



**NATIONAL COMPETENCY STANDARDS
FOR
MECHANICAL PRODUCT DESIGNER
(NC3)**

**TVET Quality Council
Bhutan Qualifications and Professional
Certification Authority
Thimphu Bhutan
(April 2023)**



**NATIONAL COMPETENCY STANDARDS
FOR
MECHANICAL PRODUCT DESIGNER
(NC3)**

**TVET Quality Council
Bhutan Qualifications and Professional
Certification Authority
Thimphu Bhutan
(April 2023)**

First Publication 2023
© TVET Quality Council, BQPCA

FOREWORD

The TVET Quality Council, Bhutan Qualifications and Professionals Certification Authority (BQPCA) is pleased to present National Competency Standards (NCSs) for Mechanical Product Designer. The standards represent the fruits of hard work and invaluable experiences gained by the council 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
Bhutan Qualifications and Professional Certification Authority
Ministry of Education and Skills Development

Acknowledgement

NATIONAL COMPETENCY STANDARDS FOR MECHANICAL PRODUCT DESIGNER

Validation date : 05/04/2023

Date of Review : 05/04/2026 (Max. 3 years)

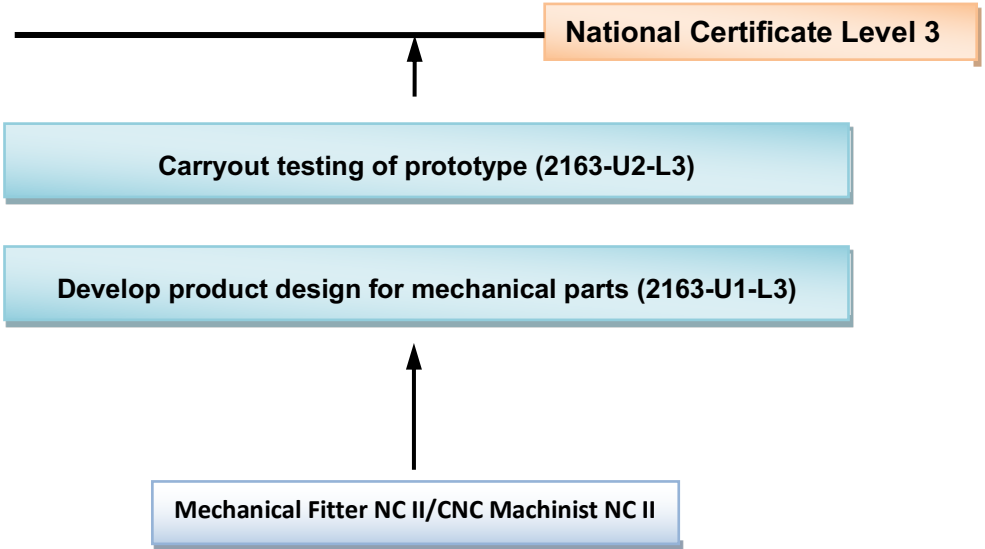
Subject experts involved during the consultative workshop for the development of NCS:

1. Lobzang Dorji, TTI-Khuruthang
2. Rinzin Norbu, TTI-Khuruthang
3. Ash Bdr. Subba, TTI-Khuruthang
4. Sonam Dorji, TTI-Chumey
5. Yebi Dema, TTI- Khuruthang
6. Chencho Dorji, TTI-Khuruthang
7. Nima Dorji, TTI-Khuruthang
8. Pema Zangmo, TTI-Khuruthang

Facilitators:

1. Karma Loday, Specialist, TVET Quality Council, BQPCA
2. Chogay Lhendup, Sr. Program Officer, TVET Quality Council, BQPCA

Packaging of Qualifications



Overview of the National Competency Standards

UNIT TITLE	ELEMENTS OF COMPETENCE
1. Develop product design for mechanical parts	1. Conceptualize the product design of mechanical parts 2. Prepare product design using CAD software
2. Carryout testing of the prototype	1. Develop Prototype 2. Test Prototype

UNIT TITLE:	Develop Product design for mechanical parts
DESCRIPTOR:	This unit covers the competencies required to conduct basic research and conceptualize the product designs and prepare product design using CAD software.
CODE :	2163-U1-L3
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Conceptualize the product design of mechanical parts	<p>1.1 Develop sketch of the product as per the customer's requirement following standard procedures</p> <p>1.2 Modify the product design as per the job requirement following standard procedures</p> <p>1.3 Finalize the design as per the customer's requirement following standard procedures</p>
2. Prepare product design using CAD software	<p>2.1 Select and use CAD software as per the job requirement</p> <p>2.2 Produce product design using the CAD software as per the design following standard procedures</p>

RANGE STATEMENT	
CAD software may include but not limited to:	
<ul style="list-style-type: none"> • AutoDESK Inventor • Solidwork 	<ul style="list-style-type: none"> • Sketchup

Critical Aspects:

- Follow occupational health and safety procedures
- Finalize the design as per the customer's requirement

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethics and Integrity• Occupational Health and safety regulations• Basic First Aid• Estimation and costing• Precision and tolerance• Engineering drawing and design• Basic IT• Design thinking• Basic Metallurgy• Basic strength of Materials	<ul style="list-style-type: none">• Team work• Communication skills• Problem solving• Negotiation• Time management• Critical thinking• Innovative thinking

UNIT TITLE:	Carryout testing of the prototype
DESCRIPTOR:	This unit covers the competencies required to develop prototype and test prototype of mechanical products
CODE:	2163-U2-L3
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Develop Prototype	1.1 Select and use Materials, tools and equipment as per the job requirement 1.2 Produce prototype as per the design following standard procedures
2. Test Prototype	2.1 Select and use testing equipment as per the job requirement 2.2 Perform testing of prototype as per the job requirement following standard procedures 2.3 Analyze the test reports as per the job requirement 2.4 Prepare report of the test following standard procedures

RANGE STATEMENT	
Materials, Tools and equipment may include but not limited to:	
<ul style="list-style-type: none"> • 3D printing • Machine tools 	<ul style="list-style-type: none"> • hand tools • CNC machines

Testing equipment may include but not limited to:	
<ul style="list-style-type: none"> • UTM • Torsion Testing Machine 	<ul style="list-style-type: none"> • Harness testing machine • Fatigue testing machine
Critical Aspects:	
<ul style="list-style-type: none"> • Follow occupational health and safety procedures • Produce prototype as per the design following standard procedures 	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupational Health and safety regulations • Basic First Aid • Estimation and costing • Precision and tolerance • Types of testing method (Destructive testing and Non-Destructive Testing) 	<ul style="list-style-type: none"> • Team work • Communication skills • Problem solving • Negotiation • Time management • Critical thinking • Innovative thinking

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

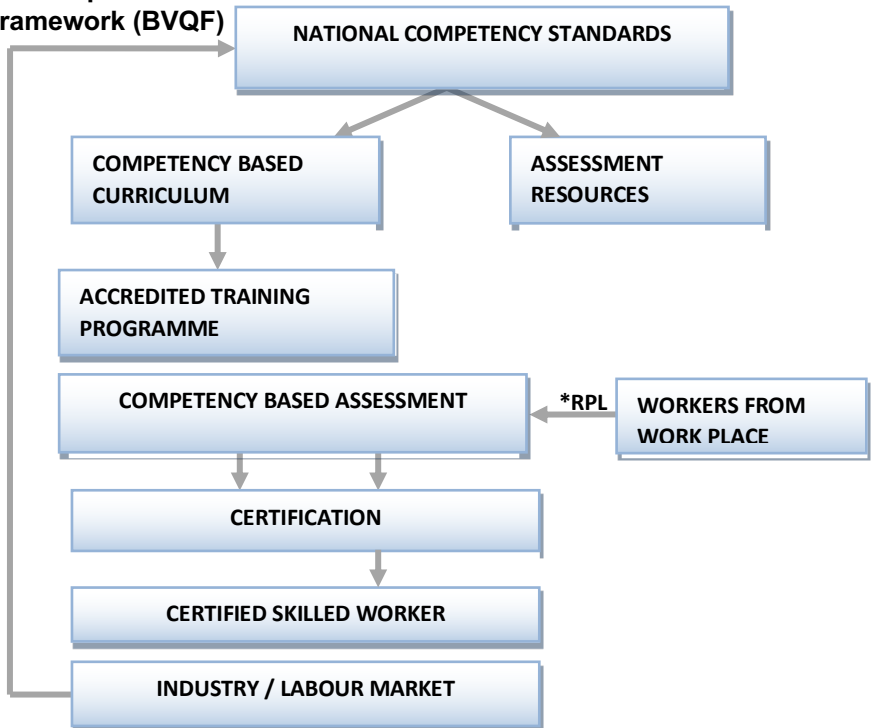
National Competency Standards serve a number of purposes including:

- 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.

1.4 Components of the Bhutan Vocational Qualifications Framework (BVQF)



* RPL = Recognition of Prior Learning

1.5 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 	<ul style="list-style-type: none"> • A broad knowledge base which incorporates some theoretical concepts. • Analytical 	<ul style="list-style-type: none"> • In self-directed activity. • Under broad guidance and evaluation. • With complete responsibility for quantity and

<p>procedures requiring prioritization to achieve optimum outcomes.</p> <ul style="list-style-type: none"> • Are employed in a variety of familiar and unfamiliar contexts. 	<p>interpretation of information.</p> <ul style="list-style-type: none"> • Informed judgment. • A range of sometimes innovative responses to concrete but often unfamiliar problems. 	<p>quality of output.</p> <ul style="list-style-type: none"> • With possible responsibility for the output of others.
--	--	--

1.7 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

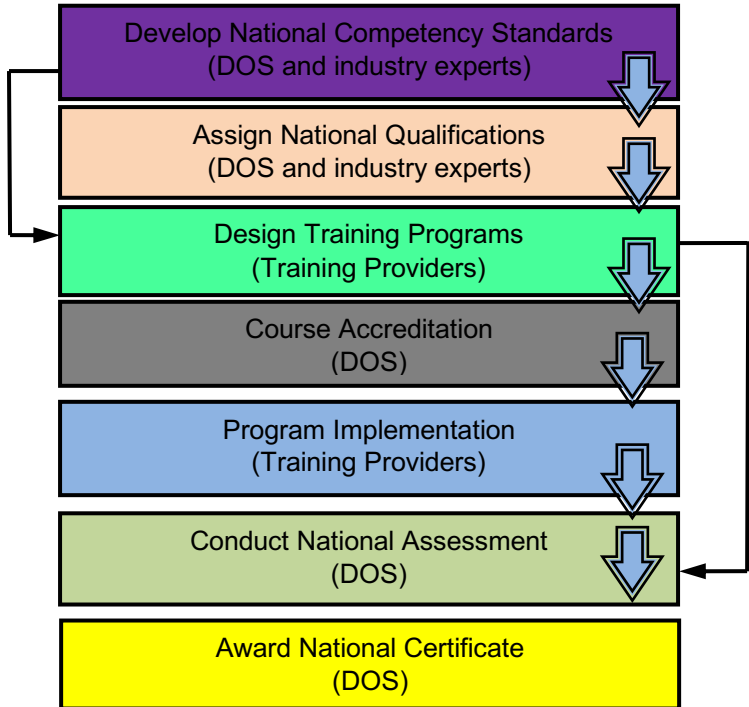
Coding the individual skills standard has a multiple purpose:

- 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.

Implementation and operational procedures for National Competency Standards (NCS)



Key:

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

1.8 ASSESSMENT GUIDE

Form of assessments

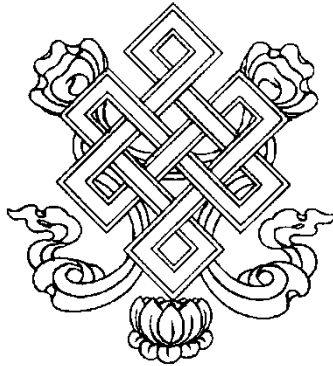
- Continuous assessment together with collected evidence of performance will be used.
- Evidence of the performance shall be based on practical demonstration.
- Knowledge can be assessed through diagrams, in writing or orally (viva-voce).

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.



**Department of Occupational Standards
Ministry of Labour & Human Resources
Thongsel Lam, Lower Motithang
P.O. Box 1036, Thimphu.
Tel: 02-331611, Fax: 02-326873
www.molhr.gov.bt**