



**NATIONAL COMPETENCY STANDARDS  
FOR  
SUBSTATION OPERATOR  
(NC2)**

**Department of Occupational Standards  
Ministry of Labour and Human Resources  
Thimphu Bhutan  
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## FOREWORD

The Department of Occupational Standards of the Ministry of Labour and Human Resources is pleased to present the National Competency Standards (NCSs) for Substation Operator. 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 NCS is to set up a well-defined nationally recognized Vocational Qualifications System that will help set a benchmark for the Technical Vocational Education and Training (TVET) System in our country aligned to international best practices.

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

A vocational education and training system based on NCS 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.

I gratefully acknowledge collaboration and the valuable contributions made by experts from industries during the consultation and validation processes of the standards. I look forward for continued engagement and participation of the industry and employers in the development of a quality assured demand driven TVET system and to build competent and productive national workforce that will contribute to the continued socio-economic progress of our country.

Director  
Department of Occupational Standards  
Ministry of Labour and Human Resource

## ACKNOWLEDGEMENT

### NATIONAL COMPETENCY STANDARDS FOR SUBSTATION OPERATOR

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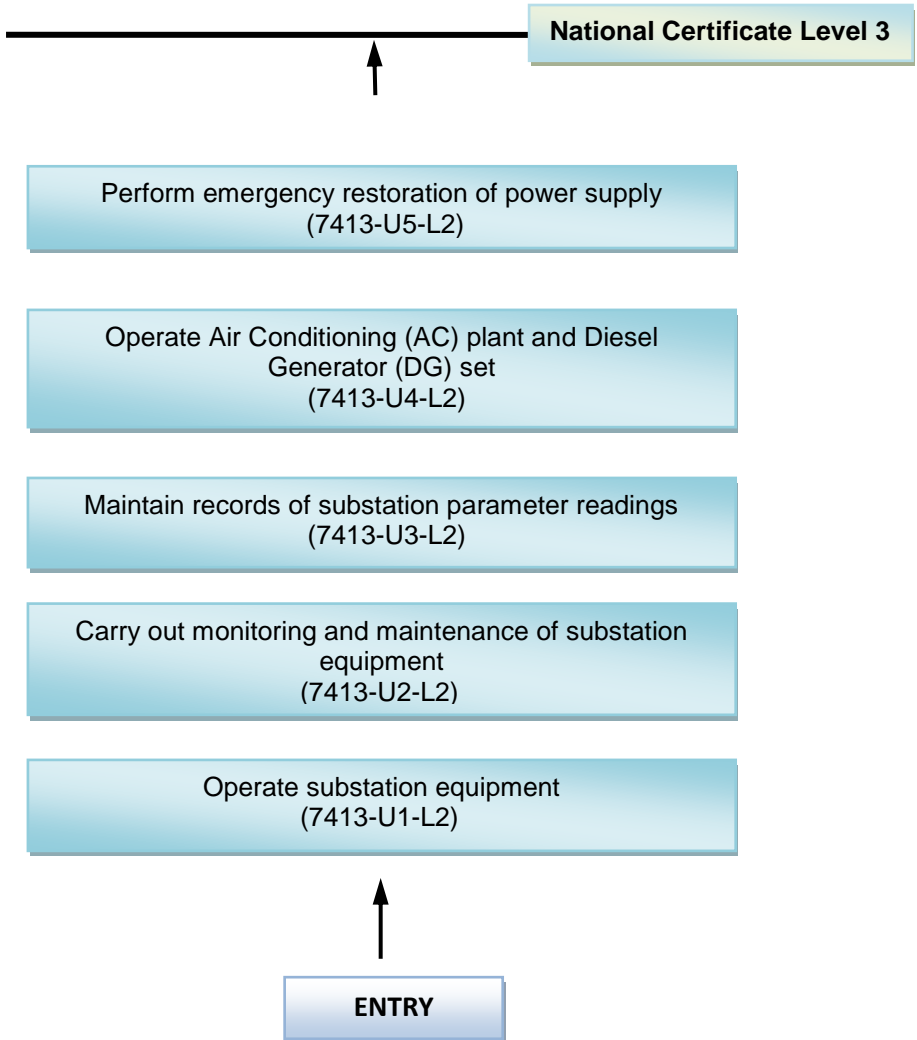
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## Packaging of Qualifications for Substation Operator

The National Competency Standards for the substation operator comprises of five units which are clustered into following level of qualifications.



## OVERVIEW OF UNIT COMPETENCIES

UNIT TITLE	ELEMENTS OF COMPETENCE
Operate substation equipment	<ol style="list-style-type: none"> <li>1. Operate switch yard equipment</li> <li>2. Operate control room equipment</li> </ol>
Carryout monitoring and maintenance of substation equipment	<ol style="list-style-type: none"> <li>1. Monitor control room equipment</li> <li>2. Monitor switch yard equipment</li> <li>3. Perform basic maintenance of substation equipment</li> </ol>
Maintain records of substation parameter readings	<ol style="list-style-type: none"> <li>1. Record switch yard readings</li> <li>2. Record parameters (control room) readings</li> </ol>
Operate Air Conditioning (AC) plant and Diesel Generator (DG) set	<ol style="list-style-type: none"> <li>1. Operate AC plant</li> <li>2. Operate DG set</li> </ol>
Perform emergency restoration of power supply	<ol style="list-style-type: none"> <li>1. Diagnose the fault</li> <li>2. Restore the fault</li> </ol>



**UNIT TITLE** : **Operate substation equipment**

**DESCRIPTOR** : This unit covers the competencies required to carry out routine operation of switch yard and control room equipment following safety practices at all times.

**CODE** : **7413 –U1- L2**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Operate switch yard equipment	1.1 Select and use <b>personal protective equipment (PPE)</b> as per the job requirement following standard procedures 1.2 Operate circuit breakers as per the job requirement following standard procedures. 1.3 Operate isolators as per the job requirement following standard procedures. 1.4 Operate earth switch as per the job requirement following standard procedures. 1.5 Operate tap changer as per the job requirement following standard procedures 1.6 Operate <b>valves</b> as per the job requirement following standard procedures 1.7 Operate transformer cooling system as per the job requirement following standard procedures
2. Operate control room equipment	2.1 Operate circuit breaker switch as per the job requirement following standard procedures 2.2 Operate isolator as per the job requirement following standard procedures 2.3 Operate vacuum circuit breaker trolley as per the requirement following standard procedures

- Gloves
- Helmet
- Safety shoes
- Goggles
- Ear muff
- Dust mask
- Safety belt

**Valves may include but not limited to:**

- Air pressure release valves
- Buchholz relay valves

**Performance of this unit is expected to be carried out the following standards:**

- Occupational health and Safety regulations (OHS)
- BEA rules and regulations

**Critical Aspects:**

- Demonstrate compliance with safety regulations applicable to work site operations
- Operate circuit breaker, isolator and earth switch.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Basic first aid</li> <li>• Meter reading</li> <li>• Switch yard equipment</li> <li>• Control room equipment</li> <li>• Functions of switch yard equipment / components</li> <li>• Functions of control room equipment / panels</li> <li>• Safety signs and symbols</li> <li>• Shut down procedures</li> <li>• Charging procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Handling of switchyard and control room equipment</li> <li>• Team work</li> <li>• Communication skills</li> <li>• Planning</li> <li>• Interpersonal relations</li> <li>• Problem solving</li> <li>• House keeping</li> <li>• Alertness</li> </ul>

**UNIT TITLE** : **Carryout monitoring and maintenance of substation equipment**

**DESCRIPTOR** : This unit covers the competencies required to monitor substation equipment and to carry out basic minor maintenance following safety practices at all times.

**CODE** : **7413- U2-L2**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Monitor switchyard equipment	1.1 Select and use required <b>PPE</b> as per the job requirement following standard procedures 1.2 Monitor <b>switchyard transformer</b> for proper functioning / conditions for any <b>defects</b> and take necessary actions as per the job requirement following standard procedures 1.3 Monitor the condition of lighting arrestor and take necessary action as per the job requirement following standard procedures 1.4 Monitor the status of DC supply and take necessary action as per the job requirement following standard procedures 1.5 Monitor the condition of circuit breakers and take necessary action as per the job requirement following standard procedures 1.6 Monitor the condition of isolators and take necessary action as per the job requirement following standard procedures 1.7 Monitor the condition of earth switch and take necessary action as per the job requirement following standard procedures 1.8 Monitor the condition of conductors and insulators & take necessary action as per the job requirement following standard procedures

	<p>1.9 Monitor the condition of bushings and cable connections and take necessary action as per the job requirement following standard procedures</p> <p>1.10 Monitor the condition of lighting and ventilation system take necessary action as per the job requirement following standard procedures</p>
<p>2. Monitor control room equipment</p>	<p>2.1 Monitor relay panels and take necessary action as per the job requirement following standard procedures.</p> <p>2.2 Monitor protection panels and take necessary action as per the job requirement following standard procedures.</p> <p>2.3 Monitor control panels and take necessary action as per the job requirement following standard procedures.</p> <p>2.4 Monitor PLCC panels and take necessary action as per the job requirement following standard procedures.</p> <p>2.5 Monitor SCADA and take necessary action as per the job requirement following standard procedures.</p> <p>2.6 Monitor battery condition take necessary action as per the job requirement following standard procedures.</p> <p>2.7 Monitor communication system and take necessary action as per the job requirement following standard procedures.</p> <p>2.8 Document the records as per the job requirement following standard procedures</p>
<p>3. Perform basic maintenance of substation equipment</p>	<p>3.1 Select and use <b>tools and equipment</b> as per the job requirement following standard procedures</p> <p>3.2 Clean the substation equipment as per the job</p>

	requirement following standard procedures
3.3	Replace <b>basic lighting components</b> as per the job requirement following standard procedures
3.4	Replace silica gel as per the job requirement following standard procedures

RANGE STATEMENT	
<b>Personal Protective equipment (PPE) may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Gloves</li> <li>• Helmet</li> <li>• Safety shoes</li> <li>• Goggles</li> </ul>	<ul style="list-style-type: none"> <li>• Ear muff</li> <li>• Dust mask</li> <li>• Safety belt</li> </ul>
<b>Switch yard transformer may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Power transformer</li> <li>• Potential transformer</li> </ul>	<ul style="list-style-type: none"> <li>• Current transformer</li> </ul>
<b>Defects may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Breakages</li> <li>• Leakages</li> <li>• Over heating</li> </ul>	<ul style="list-style-type: none"> <li>• Abnormal sound</li> <li>• Change in color of silica gel</li> <li>• Arc formation</li> </ul>
<b>Tools and equipment may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Wrench set</li> <li>• Pliers</li> <li>• Screw driver</li> </ul>	<ul style="list-style-type: none"> <li>• Multimeter</li> </ul>

**Basic lighting components may include but not limited to:**

- Bulbs
- Fuses

**Performance of this unit is expected to be carried to the following standards:**

- Occupational Health Safety Regulations (OHS)
- BEA rules and regulations

**Critical Aspects:**

- Demonstrate compliance with safety regulations applicable to work site operations
- Monitor control room equipment.

<b>UNDERPINNING KNOWLEDGE</b>	<b>UNDERPINNING SKILLS</b>
<ul style="list-style-type: none"><li>• Basic First Aid</li><li>• Types of defects</li><li>• Control room equipment</li><li>• Switchyard equipment</li><li>• Electrical signs, symbols and circuits</li><li>• Related Trade theory</li></ul>	<ul style="list-style-type: none"><li>• Interpretation of drawings and specifications</li><li>• Safe handling of tools and equipment</li><li>• Physically fit</li><li>• Pole/ladder climbing</li><li>• Team work</li><li>• Communication</li><li>• Coordination</li><li>• Problem solving</li><li>• Negotiations</li><li>• Alertness</li></ul>

**UNIT TITLE** : **Maintain records of substation parameter readings**

**DESCRIPTOR** : This unit covers the competencies required to record the daily readings of the switchyard equipment and control room equipment parameter readings.

**CODE** : **7413 –U3- L2**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Record switchyard readings	1.1 Select and use required <b>PPE</b> as per the job requirement following standard procedures 1.2 Record <b>temperature</b> as per the job requirement following establishment procedures 1.3 Record oil level readings as per the job requirement following establishment procedures 1.4 Record <b>pressure</b> as per the job requirement following establishment procedures 1.5 Record surge counter readings as per the job requirement following establishment procedures 1.6 Record tap position of transformer as per the job requirement following establishment procedures 1.7 Document the records as per the job requirement following establishment procedures
2. Record control room readings	2.1 Record ampere as per the job requirement following establishment procedures 2.2 Record voltage as per the job requirement following establishment procedures 2.3 Record power factor as per the job requirement following establishment procedures 2.4 Record load as per the job requirement following establishment procedures 2.5 Record MVAR as per the job requirement following



	establishment procedures
2.6	Record energy as per the job requirement following establishment procedures
2.7	Record frequency as per the job requirement following establishment procedures
2.8	Record specific gravity and cell voltage of batteries as per the job requirement following establishment procedures
2.9	Maintain tripping records and trip values as per the job requirement following establishment procedures
2.10	Document the records as per the job requirement following establishment procedures.

## RANGE STATEMENT

### PPE may include but not limited to:

- Gloves
- Helmet
- Safety shoes
- Goggles
- Ear muff
- Dust mask
- Safety belt

### Temperature for may include but not limited to:

- Oil temperature
- Control room temperature
- Winding temperature

### Pressure may include but not limited to:

- Oil pressure
- Gas pressure

**Performance of this unit is expected to be carried out to the following standards:**

- Occupational health and Safety regulations (OHS)
- BEA rules and regulations

**Critical Aspects:**

- Demonstrate compliance with safety regulations applicable to work site operations
- Routine recording of load and energy readings

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"><li>• Types of distribution transformer</li><li>• Basic first aid</li><li>• Control room equipment and parameters</li><li>• Switchyard equipment and parameters</li><li>• Units of measurement</li></ul>	<ul style="list-style-type: none"><li>• Interpretation of signs and symbols</li><li>• Team work</li><li>• Communication skills</li><li>• Problem solving</li><li>• Alertness</li><li>• Record keeping</li><li>• House keeping</li></ul>

**UNIT TITLE** : **Perform emergency restoration of power supply**

**DESCRIPTOR** : This unit covers the competencies required diagnose the faults in the feeder lines and to restore the power supply following safety at all times.

**CODE** : **7413 – U4- L2**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Diagnose the fault	1.1 Select and use <b>personal protective equipment (PPE)</b> as per the job requirement following standard procedures 1.2 Interpret the relay information as per the job requirement following standard procedures. 1.3 Analyze and identify the nature of <b>faults</b> as per the job requirement following standard procedures 1.4 Document the records as per the job requirement following establishment procedures
2. Restore the fault	2.1 Analyze the nature of faults and take necessary actions as per the job requirement following standard procedures 2.2 Test charge the faulty feeder if necessary, following standard procedures

#### **RANGE STATEMENT**

**Personal Protective Equipment (PPE) may include but not limited to:**

- Helmet
- Safety shoes
- Gloves
- Safety belt

**Faults may include but not limited to:**

- Transient faults
- Major faults

**Performance of this unit is expected to be carried out to the following standards:**

- Occupational Health and Safety Regulations (OHS)  
BEA rules and regulations

**Critical aspects:**

- Demonstrate compliance with safety regulations applicable to work site operations
- Analyze and identify the faults
- Interpretation of relay information

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Basic first aid</li> <li>• Interpretation of relay information</li> <li>• Power supply restoration procedures</li> <li>• Electrical signs, symbols and circuits</li> <li>• Related Trade theory</li> <li>• Types of faults</li> </ul>	<ul style="list-style-type: none"> <li>• Interpretation of drawings and specifications</li> <li>• Team work</li> <li>• Communication</li> <li>• Coordination</li> <li>• Problem solving</li> <li>• Negotiations</li> <li>• Alertness</li> </ul>

**UNIT TITLE** : **Perform operation of diesel generator (DG) set and Air conditioner (AC) plant**

**DESCRIPTOR** : This unit covers the competencies required operate diesel generator set and air conditioner plant as an when required following safety operation at all times.

**CODE** : **7413 – U4- L2**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Operate diesel generator (DG) set	<p>1.1 Select and use <b>personal protective equipment (PPE)</b> as per the job requirement following standard procedures</p> <p>1.2 Test and check the condition of <b>DG set components</b> and take necessary action as per the job requirement following standard procedures</p> <p>1.3 Select and feed the feeders as per the job requirement following standard procedures</p> <p>1.4 Back feed the power supply following standard / establishment procedures</p> <p>1.5 Normalize the power supply as per the job requirement following standard procedures</p>
2. Operate air conditioner (AC) plant	<p>2.1 Check the condition of <b>AC plant / components</b> and take necessary action as per the job requirement following standard procedures</p> <p>2.2 Start the functioning of AC plant as per the job requirement following standard procedures</p> <p>2.3 Record <b>readings</b> (pressure, current, voltage, temperature) as per the job requirement following establishment procedures</p> <p>2.4 Stop the functioning of AC plant as per the job requirement following standard procedures</p>

## RANGE STATEMENT

### **Personal Protective Equipment (PPE) may include but not limited to:**

- Helmet
- Safety shoes
- Gloves
- Safety belt

### **Diesel Generator set components may include but not limited to:**

- Batteries
- Fuel
- Relays
- Filter
- Connections

### **Condition of AC plant / components may include but not limited to:**

- Water level
- Oil level
- Air pressure
- Switches
- Compressors
- Temperature
- Control circuits
- Air housing units
- Connections

### **Performance of this unit is expected to be carried out to the following standards:**

- Occupational Health and Safety Regulations (OHS)
- BEA rules and regulations

### **Critical aspects:**

- Demonstrate compliance with safety regulations applicable to work site operations
- Test and check the condition of Diesel generator set components
- Check the condition of AC plant / components

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Basic first aid</li> <li>• Functions and components of Diesel Generator set</li> <li>• Functions and components of Air Condition plant</li> <li>• Electrical signs, symbols and circuits</li> <li>• Related Trade theory</li> </ul>	<ul style="list-style-type: none"> <li>• Interpretation of drawings and specifications</li> <li>• Team work</li> <li>• Communication</li> <li>• Coordination</li> <li>• Problem solving</li> <li>• Negotiations</li> <li>• Alertness</li> </ul>

# Annexure

## 1.1 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.

## 1.2 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 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.

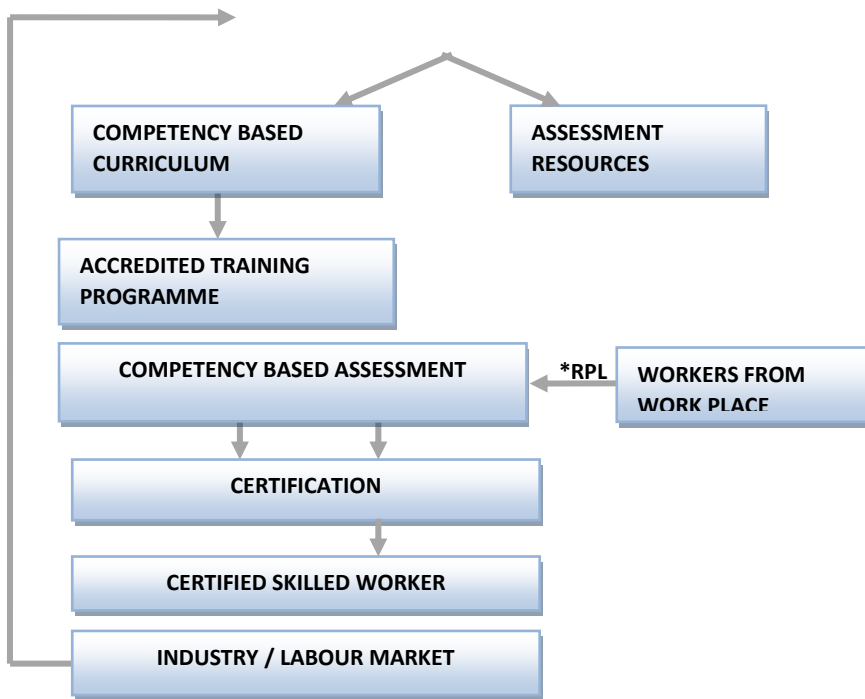
## 1.3 Bhutan Vocational Qualifications Framework (BVQF)

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

## Components of the Bhutan Vocational Qualifications Framework (BVQF)

**NATIONAL COMPETENCY STANDARDS**





**\* 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 III)
- National Certificate Level 2 (NC II)
- National Certificate Level 1 (NC I)

### 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

<b>Carry out processes that:</b>	<b>Learning demand:</b>	<b>Responsibilities which are applied:</b>
<ul style="list-style-type: none"> <li>• Are narrow in range.</li> <li>• Are established and familiar.</li> <li>• Offer a clear choice of routine responses.</li> <li>• Involve some prioritizing of tasks from known solutions.</li> </ul>	<ul style="list-style-type: none"> <li>• Basic operational knowledge and skill.</li> <li>• Utilization of basic available information.</li> <li>• Known solutions to familiar problems.</li> <li>• Little generation of new ideas.</li> </ul>	<ul style="list-style-type: none"> <li>• In directed activity.</li> <li>• Under general supervision and quality control.</li> <li>• With some responsibility for quantity and quality.</li> <li>• With no responsibility for guiding others.</li> </ul>

## National Certificate Level 2

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> <li>• Require a range of well-developed skills.</li> <li>• Offer a significant choice of procedures requiring prioritization.</li> <li>• Are employed within a range of familiar context.</li> </ul>	<ul style="list-style-type: none"> <li>• Some relevant theoretical knowledge.</li> <li>• Interpretation of available information.</li> <li>• Discretion and judgments.</li> <li>• A range of known responses to familiar problems</li> </ul>	<ul style="list-style-type: none"> <li>• In directed activity with some autonomy.</li> <li>• Under general supervision and quality checking.</li> <li>• With significant responsibility for the quantity and quality of output.</li> <li>• With some possible responsibility for the output of others.</li> </ul>

## National Certificate Level 3

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> <li>• Requires a wide range of technical or scholastic skills.</li> <li>• Offer a considerable choice of procedures requiring prioritization to achieve optimum outcomes.</li> <li>• Are employed in a variety of familiar and unfamiliar contexts.</li> </ul>	<ul style="list-style-type: none"> <li>• A broad knowledge base which incorporates some theoretical concepts.</li> <li>• Analytical interpretation of information.</li> <li>• Informed judgment.</li> <li>• A range of sometimes innovative responses to concrete but often</li> </ul>	<ul style="list-style-type: none"> <li>• In self-directed activity.</li> <li>• Under broad guidance and evaluation.</li> <li>• With complete responsibility for quantity and quality of output.</li> <li>• With possible responsibility for the output of others.</li> </ul>

## **1.5 PURPOSE**

This qualification is designed for people interested in a career as a Plumber at the Certificate level. It comprises of four units that cover the essential knowledge and skills required for people working as a Plumber.

It provides industry specific skills and demands a level of performance that will enable new recruits to the industry to be immediately productive.

## **1.6 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 practises. 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 national competency standards**

Coding the individual skills standard has a multiple purpose:

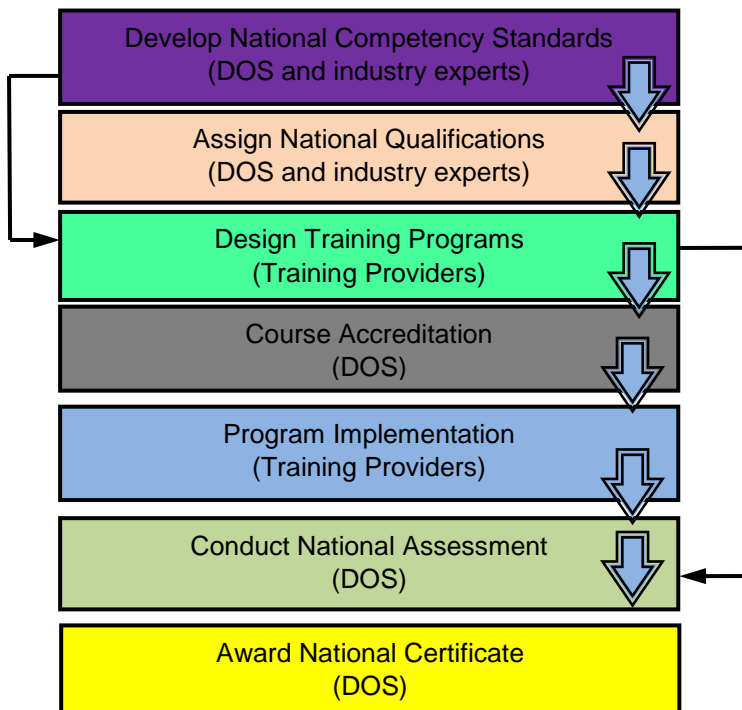
- to identify the level,
- to identify to which module the standard belongs,
- to identify in which order the standard is clustered within that module.

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.

To illustrate with an example, the ILO assigns the code 7126 to the occupation plumber. Therefore, in the Bhutan's context, the occupation Plumber has been assigned the code 7126 in the National Coding System. The first unit is assigned the code U1, the first Unit of National Competency Standard is designated the code 7126 U1. Levels are assigned the code L and follow a logical progression from the National Certificate Level 1 (NC I) to the National Certificate Level 3 (NC III). Therefore the National Certificate Level 3 is assigned the code L3.

### Implementation and operational procedures for National Competency Standards (NCS)



**Key:**

MoLHR – Ministry of Labour and Human Resources  
DOS – Department of Occupational Standards

**1.7 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).

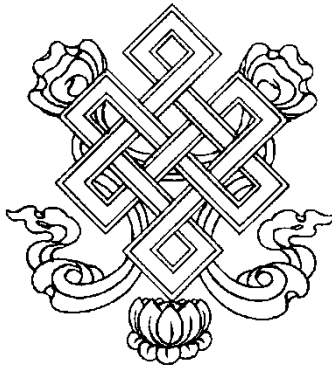
**Assessment context**

- 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, equipments, materials and documents.
- Candidate must complete the assessment in industry accepted time frame.





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