NATIONAL COMPETENCY STANDARDS FOR TRANSMISSION AND DISTRIBUTION TECHNICIAN (NC2)

Department of Occupational Standards
Ministry of Labour and Human Resources
Thimphu, Bhutan.
(May 2022)

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FOREWORD

The Department of Occupational Standards of the Ministry of Labour and Human Resources proudly presents the revised National Competency Standards (NCS) for Transmission and Distribution Technician as part of TVET reform initiative for improving the quality of Vocational Education and Training System in Bhutan. The standards represent the fruits of hard work and invaluable experiences gained by the department since its establishment in the latter half of 2003. The main aim of developing National Competency Standards is to set up a well-defined nationally recognized Vocational Qualification and Certification system that will help set a benchmark for the Technical Vocational Education and Training (VET) System in our country aligned to international best practices.

National Competency Standards is one of the base pillars in the Bhutan Vocational Qualification Framework (BVQF) and is the first step in its implementation. The standards are developed to ensure that employees or vocational graduates possess and acquire the desired skills, knowledge and attitude required by industries and employers. In order to ensure this close match in supply and demand of skills, knowledge and attitude, standards have been developed in close consultation and partnership with industry experts and validated by the Technical Advisory Committees for the concerned economic sectors.

A vocational education and training system based on National Competency Standards shall ensure that delivered training is of a high quality and relevant to the needs of the labour market. As a result, future TVET graduates will be better equipped to meet the need and expectations of industries and employers. This positive impact on the employability of TVET graduates will enhance the reputation of vocational education and training and make it attractive to school leavers.

While acknowledging the existing level of cooperation and collaboration, the ministry earnestly requests employers and training providers to extend the fullest support and cooperation in implementing the National Competency Standards. The ultimate objective is to build a competent and productive national workforce that will contribute to the continued socio-economic progress of our country.

I gratefully acknowledge the valuable contributions made by experts from industries during the consultation, verification and validation processes of the standards. I look forward to improved engagement and active participation of the industry and employers in the development of a quality assured demand driven TVET system in the near future.

Department of Occupational Standards,
Ministry of Labour and Human Resources

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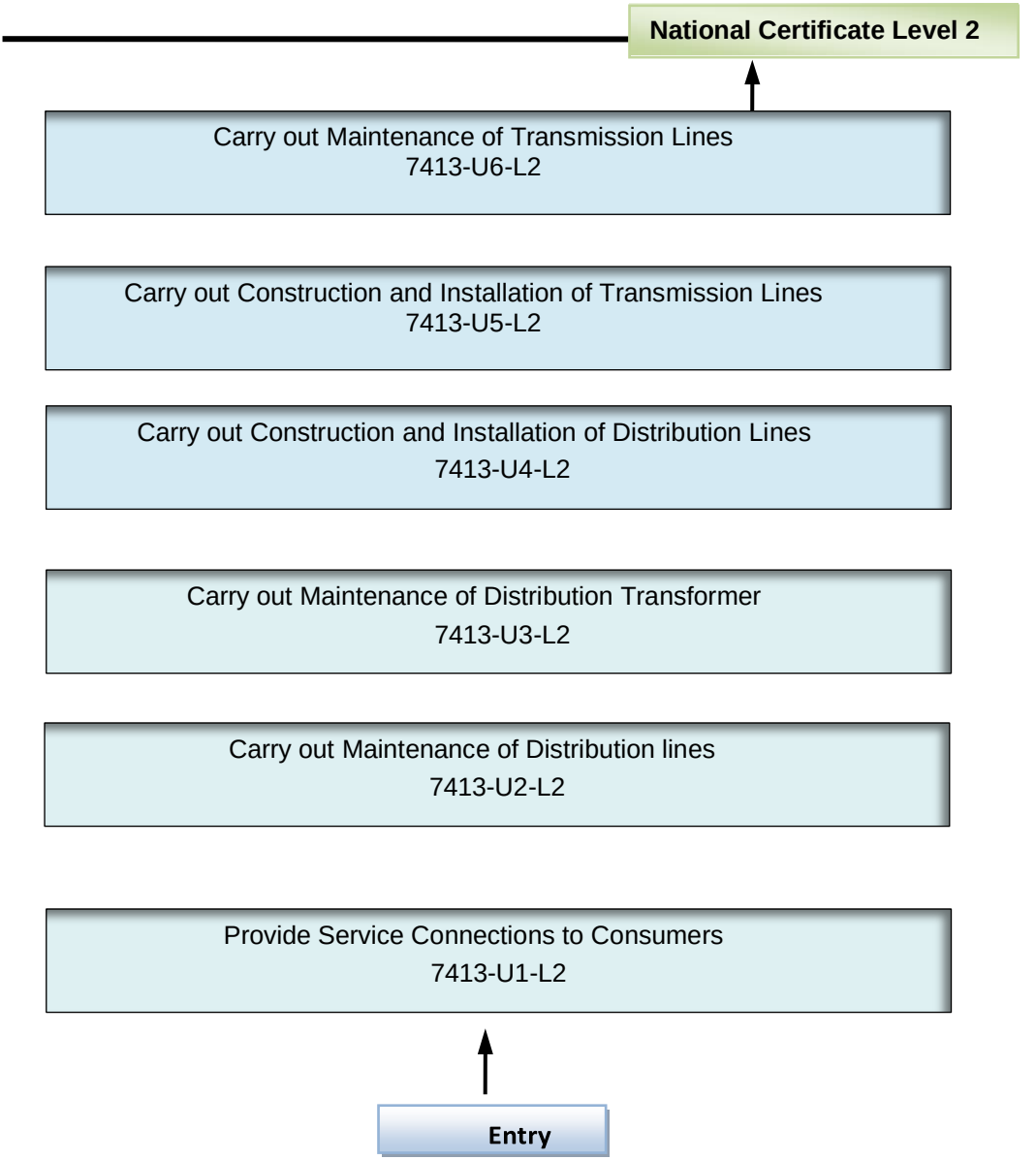
PACKAGING OF QUALIFICATIONS



OVERVIEW OF UNIT COMPETENCIES

National Certificate - Level 2

UNIT TITLE	ELEMENTS OF COMPETENCE	PAGE
Provide Service Connections to Consumers	1. Inspect internal house wiring connections and fittings 2. Provide service connections	6
Carry Out Maintenance of Distribution Lines	1. Diagnose the distribution line faults 2. Service the distribution lines	9
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Carry Out Construction and Installation of Distribution Lines	1. Install MV and LV distribution lines 2. Lay UG cables	17
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Carry Out Maintenance of Transmission Lines	1. Diagnose the transmission line faults 2. Service the transmission lines	24

UNIT TITLE : Provide Service Connections to Consumers

DESCRIPTOR: This unit covers the competencies required to carry out inspection of internal house wiring connections and fittings and providing of service connections to residential, commercial and institutions.

CODE : 7413 –U1- L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Inspect internal house wiring connections and fittings	1.1 Select and use ***personal protective equipment*** (***PPE)*** as per the job requirement following standard procedures. 1.2 Select and use required ***tools and equipment*** as per the job requirement following standards procedures. 1.3 Inspect wiring specifications and recommend for necessary action as per the job requirement following standard procedures. 1.4 Inspect fixtures and fittings specification and recommend for necessary action as per the job requirement following standard procedures. 1.5 Conduct insulation resistance test and take necessary action as per the job requirement following standard procedures. 1.6 Conduct earthing test and take necessary action as per the job requirement following standard procedures.
2. Provide service connections	2.1 Select and use required ***tools and equipment*** as per the job requirement following standard procedures. 2.2 Install service lines as per the job requirement following standard procedures. 2.3 Install energy meter as per the job requirement following standard procedures.

RANGE STATEMENT	
Tools and equipment may include but not limited to conducting:	
• IR (Insulation Resistance) tester • Earth tester • Digital Energy meter	• Multi meter • Clamp-on-meter • IPC (insulation piercing connector)
Personal protective equipment (PPE) may include but not limited to:	
• Hand gloves • Reflector vest • Safety belt	• Safety shoes • Safety Goggles • Helmet

Critical aspects:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Carryout IR test following standards procedure.
- Carryout earthing test following standards procedure.
- Provide service connection to consumers.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Basic first aid • Meter reading • Basic Billings • Types of energy meter • Household fixtures and fitting specification • Occupational health and safety regulations • Safety signs and symbols • Wiring knowledge • Basics of switch gear	• Team work • Negotiation • Communication skills • Problem solving • Analytical Skills • Time Management

UNIT TITLE : Carry out Maintenance of Distribution Lines

DESCRIPTOR: This unit covers the competencies required to carry out diagnosis of distribution line faults and servicing of distribution lines.

CODE : 7413- U2-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA	
1. Diagnose the distribution line faults	1.1	Select and use ***personal protective equipment*** (***PPE)*** as per the job requirement following standard procedures
	1.2	Select and use required ***diagnostic tools and equipment*** as per the job requirement following standard procedures.
	1.3	Troubleshoot the distribution line to identify the ***faults*** as per the job requirement following standard procedures.
2. Service the distribution lines	2.1	Select and use ***service tools and equipment*** as per the job requirement following standard procedures.
	2.2	Prepare estimates of ***materials*** (*conductors, poles & fittings, insulators, connectors, clamps, nuts and bolts, jointing and termination kits*) as per the job requirement following standard procedures.
	2.3	Prepare materials as per the job requirement following standard procedures.
	2.4	Repair the faulty components as per job requirement following standard procedures.
	2.5	Replace the ***faulty components*** as per job requirement following standard procedures.
	2.6	Test the distribution lines as per the job requirement following standard procedures.
	2.7	Document the records as per the job requirement following standard procedures.

RANGE STATEMENT
Personal protective equipment may include but not limited to: • Hand gloves • Helmet • Proximity sensor • Reflector vest • Safety shoes • Safety Goggles • Safety belt
Diagnostic tools and equipment may include but not limited to: • Insulation Resistance (IR)tester • Multi meter • Discharge rods/clamps • Hot stick tester (online tester) • Fault locator
Faults may include but not limited to: • Breakages • Leakages • Disc/pin insulator puncture • Conductor snapping • Lightening Arrester failure •
Service tools and equipment may include but not limited to: • Wrench set • Cable Cutter • Crimping Tools • Max Puller • Rope • Block and tackle • Measuring tape • Spirit level • Spade • Crowbar • Pulley • Come-along
Faulty components may include but not limited to: • Conductor • Insulator • Switches • Poles • Fuses • Connectors

Critical aspects:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Troubleshoot to identify the faults.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Basic First Aid • Types of faults • Types of conductors • Distribution system/ networks • Electrical signs, symbols and circuits. • Electricity supply rules and regulations • Basics of switch gear	• Team work • Negotiation • Communication skills • Problem solving • Analytical Skills • Time Management

UNIT TITLE : Carry out Maintenance of Distribution Transformer

DESCRIPTOR: This unit covers the competencies required to carry out diagnosis of distribution transformer faults and servicing of distribution transformer.

CODE : 7413 –U3- L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA	
1. Diagnose the distribution transformer faults	1.1	Select and use ***personal protective equipment*** (***PPE)*** as per the job requirement following standard procedures
	1.2	Select and use ***diagnostic tools and equipment*** *as* per the job requirement following standard procedures
	1.3	Troubleshoot the distribution transformer to identify the ***faults*** as per the job requirement following standard procedures.
2. Service the distribution transformer	2.1	Prepare and place safety signs and symbols as per the job requirement following standard procedures.
	2.2	Select and use ***service tools and equipment*** as per the job requirement following standard procedures.
	2.3	Prepare estimates of ***materials*** as per the job requirement following standard procedures.
	2.4	Prepare materials as per the job requirement following standard procedures.
	2.5	Repair the faulty distribution transformer components as per the job requirement following standard procedures.
	2.6	Replace the faulty ***components*** as per job requirement following standard procedures.
	2.7	Top up transformer oils as per the job

		requirement following standard procedures.
	2.8	Test the distribution transformer as per the job requirement following standard procedures.
	2.9	Document the record as per the job requirement following standard procedures.

RANGE STATEMENT
Personal protective equipment may include but not limited to: • Hand gloves • Safety belts • Proximity sensor • Reflector sensor • Safety shoes • Safety Goggles • Helmet
Diagnostic tools and equipment may include but not limited to: • BDV testing kit • IR tester • Ratio tester • micro-ohm meter
Service tools and equipment may include but not limited to: • Insulated Pliers • Wrench/Socket set • Chisel • Screw driver set • Soldering iron • Oil filtration machine • BDV testing kit, • IR tester, • Ratio tester, • Micro-ohm meter
Faults may include but not limited to: • Winding Short/Open Circuit • Deterioration Of Breather • Bushing Puncture • Oil Leakage
Materials may include but not limited to: • Transformer oil • Silica Gel • Bushing • Arching horns • Laminated sheets • Nuts and bolts/washers • Gaskets • Fuse • Enamel Copper wires • LV/HV studs • Oil seal
Faulty components may include but not limited to: • Bushing • Breather • Arcing horns • Winding • Core • Nuts and bolts • Fuse • Gasket • LV/HV studs

Critical aspects:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Troubleshoot to identify the distribution transformer faults
- Carryout the maintenance of distribution transformer.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Basic first aid • Components of distribution transformer • Working principle of distribution transformer • Fuse ratings • Types of transformer faults • Types of transformer testing • Basics of switch gear	• Team work • Negotiation • Communication skills • Problem solving • Analytical Skills • Time Management

UNIT TITLE : Carry out Construction and Installation of Distribution Lines

DESCRIPTOR: This unit covers the competencies required to carry out construction and installation of MV (6.6kV, 11kV and 33kV) and LV (230V and 415V) overhead and underground distribution lines.

CODE : 7413-U4-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Install MV and LV distribution lines	1.1 Identify the route for construction and installation of distribution lines as per the job requirement following standard procedures. 1.2 Select and use required tools and equipment as per the job requirement. 1.3 Select and use required PPE as per the job requirement. 1.4 Prepare foundations for erection of poles as per the job requirement following standard procedures. 1.5 Prepare and erect the poles as per the job requirement following standard procedures. 1.6 Fit the pole accessories and hard ware fittings as per the job requirement following standard procedures. 1.7 Provide spike earthing as per the standard procedures. 1.8 Prepare the conductors as per the job requirement following standard procedures. 1.9 String the conductors as per the job requirement following standard procedures. 1.10 Fit gang operating switch (GO)/Ring main unit (RMU) as per the job requirement following

		standard procedures.
	1.11	Test the lines as per the job requirement following the standard procedures.
2. Lay UG cables	2.1	Identify the routes for laying of UG cables as per the job requirement following standard procedures.
	2.2	Select and use required tools and equipment as per the job requirement.
	2.3	Select and use required PPE as per the job requirement.
	2.4	Prepare cable trench as per the job requirement following standard procedures.
	2.5	Prepare and lay UG cables as per the job requirement following standard procedures.
	2.6	Perform cable jointing as per job requirement following standard procedures.
	2.7	Perform cable termination and earthing as per the job requirement following the standard procedures.
	2.8	Provide earthing as per the job requirement following the standard procedure
	2.9	Test the UG cables as per the job requirement following standard procedures.

RANGE STATEMENT
Personal protective equipment may include but not limited to: • Hand gloves • Safety belts • Helmet • Safety shoes • Safety Goggles • Safety harness
Tools and equipment may include but not limited to: • Pliers • Wrench • Screw driver • Knife • Crimping tools • Spade • Cable cutter • Max puller • Come-along-clamp • Turn table • crowbar • pulley • rope • insulation remover • IR tester • Ladder • Shovel • Pickaxe • Shrinking torch • Torch
Pole accessories may include but not limited to: • Cross brace and arms • Insulators • Single cross arms • H- frame • Label plate • Top hamper • Spike earthing • Stay sets • Anti-climbing device • Danger name plate • Strain clamps • Suspension clamps • Hook bolts/brackets • IPC (Insulation piercing connector)

Critical aspects:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Stringing of conductors.
- Laying of underground cables.
- Perform cable jointing and terminations.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and integrity • Types of conductors • Distribution system/ networks • Electrical signs, symbols and circuits • Types of UG cables • Types of cable joints and terminations (Hot and cold shrink) • Types of rope knots • Basics of switch gear	• Team work • Negotiation • Communication skills • Problem solving • Analytical Skills • Time Management

UNIT TITLE : Carry out Construction and Installation of Transmission Lines

DESCRIPTOR: This unit covers the competencies required to carry out construction of transmission tower and installation of transmission lines (66kV and above).

CODE : 7413-U5-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA	
1. Construct transmission tower	1.1	Identify the locations for construction of transmission tower as per the job requirement following standard procedures.
	1.2	Select and use required ***tools and equipment*** as per the job requirement.
	1.3	Select and use required ***PPE*** as per the job requirement following standard procedures.
	1.4	Prepare tower foundations as per the job requirement following standard procedures
	1.5	Fit ***tower accessories*** and fittings as per the job requirement following standard procedures.
	1.6	Provide earthing as per the standard procedures.
	1.7	Test the earthing as per the job requirement following standard procedures
2. Install Transmission Lines	2.1	Prepare corridor/ right of way (ROW) as per the job requirement following standard procedures.
	2.2	Prepare materials as per the job requirement following standard procedures.
	2.3	Fit the tower accessories as per the job requirement following standard procedures.
	2.4	Perform stringing of the conductors as per the job requirement following standard procedures.
	2.5	Provide overhead ground wire and earthing connections as per the job requirement

		following standard procedures.
	2.6	Test the lines as per the job requirement following standard procedures.

RANGE STATEMENT	
Tools and Equipment may include but not limited to:	
• Wrench set • Pliers • Knife and Power chain • Screw driver • Max puller • Come-along-clamp • Hack saw • Conductor cutter • Spirit level • Pulley • Rope • Earth tester	• Roller • Sling • Derrick pole • Winch machine • Dummy wrench • Hydraulic compressor • Tower setting template • Adjustable jack • Sagging bridge • Line signature analyzer • IR tester • Measuring tape
PPE may include but not limited to:	
• Safety Gloves • Safety Helmet • Safety shoes	• Safety belts • Safety Goggles
Tower Accessories and fittings may include but not limited to:	
• Dead end fittings • Tower members • Anti-climbing device • Insulators • Vibration damper • Lightning arrester	• Tension plate • Phase plate • Location number plate • Danger plate • Arching horn • Jumper cone

Critical aspects applicable to these unit:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Erect the tower and string the conductors.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and integrity • Types of conductors • Types of transmission Towers • Electrical signs, symbols and circuits • Components of transmission towers • Types of rope knots • Basics of switch gear • Sag calculations	• Communication • Negotiation • Team work • Problem Solving • Time Management • Critical thinking • Innovative thinking

UNIT TITLE : Carry out Maintenance of Transmission Lines

DESCRIPTOR: This unit covers the competencies required to carry out offline maintenance of transmission lines which includes diagnosis of transmission line faults and restoration of transmission lines.

CODE : 7413-U6-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Diagnose the transmission line faults.	1.1 Select and use required ***PPE*** as per the job requirement following standard procedures. 1.2 Select and use required ***diagnostic tools and equipment*** as per the job requirement following standard procedures. 1.3 Collect fault data from sub-station as per the job requirement. 1.4 Identify the ***faults*** *and* troubleshoot the transmission line as per the job requirement following standard procedures.
2. Perform restoration of transmission lines	2.1 Select and use required PPE as per the job requirement following standard procedures. 2.2 Select and use tools and equipment as per the job requirement following standard procedures. 2.3 Prepare estimates of materials as per the job requirement following standard procedures. 2.4 Prepare materials as per the job requirement following standard procedures. 2.5 Repair the faulty components as per job requirement following standard procedures. 2.6 Replace the faulty components as per job requirement following standard procedures. 2.7 Test the transmission lines as per job requirement following standard procedures.

	2.8 Document the records as per the job requirement following standard procedures.

RANGE STATEMENT
Diagnostic Tools and Equipment may include but not limited to:
• Insulation Resistance (IR) tester • Line signature analyzer • Offline fault locator
PPE may include but not limited to:
• Safety Gloves • Safety Helmet • Safety shoes • Safety belts • Safety Goggles
Faults may include but not limited to: • Breakage of conductors • Insulator puncture/flash over • Short circuits • Tower collapse • Missing components
Tools and equipment may include but not limited to: • Wrench set • Pliers • Knife and Power chain • Screw driver • Max puller • Come-along-clamp • Hack saw • Conductor cutter • Pulley • Rope • Earth tester • Roller • Wire rope Sling • Ridging sling • Winch machine • Hydraulic compressor • Sagging bridge • Line signature analyzer • Discharging rod • Measuring tape • IR tester
Faulty components may include but not limited to: • Conductors • Insulators • Hardware Fittings • Tower members • Clamps

Critical aspects applicable to these unit:
• Demonstrate compliance with safety regulations applicable to work site operations. • Identify and troubleshoot the transmission lines faults.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Types of conductors • Basic First Aid • Transmission system/ networks • Types of transmission Towers • Electrical signs and symbols • Components of transmission towers • Sag calculations • Types of rope knots • Types of faults	• Communication • Negotiation • Team work • Problem Solving • Time Management. • Critical thinking • Innovative thinking

Annexure

1.1 National Competency Standards (NCS)

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.

1.2 Purpose of National Competency Standards

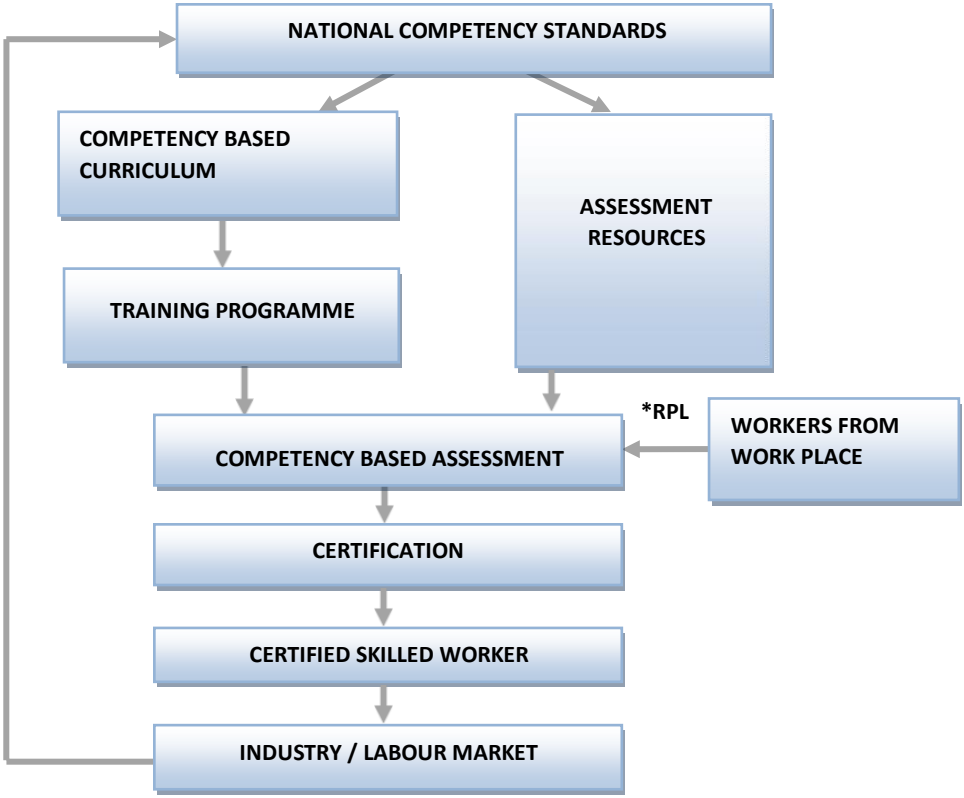
Competency Standards serve a number of purposes including:

- Providing advice to curriculum developers about the skill and knowledge to be included in curriculum.
- Providing specifications to assessment resource developers about the skill, knowledge and attitudes 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.

1.3 Bhutan Vocational Qualifications Framework (BVQF)

Bhutan Vocational Qualifications Framework is an agreed system of Assessing, Certifying and Monitoring nationally recognized qualifications for all learning in the VET sector against national standards, in training institutions, in the workplace, in schools or anywhere where learning takes place.

Components of the Bhutan Vocational Qualification Framework (BVQF)



*** RPL = Recognition of Prior Learning**

1.4 BVQF Levels

The Bhutan Vocational Qualifications Framework has three levels classified based on the competency of the skilled workers. The three levels are:

- National Certificate Level 3 (NC 3) -Master Craftsman
- National Certificate Level 2 (NC 2) -Craftsman
- National Certificate Level 1 (NC 1) -Semi Skilled Worker

BVQF Level Descriptors

The qualification levels are decided based on level descriptors. The detail of the qualification level descriptor is as follows:

National Certificate Level 1 (Semi skilled)

Carry out processes that:	Learning demand:	Responsibilities Which are applied:
• Are narrow in range. • Are established and familiar. • Offer a clear choice of routine responses. • Involve some prioritizing of tasks from known solutions.	• Basic operational knowledge and skill. • Utilization of basic available information. • Known solutions to familiar problems. • Little generation of new ideas.	• In directed activity. • Under general supervision and quality control. • With some responsibility for quantity and quality. • With no responsibility for guiding others.

National Certificate Level 2 (Craftsman)

Carry out processes that:	Learning demand:	Responsibilities which are applied:
• Require a range of well-developed skills. • Offer a significant choice of procedures requiring prioritization. • Are employed within a range of familiar context.	• Some relevant theoretical knowledge. • Interpretation of available information. • Discretion and judgment. • A range of known responses to familiar problems	• In directed activity with some autonomy. • Under general supervision and quality checking. • With significant responsibility for the quantity and quality of output. • With some possible responsibility for the output of others.

National Certificate Level 3 (Master Craftsman)

Carry out processes that:	Learning demand:	Responsibilities which are applied:
• Requires a wide range of technical or scholastic skills. • Offer a considerable choice of procedures requiring prioritization to achieve optimum outcomes. • Are employed in a variety of familiar and unfamiliar contexts.	• A broad knowledge base which incorporates some theoretical concepts. • Analytical interpretation of information. • Informed judgment. • A range of sometimes innovative responses to concrete but often unfamiliar problems.	• In self–directed activity. • Under broad guidance and evaluation. • With complete responsibility for quantity and quality of output. • With possible responsibility for the output of others.

1.5 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 Vocational Education and Training Management Information System (VET – MIS) both in terms of economic sector identification and that of the individual standard.
Coding the individual unit competency standard is to identify the level in qualification package to which it belongs.

While packaging, in order to follow a logical order, only 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 qualification package.

1.6 ASSESSMENT GUIDE

Form of assessments

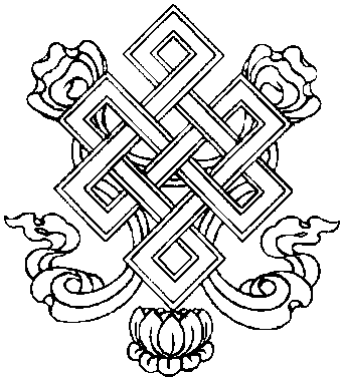
- Continuous assessment together with collected evidence of performance will be used.
- Evidence of the performance shall be based on practical demonstration.
- Knowledge can be assessed through diagrams, in writing or orally (viva- voce).

Assessment context

- Competency may be assessed in the actual work place or in a simulated workplace setting.

Assessment condition

- The candidate shall have access to all required tools, equipment, materials and documents.
- Candidate must complete the assessment in industry accepted time frame.



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