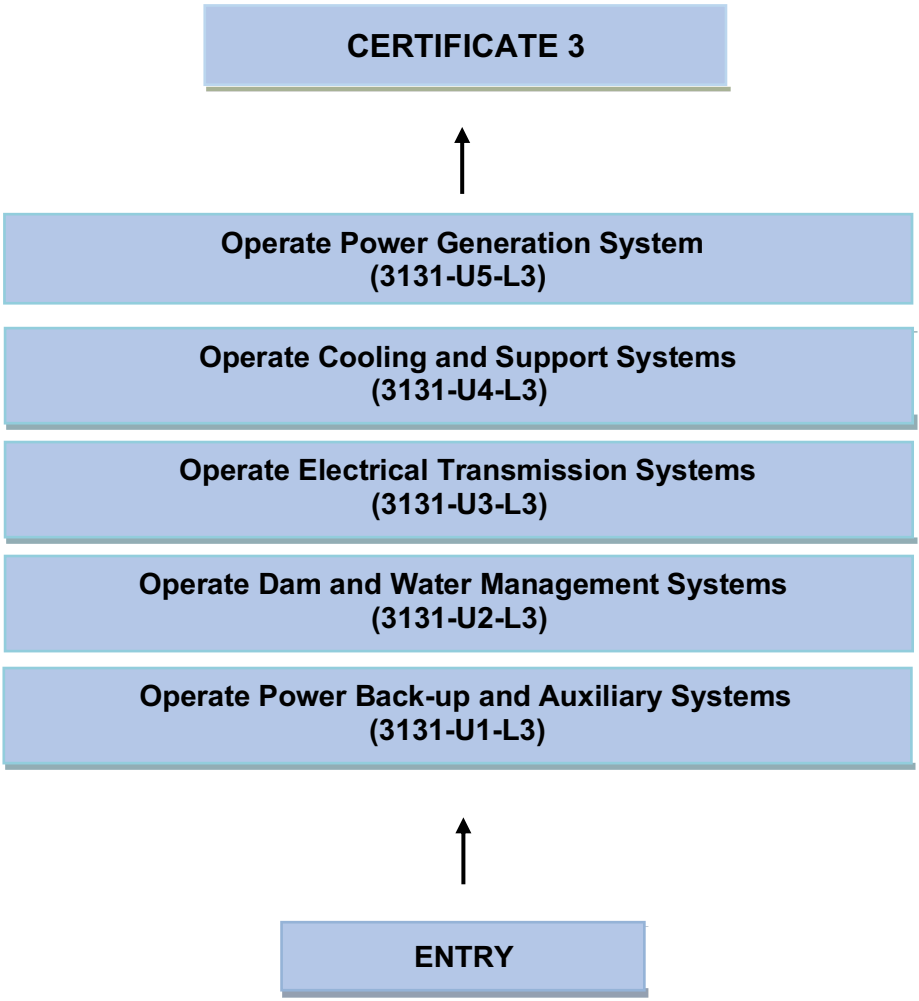
The TVET Quality Council, Bhutan Qualifications and Professionals Certification Authority would like to express our deepest appreciation to the following industry and subject matter experts who have participated in development of the National Competency Standards for Hydropower Plant Operator:

Experts involved in the development of NCS			
SN	**Name**	**Designation**	**Organization**
1	Oma Nath Kuikel	EE	CHP
2	Pavin Tamang	Operator	THP
3	Arjun Gurung	Operator	CHP
4	Khandu Wangchuk	AE	THP
5	Rinzin Namgay	Engineer	TVET QC, BQPCA
6	Karma Loday	Facilitator	TVET QC, BQPCA

PACKAGING OF QUALIFICATIONS



OVERVIEW OF THE NCS

Unit Title	Element of Competence
1. Operate Power Back-up and Auxiliary Systems	1. Prepare for operation of back-up and auxiliary systems 2. Operate and monitor diesel generator 3. Operate and monitor battery bank systems 4. Operate and monitor air compressor units
2. Operate Dam and Water Management Systems	1. Prepare for dam operation and inspection 2. Assist in dam scoring and structural assessment activities 3. Conduct routine checks of dam and reservoir conditions
3. Operate Electrical Transmission Systems	1. Prepare feeder and transformer systems for operation 2. Operate and monitor electrical feeders 3. Operate and monitor transformer systems
4. Operate Cooling and Support Systems	1. Prepare cooling systems for operation 2. Start, operate, and monitor plant cooling systems 3. Perform routine inspections and ensure efficiency
5. Operate Power Generation System	1. Prepare generator system for operation 2. Start and operate hydropower generator 3. Perform routine operational checks and monitor generator performance

UNIT TITLE	Operate Power Back-up and Auxiliary Systems
DESCRIPTOR	This unit contains competencies required to operate power back-up and auxiliary systems following standard procedure.
CODE	3131-U1-L3
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for operation of back-up power supply and auxiliary systems	1.1 Select and use ***PPEs*** as per the job requirement 1.2 Select ***Tools and Equipment*** as per the job requirement 1.3 Select ***Materials*** as per the job requirement 1.4 Identify work instructions and safety requirements 1.5 Inspect ***equipment*** (DG Set, Battery status, emergency lighting, external power supply, fluid level, protection reset) for readiness 1.6 Ensure availability of fuel, lubricants, and compressed air 1.7 Verify system isolation and lock out tag-out (LOTO) procedures 1.8 Report and document preparation status as per protocol

2. Operate and monitor diesel generator	2.1 Start DG following standard procedure 2.2 Monitor output voltage, fuel level, temperature, and oil pressure 2.3 Extend DG Power supply to power house auxiliaries 2.4 Observe and respond to alarms or warning indicators 2.5 Adjust operating parameters based on load demand 2.6 Shut down DG safely after use
3. Operate and monitor battery bank systems	3.1 Check battery bank voltage and electrolyte levels 3.2 Monitor battery charging system 3.3 Inspect terminals and ensure clean, tight connections 3.4 Record readings and identify abnormalities
4. Operate and monitor air compressor units	4.1. Start and run air compressor 4.2. Monitor pressure gauge and safety valve 4.3. Inspect belts, filters, and lubricant level 4.4. Drain condensate and check for air leakage 4.5. Maintain routine report

RANGE STATEMENT	
PPEs may include but not limited to:	
• Safety boot • Hand gloves • Safety Helmet • Fire Extinguisher	• Goggles • Work dress • Earplug
Tools and Equipment may include but not limited to:	
• Hand tool set • Multimeter	• Hydrometer • Communication Handset
Materials may include but not limited to:	
• Coolant • Distilled Water • Markin cloth	• Lubricant • HSD • Cleaning agent
Critical Aspects	
• Follow Safety at workplace • Follow standard procedure for all the tasks • Meeting all the prerequisite of the power backup system	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Occupational Health and Safety regulations • Basic first Aid • Fundamentals standby power systems • Battery maintenance and safety • Diesel generator components and operation • Compressor working principle and preventive care • Waste Management • Basic SAP • Basic Computer Operation	• Team Work • Communication • Problem Solving • Interpersonal Relationship • Time Management • Innovation

UNIT TITLE	Operate Dam and Water Management Systems
DESCRIPTOR	This unit contains competencies required to operate dam and water management systems following standard procedure.
CODE	3131-U2-L3
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for dam operation and inspection	1.1 Select and use ***PPEs*** as per the job requirement 1.2 Select ***Tools and Equipment*** as per the job requirement 1.3 Review water level data and safety checks 1.4 Observe spillway, SFT, intake gates, HRT, TRCM and valves 1.5 Identify risks such as flood, debris, seepage, or overflow 1.6 Verify instrumentation functionality and power supply healthiness 1.7 Ensure communication readiness for emergency alerts
2. Assist in dam scoring and structural assessment	2.1 Assist in data collection for structural monitoring 2.2 Perform scoring and dam level buildup 2.3 Report potential damage or hazards

activities	2.4 Communicate findings with responsible supervisor
3. Conduct routine checks of dam and reservoir conditions	3.1 Monitor weather condition upstream and condition of catchment area 3.2 Monitor water inflow/outflow levels 3.3 Check gate and valve operations 3.4 Inspect for seepage, erosion, and slope stability 3.5 Maintain records of inspections and conditions 3.6 Report anomalies to supervisor

RANGE STATEMENT	
PPEs may include but not limited to:	
• Safety boot • Hand gloves • Safety Helmet • Rain coat	• Goggles • Work dress • Life Jacket • Fire Extinguisher
Tools and Equipment may include but not limited to:	
• Hand tool set • Multimeter • Excavator	• Torch • Communication Handset • Tractor

• Power Chain	

Critical Aspects
• Follow Safety at workplace • Follow standard procedure for all the tasks • Healthiness of backup power supply • Identification of risks such as flood, debris, seepage, or overflow

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Occupational Health and Safety regulations • Basic first Aid • Basic hydrology and dam operation • Climate and Flood control • Dam safety protocols and scoring methods • Gate operations and emergency procedures • Basic SAP • Basic Computer Operation	• Team Work • Communication • Problem Solving • Interpersonal Relationship • Creativity • Time Management • Innovation

UNIT TITLE	Operate Electrical Transmission Systems
DESCRIPTOR	This unit contains competency required to operate and maintain electrical transmission systems following standard procedure.
CODE	**3131-U3-L3**
ELEMENTS OF COMPETENCE	**PERFORMANCE CRITERIA**
1. Prepare feeder and transformer systems for operation	1.1 Select and use ***PPEs*** as per the job requirement 1.2 Select ***Tools and Equipment*** as per the job requirement 1.3 Identify and isolate systems for safety 1.4 Verify the ***precondition*** of the system 1.5 Use correct PPE and safety gears 1.6 Verify operation readiness with control room
2. Operate and monitor electrical feeders	2.1 Switch on/off feeder/reactor as per grid requirement 2.2 Monitor ***feeder parameters*** (load, voltage, current, reactive power, power factor) 2.3 Monitor switch gear healthiness 2.4 Observe abnormal conditions report to the concerned unit 2.5 Record operational parameters in logbook

3. Operate and monitor transformer systems	3.1 Check oil level, temperature, and cooling system 3.2 Monitor bushings, cooling fans, and alarms 3.3 Record and report transformer performance data including daily checklist 3.4 Identify unusual sounds, smells, leakages and visual signs

RANGE STATEMENT	
PPEs may include but not limited to:	
• Safety boot • Hand gloves • Safety Helmet • Fire Extinguisher	• Goggles • Work dress • Safety belt
Tools and Equipment may include but not limited to:	
• Hand tool set • Multimeter • Ladder	• Communication Handset • Torch
Precondition may include but not limited to:	
• Connections • Temperature	• Oil levels • Switch gears

• Pressure	• Protective devices
Critical Aspects	
• Follow Safety at workplace • Follow Standard Procedure for all the tasks • Verify the precondition before operating the system	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • OHS regulations • Basic first Aid • Basics of power transmission and distribution • Transformer components and functions • Feeder operation, protection, and isolation procedures • Electrical safety and grounding systems • Fundamentals of switchgear operation • Basic SAP • Basic Computer Operation	• Team Work • Communication • Problem Solving • Interpersonal Relationship • Time Management • Innovation

UNIT TITLE	Operate Cooling and Support Systems
DESCRIPTOR	This unit contains competencies required to operate cooling and support systems following standard procedure.
CODE	3131-U4-L3
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare cooling systems for operation	1.1 Select and use ***PPEs*** as per the job requirement 1.2 Select ***Tools and Equipment*** as per the job requirement 1.3 Select ***Materials*** as per the job requirement 1.4 Inspect pump, fans, cooling water sump and coolant level 1.5 Check healthiness of the emergency cooling system 1.6 Check valves, pressure gauge and flow control devices 1.7 Identify leaks or faults 1.8 Confirm power supply and system status 1.9 Verify sensor and alarm functionality
2. Start, operate, and monitor plant cooling systems	2.1 Start the pump 2.2 Monitor temperature, current, flow and system pressure 2.3 Adjust flow controls as per unit requirement 2.4 Respond to alarm and annunciation

	2.5 Log operating data and report deviations
3. Perform routine inspections and ensure efficiency	3.1 Perform cleaning of filters and strainers 3.2 Top up coolant and lubricants as needed 3.3 Inspect hoses and joints for wear or leaks 3.4 Maintain daily/hourly check list

RANGE STATEMENT	
PPEs may include but not limited to:	
• Safety boot • Hand gloves • Safety Helmet	• Goggles • Work dress •
Tools and Equipment may include but not limited to:	
• Hand tool set • Communication handset	• Multimeter • Torch
Materials may include but not limited to:	
• Lubricants • Cleaning agent	• Markin cloth
Critical Aspects	

- Follow Safety at workplace
- Follow Standard procedure for all the tasks
- Maintaining flow and pressure of cooling water

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Occupational Health and Safety regulations • Basic first Aid • Working principle and functions of Cooling system • Components of cooling system • Types of valves and pumps • Types of cooling systems • Basic Heat transfer • Preventive maintenance practices • Basic SAP • Basic Computer Operation	• Team Work • Communication • Problem Solving • Interpersonal Relationship • Time Management • Innovation

UNIT TITLE	Operate Power Generation System
DESCRIPTOR	This unit contains competencies required to operate power generation system following standard procedure.
CODE	3131-U5-L3
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare generator system for operation	1.1 Select and use ***PPEs*** as per the job requirement 1.2 Select ***Tools and Equipment*** as per the job requirement 1.3 Follow instruction from control room for pre checks and normalization of the machine 1.4 Check the status of power supply, cooling system, GOP, OCP, MIV, Braking system, Air Compression system, Transformers and Feeders 1.5 Reset all the relays and alarms 1.6 Report status to supervisor and seek clearance
2. Start and operate hydropower generator	2.1 Start the hydropower generator 2.2 Excite the generator and build up the rated voltage 2.3 Synchronize the generator to the grid 2.4 Adjust load according to generation schedule

	2.5 Monitor ***generator parameters*** (active power, reactive power, voltage, current, frequency, PF, temperature, speed and vibration) 2.6 Respond to tripping or emergency shutdown 2.7 Maintain continuous communication with supervisor
3. Perform routine operational checks and monitor generator performance	3.1 Monitor temperatures, pressure, flow and vibration 3.2 Perform rounds checks on regular interval 3.3 Monitor cooling system and bearing oil temperature 3.4 Record Data and upload in SAP 3.5 Report anomalies to the supervisor

RANGE STATEMENT	
PPEs may include but not limited to:	
• Safety boot • Hand gloves • Safety Helmet	• Goggles • Work dress • Earplug
Tools and Equipment may include but not limited to:	
• Hand tool set • Torch	• Communication Handset •

Critical Aspects
• Follow Safety at workplace • Follow Standard Procedure for all the tasks • Check the status of power supply, cooling system, GOP, OCP, MIV, Braking system, Air Compression system, Transformers and Feeders • Reset all the relays and alarms

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Occupational Health and Safety regulations • Basic first Aid • Working principles of hydro generator • Turbine-generator components and operation • Generator protection systems • Basic Computer Operation • Basic SAP	• Team Work • Communication • Problem Solving • Interpersonal Relationship • Time Management • Innovation

ANNEXURE

National Competency Standards (NCS)

The National Competency Standards specify the skill, knowledge and attitudes applied to a particular occupation. Standards also specify the standards or criteria of performance of a competent worker and the various contexts in which work may take place. Standards provide explicit advice to assessors regarding the skill and knowledge to be demonstrated by candidates seeking formal recognition either following training or through work experience.

Purpose of National Competency Standards

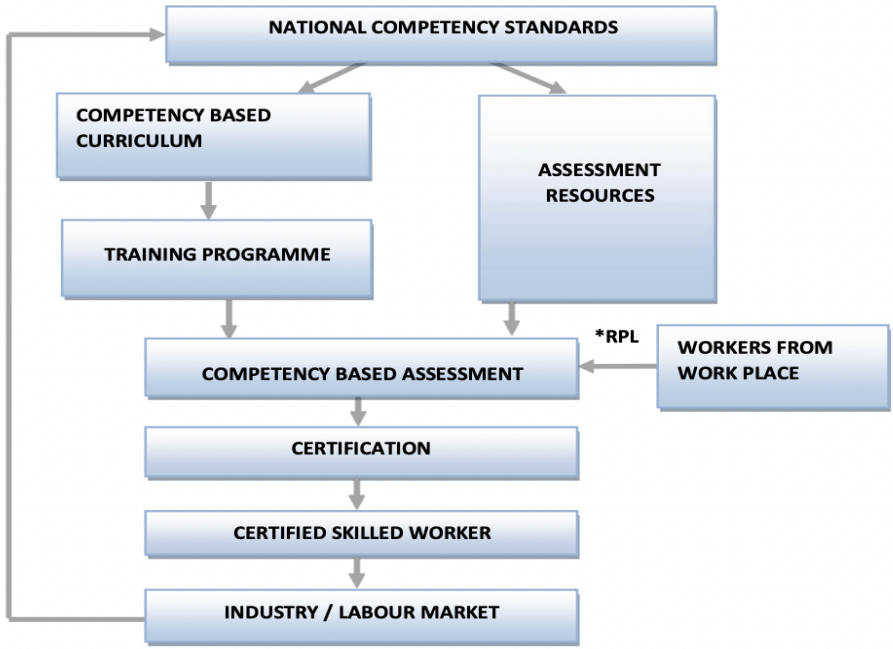
National Competency Standards serve a number of purposes including:

- Providing advice to curriculum developers about the competencies to be included in the curriculum.
- Providing specifications to assessment resource developers about the competencies within an occupation to be demonstrated by candidates.
- Providing advice to industry/employers about job functions, which in turn can be used for the development of job descriptions, performance appraisal systems and work flow analysis.

Bhutan Qualifications Framework (BQF)

Bhutan Qualifications Framework is an integrated national framework that outlines all types of qualification in Bhutan. As an established and nationally accepted instrument, the BQF has been benchmarked against international practices in terms of standards. The BQF aims to recognize all forms of learning systems, including formal, non-formal, and informal learning. It acknowledges technological advancements and recognizes contemporary modes of delivery. It covers a broad range of education systems including the TVET education.

Implementation of TVET Qualifications



*** RPL = Recognition of Prior Learning**

TVET Qualifications Levels

TVET Qualifications have seven levels as per the BQF as follows:

Bhutan Qualifications Framework 2023

Table 2: Qualification Types and Levels Based on Education Sector.

BQF Level	Community Education	School Education	TVET	Higher Education	Monastic Education
8				Doctoral Degree	*Khewang* མཁས་དབང་།
7			Master's Degree Postgraduate Diploma Postgraduate Certificate	Master's Degree Postgraduate Diploma Postgraduate Certificate	*Tsugla Gongma* གཙུག་ལག་གོང་མ།
6			Applied Degree	Bachelor's Degree Bachelor's Degree (Honours) Graduate Diploma Graduate Certificate	*Tsugla Wogma* གཙུག་ལག་འོག་མ།
5			Advanced Diploma	Advanced Diploma	
4			Diploma	Diploma	
3		Bhutan Higher Secondary Education Certificate	Certificate 3		*Dringrim Gongma* འགྲིང་རིམ་གོང་མ།
2		Bhutan Certificate for Secondary Education	Certificate 2		*Dringrim Barma* འགྲིང་རིམ་བར་མ།
1	ALC		Certificate 1		

Level Descriptors

The TVET Qualification levels are set based on the level descriptors, as defined in the BQF. The detail of the qualification level descriptor is as follow:

Level	Knowledge Knowledge that is:	Skills Demonstrate skills that involve:	Values Demonstrate values that involve:	Application Applied in contexts that involve:
4	Broad theoretical, technical and operational	Selecting and applying a range of standard processes relevant to varied and sometimes unpredictable tasks Selecting and applying a range of solutions involving formulation of solutions to resolve complex issues Demonstrating a high level of proficiency in English and Dzongkha	Strong level of awareness of self and others; and an appreciation of belief system, role of social norms, and the importance of relationship building Application of ethical norms and legal rules in decision-making; and comprehending the correlation between values and behavior Commitment to own profession and quality of work	Stable tasks with predictable changes Broad guidance with some self-direction that requires sound judgement Taking some responsibility for planning and coordination with others
3	Theoretical with some technical and operational processes	Applying a range of standard processes to known but varied tasks Selecting and applying a range of solutions to familiar	Sound level of self-awareness and beliefs; and ability to apply social norms and	Stable tasks with some aspects of change General guidance and supervision that require

		and unfamiliar problems Communicating effectively and clearly, both oral and written, in both English and Dzongkha	build relationships Application of a set of ethical norms Commitment to own field of interest and apply self-management of learning and performance	discretion and judgement Adapting to own behaviour to work with others
2	Basic, factual and conceptual	Applying standard processes relevant to carry out known tasks Applying a set of known solutions to solve simple and straightforward issues Using simple and direct exchange of information on familiar and routine matters Developing basic proficiency in Dzongkha and English	Some level of self-awareness and beliefs, and appreciation of social norms; and significance of relationships Awareness of ethical norms, and openness to different activities Developing own knowledge and skills	Structured and stable tasks General support and Supervision that require some discretion and judgement Collaboration with others to achieve goals
1	Foundational, every day and general	Applying operational literacy, numeracy skills required to carry out simple tasks Applying simple solutions to solve simple and straightforward everyday issues	Basic awareness of self, beliefs, and social norms; and understand the significance of relationships Basic awareness of	Highly structured tasks with close support and supervision Minimal Discretion and judgement

		Communicating using everyday expressions and simple phrases in Dzongkha and English	fundamental ethical norms, basic civil rights, and responsibilities Willingness to understand tasks and motivated to implement them successfully	Readiness to work together and share knowledge with others

CODING USED FOR NATIONAL COMPETENCY STANDARDS

The coding and classification system developed in Bhutan is logical, easy to use, and also aligned with international best practices. The Bhutanese coding and classification system is based on the International Standard Classification of Occupations, 2008 (ISCO-08) developed by the International Labour Organisation (ILO).The coding of the National competency standards forms the basis of the identification code for the Technical & Vocational Education and Training Management Information System (TVET – MIS) both in terms of economic sector identification and that of the individual standard.

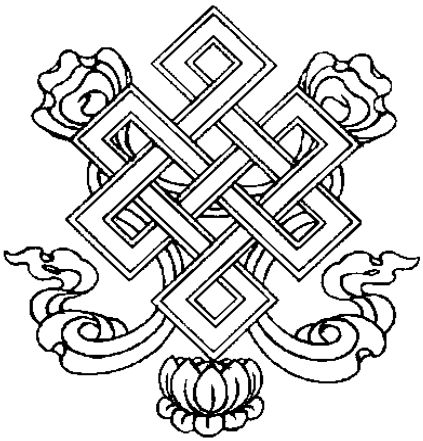
Coding the individual national competency standards

Coding the individual skills standard has a multiple purpose:

- to identify the level,
- to identify to which module the standard belongs,
- to identify in which order the standard is clustered within that module.

A job can include a number of competencies described in the national competency standards.

However, in order to follow a logical order, only national competency standards related to each other and following a logical sequence in terms of training delivery, from the simple to the complex, are clustered into a module. Some standards are so complex that they need to stand alone.



TVET Quality Council
Bhutan Qualifications and Professionals Certification Authority
Chang Gidaphu
P.O. Box 1956, Thimphu
www.bqpca.gov.bt