



**NATIONAL COMPETENCY STANDARDS  
FOR  
INDUSTRY ELECTRICAL TECHNICIAN  
(NC3)**

**Department of Occupational Standards  
Ministry of Labour and Human Resources  
Thimphu, Bhutan.  
(August 2019)**





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## FOREWORD

The Department of Occupational Standards of the Ministry of Labour and Human Resources is pleased to present the revised National Competency Standards (NCSs) for Industry Electrical Technician. 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 Qualification System that will help set a benchmark for the Technical Vocational Education and Training (TVET) System in our country aligned to international best practices.

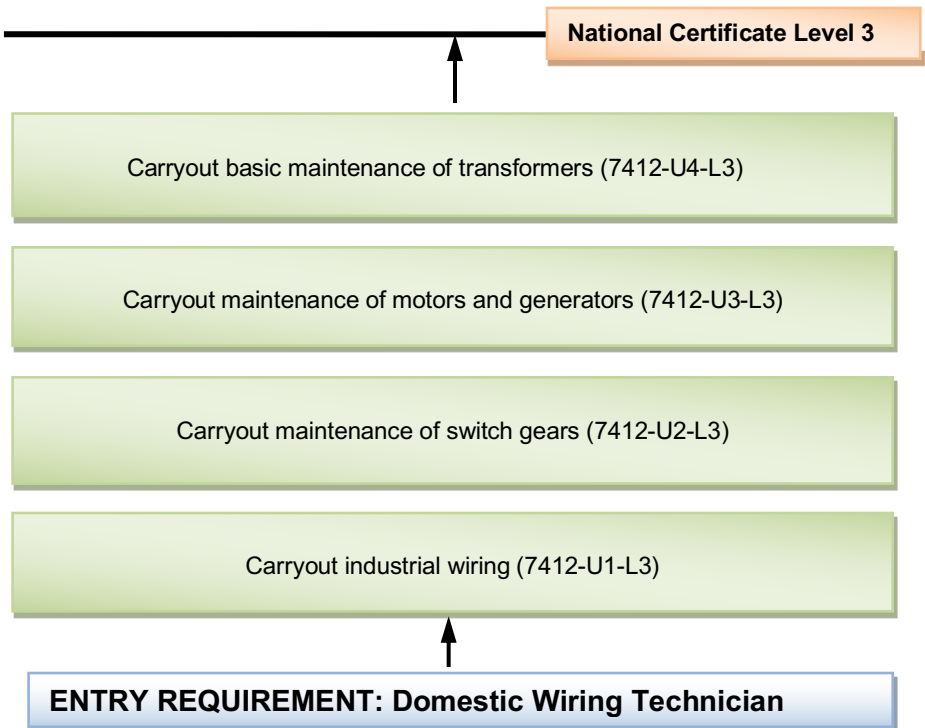
NCS is one of the base pillars in the Bhutan Vocational Qualification Framework (BVQF) and is the first step in its implementation. The NCS are developed and revised to ensure that employees or vocational graduates possess and acquire the desired competencies required by industries and employers. In 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 Resources

# PACKAGING OF QUALIFICATION FOR INDUSTRY ELECTRICAL TECHNICIAN



## Acknowledgement

**Validation date** : 30/08/2019  
**Endorsement date** :10/12/2019  
**Date of Review** :30 /08/2022 (Max. 3 years).

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1. Karma Loday, Chief Program Officer, Department of Occupational Standards (DOS), MoLHR, Thimphu
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## **COMPETENCY STANDARDS FOR INDUSTRIAL ELECTRICAL TECHNICIAN**

<b>UNIT TITLE</b>	<b>ELEMENTS OF COMPETENCE</b>
Carryout Industrial Wiring	<ol style="list-style-type: none"><li>1. Prepare to carryout industrial wiring</li><li>2. Perform industrial wiring</li><li>3. Perform maintenance of industrial wiring</li></ol>
Carryout maintenance of switch gears	<ol style="list-style-type: none"><li>1. Diagnose the faults of switch gears</li><li>2. Service switch gears</li></ol>
Carryout maintenance of motors and generators	<ol style="list-style-type: none"><li>1. Diagnose the faults of motors and generators</li><li>2. Service motors</li><li>3. Service generators</li></ol>
Carryout basic maintenance of Transformer	<ol style="list-style-type: none"><li>1. Diagnose the faults of transformer</li><li>2. Monitor transformer</li><li>3. Service the transformer</li></ol>

**UNIT TITLE** : **Carryout industrial wiring**

**DESCRIPTOR** : This unit describes the competencies required to prepare for industrial wiring and perform industrial wiring following standard procedures at all times.

**CODE** : **7412-U1-L3**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Prepare to carryout industrial wiring	1.1 Select and use required <b>tools and equipment</b> as per the job requirement following standard procedures 1.2 Select and use <b>personal protective equipment (PPE)</b> as per the job requirement following standard procedures 1.3 Interpret industrial wiring drawing as per the job requirement following standard procedures
2. Perform industrial wiring	2.1 Perform industrial wiring for lighting as per the drawing following standard procedures 2.2 Perform industrial wiring for power circuit as per the drawing following standard procedures 2.3 Perform industrial wiring for <b>control circuit</b> as per the drawing following standard procedures 2.4 Test industrial wiring circuit as per the standard procedures
3. Perform maintenance of industrial wiring	3.1 Troubleshoot the wiring for faults as per the job requirement following standard procedures

	3.2	Service the industrial wiring as per the job requirement following standard procedures
	3.3	Test the industrial wiring as per the standard procedures

RANGE STATEMENT	
<b>Tools and equipment may include but limited to:</b>	
<ul style="list-style-type: none"> <li>• Cables and wires</li> <li>• Control and protective switchgear(s)</li> <li>• Insulation resistance (IR) tester</li> <li>• Cleaning agents and cotton</li> <li>• Insulation Tester</li> </ul>	<ul style="list-style-type: none"> <li>• Personal protective equipment</li> <li>• Electrician tool set</li> <li>• Mechanical tool set</li> <li>• Multi-meter</li> <li>• Breakdown voltage test kit</li> </ul>
<b>Personal protective equipment may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Safety glove</li> <li>• Safety helmet</li> <li>• Safety boot / gum boot</li> <li>• Fire extinguisher</li> <li>• Uniform</li> </ul>	<ul style="list-style-type: none"> <li>• Safety goggle</li> <li>• Ear muff</li> <li>• Respiratory mask</li> <li>• Safety belt</li> </ul>
<b>Control Circuit may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• switch gears</li> <li>• Line indications</li> <li>• Timers</li> </ul>	<ul style="list-style-type: none"> <li>• Metering device</li> <li>• Motor control</li> </ul>
<b>Critical aspects:</b>	
<ul style="list-style-type: none"> <li>• Following Occupational health and safety regulations applicable at worksite</li> <li>• Test industrial wiring circuit as per the standard procedures</li> </ul>	

<b>UNDERPINNING KNOWLEDGE</b>	<b>UNDERPINNING SKILLS</b>
<ul style="list-style-type: none"><li>• Ethics and integrity</li><li>• Basic First Aid</li><li>• Types and sizes of cables</li><li>• Cable trench and trays routing</li><li>• Types of jointing</li><li>• Types of lugs</li><li>• Basic estimation and costing</li><li>• Record keeping and reporting</li></ul>	<ul style="list-style-type: none"><li>• Communication</li><li>• Teamwork</li><li>• Planning</li><li>• Problem solving</li><li>• Negotiation skills</li></ul>

**UNIT TITLE : Carryout maintenance of switch gears**

**DESCRIPTOR :** This unit covers the competencies required to diagnose the faults and service generators following standard procedures at all times.

**CODE : 7412-U2-L3**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Diagnose the faults of switch gears	1.1 Select and use required <b>Personal Protective Equipment</b> as per the job requirement following standard procedures 1.2 Select and use <b>tools and equipment</b> as per the job requirement following standard procedures 1.3 Troubleshoot to identify the <b>faults</b> of switch gears as per the job requirement following standard procedures
2. Service switch gears	2.1 Disassemble the switchgear as per the job requirement following standard procedures 2.2 Replace defective <b>switchgear components</b> as per the job requirement following standard procedures. 2.3 Adjust required setting of relay, timer and breaker (contact gap) as per the manufacturer's instructions and specifications. 2.4 Perform functionality test of the switch gears following standard procedures

## RANGE STATEMENT

### Tools and equipment may include:

- Cables and wires
- Control and protective switchgear(s)
- Insulation resistance tester
- Cleaning agents and cotton
- Phase sequence meter
- Forward reverse starter
- Electrician tool set
- Mechanical tool set
- Multi-meter
- Bracket and board
- Crimping tool
- Direct on line (DOL) starter
- Star-delta starter

### Personal protective equipment may include but not limited to:

- Safety glove
- Safety helmet
- Safety boot
- Fire extinguisher
- Uniform
- Safety goggle
- Ear muff
- Respiratory mask
- Safety belt

### Switchgear components may include but not limited to:

- Contact tips
- Coils
- Relays
- Contactors
- Thermostats
- Fuse
- Push button

### Faults may include but not limited to:

- Leakages
- Breakages
- Short circuits

### Critical aspects:

- Following occupational health and safety regulations
- Troubleshoot to identify the faults of switch gears as per the job requirement following standard procedures

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Ethics and Integrity</li> <li>• Basic First Aid</li> <li>• Circuit diagrams, service manuals, wiring diagram and manufacturer's specifications</li> <li>• Types of electrical tools and measuring instrument.</li> <li>• Types of switchgear(s).</li> <li>• Principle of operation of circuit breakers and their applications.</li> <li>• Types of wires, cables and their rating.</li> <li>• Related trade theory</li> <li>• Common faults in switch gears</li> <li>• Basic concept of numerical relays</li> <li>• Importance of testing and periodic inspection of switchgear(s).</li> <li>• Troubleshooting and repair procedures of switchgear(s).</li> <li>• Basic fundamentals of Programmable Logic Controller (PLC)</li> <li>• Basic field instruments(Resistance Temperature Detector (RTD,) Thermo couple, Pressure switch, Transducers)</li> <li>• Types of Backup supply</li> </ul>	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Planning</li> <li>• Problem solving</li> <li>• Team work</li> <li>• Analytical</li> </ul>

**UNIT TITLE :** Carryout maintenance of motors and generator

**DESCRIPTOR :** This unit covers the competencies required to diagnose the faults and service motors and generators.

**CODE :** 7412-U3-L3

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Diagnose the faults of motors and generators	1.1 Select and use required <b>tools and equipment</b> as per the job requirement following standard procedures 1.2 Select and use <b>PPE</b> as per the job requirement following standard procedures. 1.3 Troubleshoot to identify the <b>faults</b> of motors as per the job requirement following standard procedures
2. Service motors	2.1 Dismount the motors as per the job requirement following standard procedures. 2.2 Disassemble the motors as per the job requirement following standard procedures 2.3 Clean / lubricate the components as per the job requirement following standard procedures. 2.4 Replace the faulty <b>motor components</b> as per the job requirement following standard procedure 2.5 Perform motor rewinding as per the job requirement following standard procedures



	2.6	Assemble the motor components as per the job requirement following standard procedures
	2.7	<b>Test</b> motors as per the job requirements following standard procedures
3. Service generators	3.1	Disassemble the generator components as per the job requirement following standard procedures
	3.2	Clean / lubricate the generator components as per the job requirement following standard procedures.
	3.3	Replace the faulty <b>generator components</b> as per the job requirement following standard procedure
	3.4	Assemble the generator components as per the job requirement following standard procedures
	3.5	Test generators as per the job requirements following standard procedures

### RANGE STATEMENT

#### Tools and equipment may include but not limited to:

- Electrician tool set
- Tachometer
- Insulation tester
- Personal protective equipment
- Insulation resistance (IR) tester
- Engine oil
- Phase sequence meter
- Multi-meter
- Test lamp
- Mechanical tool set
- Pulley puller / pusher
- Bearing puller / pusher
- Work bench
- Cleaning agents and cotton
- Temperature gun

#### Personal protective equipment may include:

- Safety glove
- Safety helmet
- Safety goggle
- Ear muff

- Safety boot
- Fire extinguisher
- Respiratory mask
- Safety belt
- Uniform

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

- Loose connection,
- Burnt
- Insulation failure
- Improper settings
- Worn out bearing housing
- Leakages
- Breakages
- Improper Phase sequence
- Improper alignment
- Discharge battery (s)

**Motor components may include but not limited to:**

- Windings
- Capacitor
- Cooling system components
- Bearings
- Insulators
- Relays

**Generator components may include but not limited to:**

- Carbon brush
- Bearings
- Cooling system components
- Rectifiers
- Windings
- Couplings
- Commutators
- Slip-rings

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

- Load test
- IR test
- Short circuit test
- Open circuit test

**Critical aspects:**

- Following Occupational health and safety regulations applicable at worksite.
- Replace motor components as per the job requirement following standard procedures
- Replace generator components as per the job requirement following standard procedures.
- Test motors and generator as per the job requirement following standard procedures.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Ethics and Integrity</li> <li>• Basic First Aid</li> <li>• Motor/Generator specifications</li> <li>• Fundamental of electrical rotating machines</li> <li>• Type of motors and its construction</li> <li>• Working principles of motors and generator.</li> <li>• Types of measuring and testing instruments</li> <li>• Common faults in motors / generator</li> <li>• Troubleshooting method</li> <li>• Types of switchgear(s) and accessories used in motors and generator</li> <li>• Record keeping and reporting</li> <li>• Starting methods of motors</li> <li>• Basic fundamentals of electricity</li> <li>• Preventive maintenance work on motors and generator</li> <li>• Fire precautions</li> </ul>	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Teamwork</li> <li>• Planning</li> <li>• Problem solving</li> <li>• Negotiation skills</li> </ul>

**UNIT TITLE** : **Carryout basic maintenance of transformers**

**DESCRIPTOR** : This unit covers the competencies required to diagnose the faults and maintenance of transformers following standard procedures at all times

**CODE** : **7412-U4-L3**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Diagnose the faults of transformer	1.1 Select and use required <b>tools and equipment</b> as per the job requirement following standard procedures 1.2 Select and use <b>personal protective equipment (PPE)</b> as per the job requirement following standard procedures 1.3 Troubleshoot to identify the <b>faults</b> of transformer as per the job requirement following standard procedures
2. Monitor transformer	2.1 Conduct physical check of transformer condition as per the job requirement following standard procedures 2.2 Check the condition / level of transformer oil and take necessary action as per the job requirement following standard procedures 2.3 Monitor and record the <b>transformer parameters</b> following standard procedures. 2.4 Check the condition of breather and take necessary action as per the job requirement following standard procedures

3. Service transformer	3.1	Dismount the transformer as per the job requirement following standard procedures
	3.2	Disassemble the transformer components as per the job requirement following standard procedures
	3.3	Replace the faulty <b>transformer components</b> as per the job requirement following standard procedures
	3.4	Assemble the transformer components as per the job requirement following standard procedures
	3.5	Test the transformer as per the job requirement following standard procedures

### RANGE STATEMENT

#### Tools and equipment may include but limited to:

- Cables and wires
- Control and protective switchgear(s)
- Insulation resistance (IR) tester
- Cleaning agents and cotton
- Insulation Tester
- Electrician tool set
- Mechanical tool set
- Multi-meter
- Breakdown voltage test kit

#### Personal protective equipment may include but not limited to:

- Safety glove
- Safety helmet
- Safety boot / gum boot
- Fire extinguisher
- Uniform
- Safety goggle
- Ear muff
- Respiratory mask
- Safety belt

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

- Leakages
- Breakages
- Short circuit
- Open circuit

**Transformer parameters may include but not limited to:**

- Oil temperature
- Winding temperature

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

- Open circuit test
- IR test
- Short circuit test

**Transformer components may include but not limited to:**

- Buchholz relay
- Explosion vent
- Breather
- Conservator tank
- Magnetic oil gauge (MOG)
- Windings
- Gaskets
- Bushing
- Tap changer
- Cooling system
- Pressure relieve valve
- Arcing horn
- Pipes and valves

**Critical aspects:**

- Following Occupational health and safety regulations applicable at worksite.
- Interpretation of relevant drawings and specifications
- Testing and replacing of transformer components as per the job requirement following standard procedures.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Ethics and integrity</li> <li>• Basic First Aid</li> <li>• Types and sizes of transformer</li> <li>• Working principle of transformer and its construction</li> <li>• Basic knowledge on generation, transmission and distribution system</li> <li>• Function of tap changer</li> <li>• Types of transformer cooling system</li> <li>• Record keeping and reporting (logbook)</li> <li>• Preventive maintenance schedule</li> <li>• Transformer testing method</li> <li>• Transformer earthing and protections</li> </ul>	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Teamwork</li> <li>• Planning</li> <li>• Problem solving</li> <li>• Negotiation skills</li> </ul>

## Annexure

### 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.

## **Purpose of National Competency Standards**

Competency Standards serve a number of purposes including:

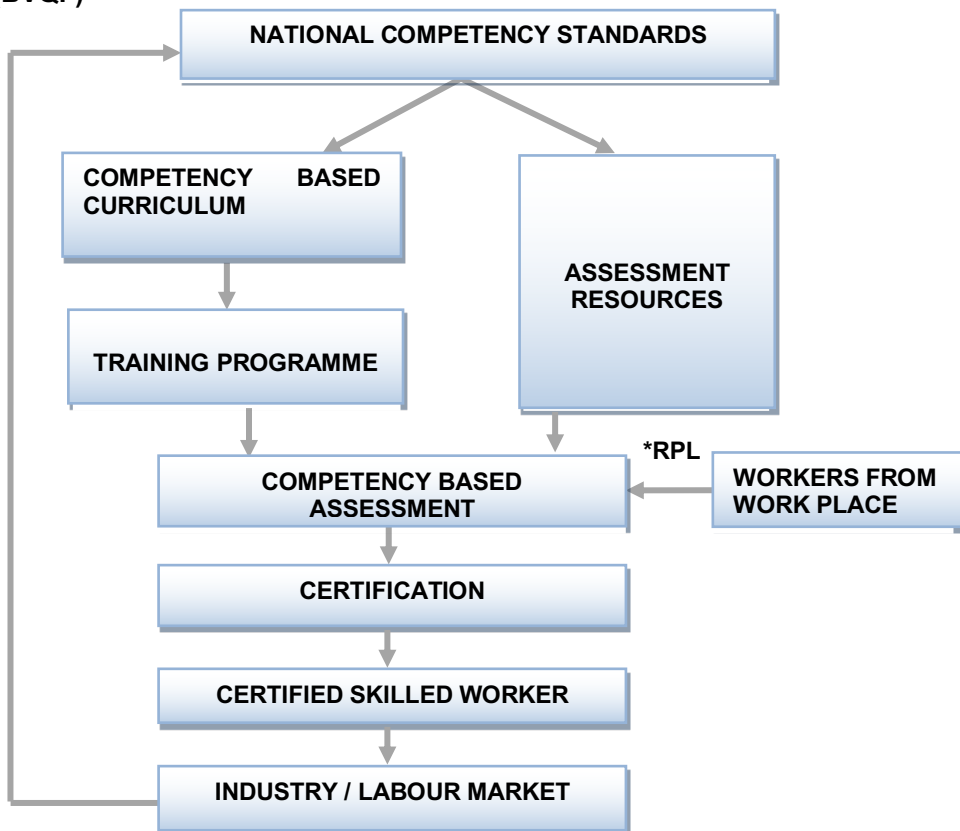
- Providing advice to curriculum developers about the skill and knowledge to be included in curriculum.
- Providing specifications to assessment resource developers about the skill, knowledge and attitudes within an occupation to be demonstrated by candidates.
- Providing advice to industry/employers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



## 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  
**Annexure III**

## 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)

Processes:	Learning demand:	Responsibilities :
<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 (Craftsman)

Processes:	Learning demand:	Responsibilities:
<ul style="list-style-type: none"> <li>• Require a range of 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 judgment.</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 (Master Craftsman)

Processes:	Learning demand:	Responsibilities:
<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 unfamiliar problems.</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>

## **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).

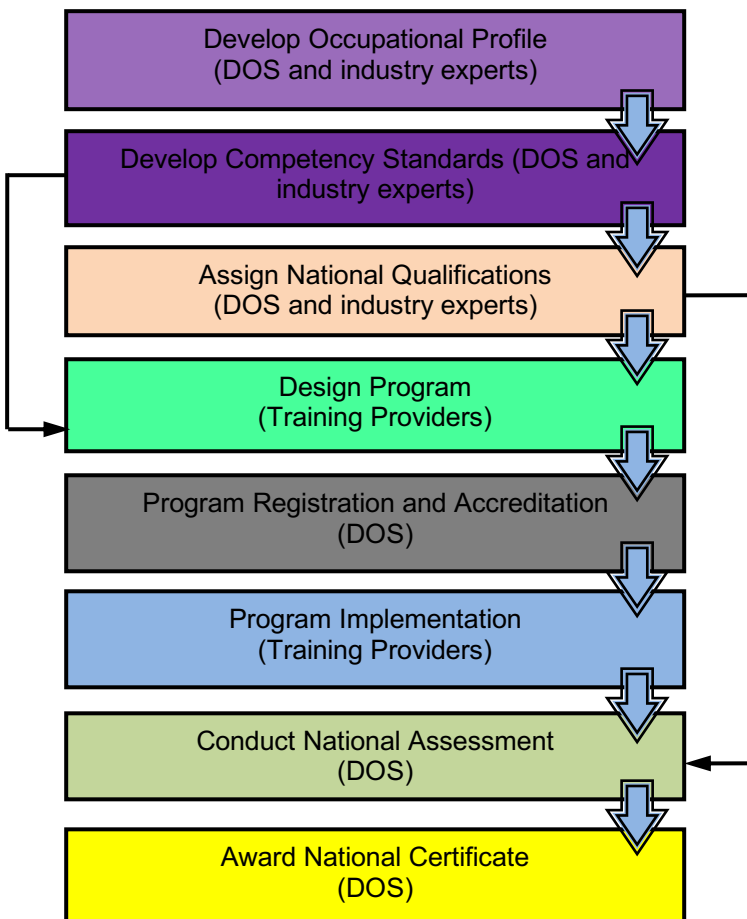
The coding of the National Competency Standards forms the basis of the identification code for the Vocational Education and Training Management Information System (VET – MIS) both in terms of economic sector identification and that of the individual standard.

Coding the individual 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 packages.

The ILO assigns the code 7412 to the occupation of Industrial Electrical Technician and related trades. Therefore, in the Bhutan context, the occupation Industrial Electrical Technician has been assigned the code 7412 in the National Coding System. The first unit is assigned the code U1, the first Unit of Competency Standard clustered into the first qualification is designated the code 7412-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 2 is assigned the code L2. The complete unit code will be 7412-U1-L2.

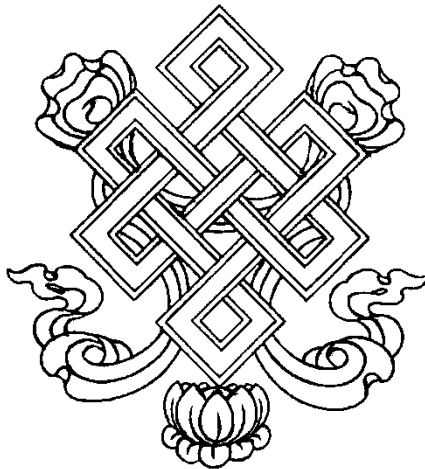
# Implementation and operational procedures for National Competency Standard (NCS)



**Key:**

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