



**NATIONAL COMPETENCY STANDARDS
FOR
DOMESTIC REFRIGERATION AND AIR
CONDITIONING TECHNICIAN
(NC2)**

**Department of Occupational Standards
Ministry of Labour and Human Resources
Thimphu, Bhutan.
(March 2021)**



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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 Domestic Refrigeration and Air Conditioning 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

ACKNOWLEDGEMENT

Validation date : 13/03/2021

Date of Review : 13/03/2023 (Max. 3 years).

Technical Advisory Committee (TAC) members for the Manufacturing Sector involved in the validation of the NCS:

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5. Kinzang Namgyel, Dy. Chief Engineer, Penden Cement Authority Limited, Gomtu.
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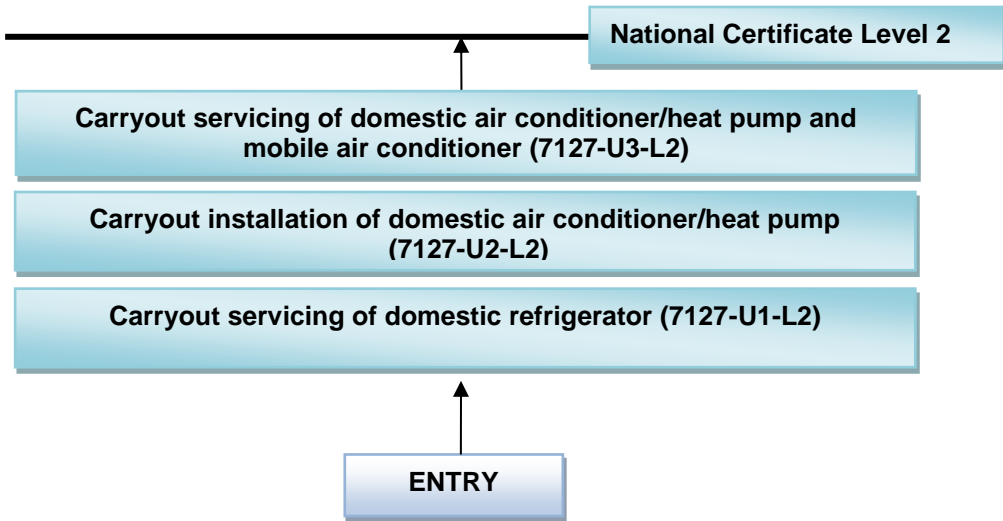
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1. Karma Loday, Specialist, SQD, DOS, MoLHR
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PACKAGING OF QUALIFICATIONS



Overview of National Competency Standards

UNIT TITLE	ELEMENTS OF COMPETENCE
1. Carryout servicing of domestic refrigerator	<ol style="list-style-type: none"> 1. Prepare for servicing of domestic refrigerator 2. Perform servicing of domestic refrigerator 3. Conduct test
2. Carryout installation of domestic air conditioner/heat pump	<ol style="list-style-type: none"> 1. Prepare for installation of domestic Air Conditioner/heat pump 2. Perform installation of domestic Air Conditioner/heat pump 3. Conduct test
3. Carryout servicing of domestic air conditioner/heat pump and mobile air conditioner	<ol style="list-style-type: none"> 1. Prepare for servicing of domestic air conditioner/heat pump 2. Perform servicing of domestic air conditioner/heat pump 3. Perform servicing of mobile air conditioner 4. Conduct test

UNIT TITLE : **Carryout servicing of domestic refrigerator**

DESCRIPTOR : This unit covers the competencies required to service domestic refrigerators of frost free and direct cooling type. This unit is applicable for the servicing of deep freezer following safety at all times.

CODE : **7127-U1-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for servicing of domestic refrigerator	1.1 Select and use personal protective equipment (PPE) as per the job requirements 1.2 Prepare the cost estimate of the servicing works following standard procedures 1.3 Select and use tools and equipment as per the job requirements 1.4 Select and use materials as per the job requirements
2. Perform Servicing of domestic refrigerator	2.1 Troubleshoot the faults following standards procedures. 2.2 Repair the faulty electrical and mechanical components as per the job requirements following standard procedures. 2.3 Replace the electrical components as per the job requirements following standard procedures. 2.4 Replace the mechanical components as per the job requirements following standard procedures. 2.5 Charge the refrigerant following standard procedures as per the relevant rules and regulations.

3. Conduct test	3.1	Test the refrigerator for proper functioning following standard procedures.
	3.2	Maintain records / documents as per the job requirements.
	3.3	Store materials and clean the workplace following standard procedures.

RANGE STATEMENT	
Tools and equipment may include but not limited to:	
<ul style="list-style-type: none"> • Screw driver set • Multi meter • Pliers • Pinching plier • Allen key set • Vacuum pump • Pipe cutter 	<ul style="list-style-type: none"> • Pressure gauge • Tester • Blow lamp • Recovery machine/cylinder
Personal protective equipment (PPE) may include but not limited to:	
<ul style="list-style-type: none"> • Hand gloves • Workshop dress 	<ul style="list-style-type: none"> • Safety shoes • Safety goggles
Materials may include but not limited to:	
<ul style="list-style-type: none"> • Brazing rod • Refrigerant 	<ul style="list-style-type: none"> • Copper tube / wire
Faults may include but not limited to:	
<ul style="list-style-type: none"> • Electrical faults 	<ul style="list-style-type: none"> • Mechanical faults
Electrical components may include but not limited to:	
<ul style="list-style-type: none"> • Thermostat • Fuse • Relay • Door switch 	<ul style="list-style-type: none"> • Over load protector • Capacitors • Timers
Mechanical components may include but not limited to:	
<ul style="list-style-type: none"> • Evaporator • Condenser • Compressor 	<ul style="list-style-type: none"> • Filter dryer • Tubes
Test may include but not limited to:	
<ul style="list-style-type: none"> • Cooling • Leakage 	<ul style="list-style-type: none"> • Current • Auto system test

Records / documents may include but not limited to:
<ul style="list-style-type: none"> • Maintenance / service records • Bills • Job / history cards
Compliance with following rules and regulations
<ul style="list-style-type: none"> • NEC rules and regulations
Critical Aspects:
<ul style="list-style-type: none"> • Demonstration of occupational health and safety practices at workplace • Troubleshooting and rectifying the faults following standards procedures • Recovery, evaporating and charging the refrigerant following standard procedures in accordance with relevant rules and regulations

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Working principles of refrigeration system • Estimation and costing • Market rates • Environment rules and regulations • Waste prevention and management Act • OHS • Types of refrigerant • Impact of refrigerant on environment • Basic electrical • Basic thermo dynamics 	<ul style="list-style-type: none"> • Team work • Communication • Negotiation • Handling of tools and equipment • Brazing • Time management

UNIT TITLE : Carryout installation of domestic air conditioner/heat pump

DESCRIPTOR: This unit covers the competencies required to prepare layout, install domestic air conditioner/heat pump following safety at all times.

CODE : 7127-U2-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for installation of domestic Air Conditioner/heat pump	1.1 Select and use tools and equipment as per the job requirements. 1.2 Prepare the cost estimate for the servicing of domestic air conditioner following standard procedures 1.3 Select and use Personal protective equipment (PPE) as per the job requirements. 1.4 Select and use materials as per the job requirements.
2. Perform installation of domestic Air Conditioner/heat pump	2.1 Determine the capacity and number of AC following standards procedures as per the job requirements. 2.2 Prepare layout for the installation following standard procedures as per the job requirements. 2.3 Lay wires following standard procedures as per the job requirements. 2.4 Install indoor air condition units following standard procedures. 2.5 Install outdoor air condition units following standard procedures.

	2.6	Provide connections following standard procedures.
3. Conduct test	3.1	Test the installation for proper functioning following standard procedures.
	3.2	Maintain records / documents as per the job requirements.
	3.3	Store materials and clean the workplace following standard procedures.

RANGE STATEMENT	
Tools and equipment may include but not limited to:	
<ul style="list-style-type: none"> • Drill machine • Pipe cutter • Screw driver set • Multi meter • Pliers 	<ul style="list-style-type: none"> • Flaring tools • Pressure gauge • Allen key set • Vacuum pump • Tube bender
Personal protective equipment (PPE) may include but not limited to:	
<ul style="list-style-type: none"> • Gloves • Safety shoes • Safety belt 	<ul style="list-style-type: none"> • Workshop dress • Mask • Goggles
Materials may include but not limited to:	
<ul style="list-style-type: none"> • Wires • Refrigerant 	<ul style="list-style-type: none"> • Tubes • Dry nitrogen gas
Connections for may include but not limited to:	
<ul style="list-style-type: none"> • Tube 	<ul style="list-style-type: none"> • Electrical
Test may include but not limited to:	
<ul style="list-style-type: none"> • Cooling/heating 	<ul style="list-style-type: none"> • Leakage
Records / documents may include but not limited to:	
<ul style="list-style-type: none"> • Installation record 	<ul style="list-style-type: none"> • Bills
Critical Aspects:	
<ul style="list-style-type: none"> • Demonstrate compliance with safety regulation applicable to work site operation. • Installation of indoor and outdoor air condition units as per the manufacturer's specification following standard procedures 	

- Conducting of leakage test following standard procedures.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupational Health and Safety (OHS) Regulations • Basic electronic components • Waste prevention & management Act • Estimation and costing • Types and uses of personal protective equipment • Manufacturer's operation manuals and specifications • Types of AC • Working principle of AC • Working principles of heat pump • Basic electrical connections • Environment hazards • Types of refrigerant 	<ul style="list-style-type: none"> • Team Work • Communication • Interpersonal relationship • Problem solving • Time Management

UNIT TITLE : Carryout servicing of domestic air conditioner/heat pump and mobile air conditioner

DESCRIPTOR : This unit covers the competencies required to troubleshoot, service domestic AC/heat pump and mobile air conditioner following safety at all times.

CODE : 7127-U3-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for servicing of domestic air conditioner/heat pump	1.1 Select and use tools and equipment as per the job requirements. 1.2 Select and use personal protective equipment (PPE) as per the job requirements. 1.3 Select and use materials as per the job requirements.
2. Perform servicing of domestic Air conditioner/heat pump	2.1 Troubleshoot the faults following standards procedures. 2.2 Estimate the cost of service following standard procedures. 2.3 Repair the faulty electrical and mechanical components as per the job requirements following standard procedures. 2.4 Replace the electrical components as per the job requirements following standard procedures. 2.5 Replace the mechanical components as per the job requirements following standard procedures. 2.6 Recover and charge the refrigerant following standard procedures in accordance with relevant rules and regulations.

<p>3. Perform servicing of mobile air conditioner</p>	<p>3.1 Troubleshoot the faults (leakage) following standards procedures.</p> <p>3.2 Estimate the cost of service following standard procedures.</p> <p>3.3 Repair the faulty electrical and mechanical components as per the job requirements following standard procedures.</p> <p>3.4 Replace the electrical components as per the job requirements following standard procedures.</p> <p>3.5 Replace the mechanical components as per the job requirements following standard procedures.</p> <p>3.6 Recover and charge the refrigerant following standard procedures in accordance with relevant rules and regulations</p>
<p>4. Conduct test</p>	<p>4.1 Test the air conditioner for proper functioning following standard procedures.</p> <p>4.2 Maintain records / document as per the job requirements.</p> <p>4.3 Store materials and clean the workplace following standard procedures.</p>

<p>RANGE STATEMENT</p>
<p>Personal protective equipment (PPE) may include but not limited to:</p> <ul style="list-style-type: none"> • Gloves • Safety shoes • Workshop dress • Goggles
<p>Tools and equipment may include but not limited to:</p> <ul style="list-style-type: none"> • Screw driver set • Multi meter • Pliers • Allen key set • Vacuum pump • Pressure gauge • Recovery machine/cylinder
<p>Materials may include but not limited to:</p>

• Wires	• Tubes
Faults may include but not limited to:	
• Electrical	• Mechanical
Electrical components may include but not limited to:	
• Thermostat	• Capacitors
• Fuse	• Timers
• Relay	• Power circuit board
• Solenoid valve	• Transformer
• PCB (Printed Circuit Board)	
Mechanical components may include but not limited to:	
• Evaporator	• Filter dryer
• Condenser	• Tubes
• Compressor	• Blower
• Reversible valve	
Test may include but not limited to:	
• Cooling	• Leakage
Records / documents may include but not limited to:	
• Maintenance / service record	• Bills
• Job card	
Electrical components for MAC may include but not limited to:	
• Pressure switch	• Fuse
Mechanical components for MAC may include but not limited to:	
• Compressor	• Evaporator
• Condenser	• Tubes
Critical Aspects:	
<ul style="list-style-type: none"> • Demonstrating compliance with safety regulation applicable to work site operation. • Troubleshooting and rectifying the faults following standards procedures • Recovery, evaporating and charging the refrigerant following standard procedures in accordance with relevant rules and regulations 	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupational Health & Safety • Basic electronics components • Basic First Aid • Basic retrofitting techniques • Manufacturer's operation manuals and specifications • Basic electrical connections • Working principles of AC • Types of AC • Working principles and components of mobile air conditioning (MAC) system • Types of refrigerants • Environment hazards • Waste prevention and management 	<ul style="list-style-type: none"> • Team Work • Communication • Interpersonal relationship • Problem solving • Time management

ANNEXURE

A. 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

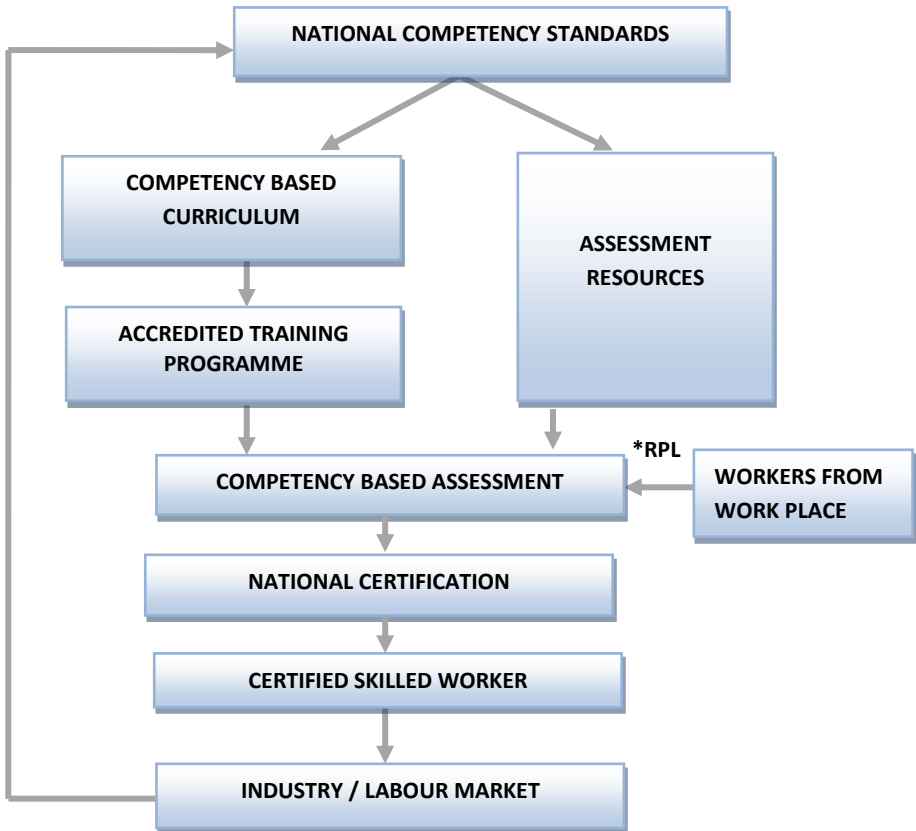
National Competency Standards serve a number of purposes including:

- Providing advice to curriculum developers about the competencies to be included in 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.

B. 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)



* RPL = Recognition of Prior Learning

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

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none">• Are narrow in range.• Are established and familiar.• Offer a clear choice of routine responses.• Involve some prioritizing of tasks from known solutions.	<ul style="list-style-type: none">• Basic operational knowledge and skill.• Utilization of basic available information.• Known solutions to familiar problems.• Little generation of new ideas.	<ul style="list-style-type: none">• 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

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> • Require a range of well-developed skills. • Offer a significant choice of procedures requiring prioritization. • Are employed within a range of familiar context. 	<ul style="list-style-type: none"> • Some relevant theoretical knowledge. • Interpretation of available information. • Discretion and judgments. • A range of known responses to familiar problems 	<ul style="list-style-type: none"> • 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

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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.

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).

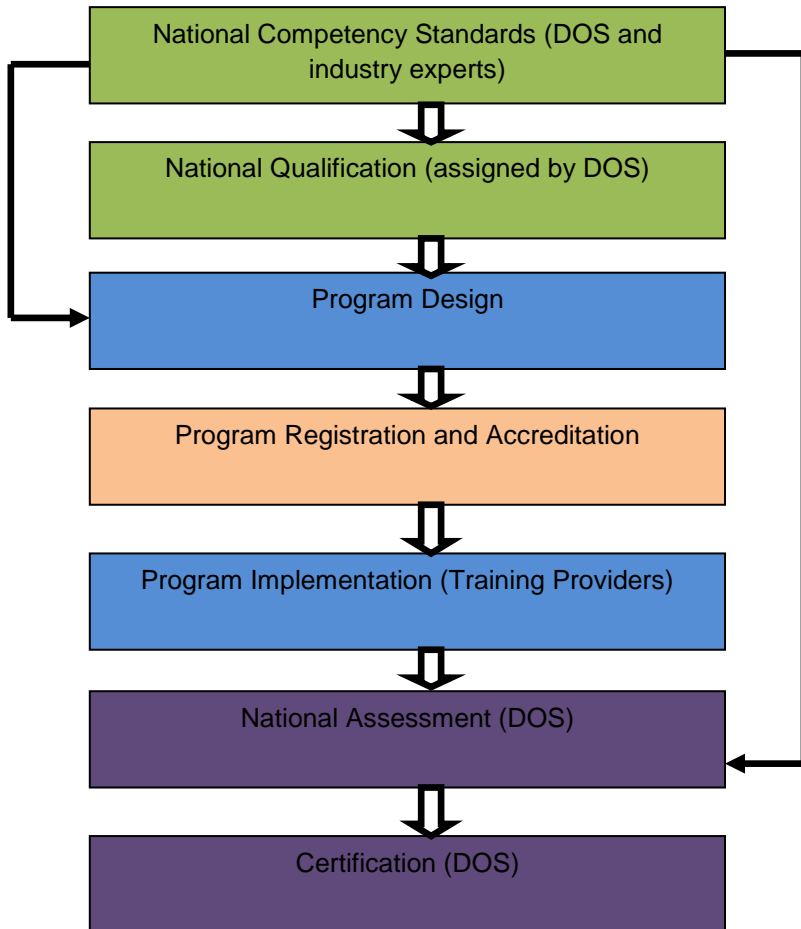
The coding of the national competency standards forms the basis of the identification code for the Vocational Education and Training Management Information System (VET – MIS) both in terms of economic sector identification and that of the individual standard.

Coding the individual units of competency standard is to identify the level in qualification packages 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 7127 to the occupation of Air conditioning and refrigeration mechanics. Therefore, in the Bhutan context, the occupation Air conditioning and refrigeration technician has been assigned the code 7127 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 7127-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 3). Therefore the National Certificate Level 2 is assigned the code L2. The complete unit code will be 7127-U1-L2.

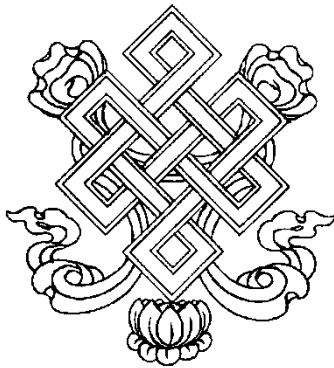
Implementation and Operational Procedures for National Competency Standards



Key:

MoLHR – Ministry of Labour and Human Resources

DOS – Department of Occupational Standards



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