



**NATIONAL COMPETENCY STANDARDS
FOR
SUPERVISORY CONTROL AND DATA
ACQUISITION(SCADA) TECHNICIAN
(NC3)**

**TVET QUALITY COUNCIL
BHUTAN QUALIFICATIONS AND PROFESSIONALS
CERTIFICATION AUTHORITY: MARCH 2023**

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FOREWORD

The TVET Quality Council, Bhutan Qualification and Professional Certification Authority proudly presents the National Competency Standards (NCS) for **SCADA 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 TVET Quality Council 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 trainers from training institutes.

A vocational education and training system based on National Competency Standards shall ensure that 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 developing or implementing the National Competency Standards. The ultimate objective is to build a competent and productive national workforce that will contribute to the socio-economic development of our country.

We gratefully acknowledge the valuable contributions made by experts from industries during the consultation 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.

TVET Quality Council

Bhutan Qualification and Professional Certification Authority

ACKNOWLEDGEMENT

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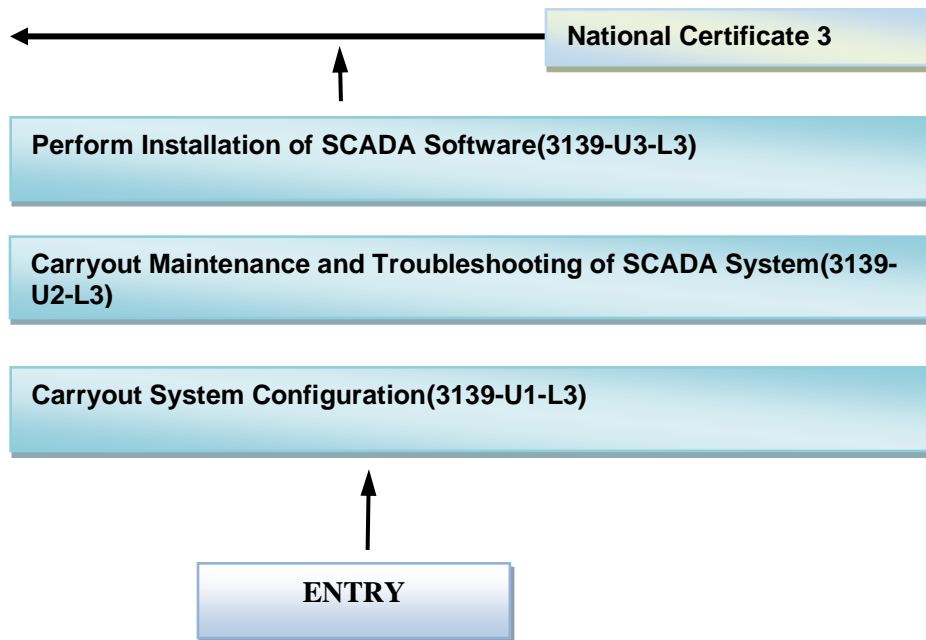
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PACKAGING OF QUALIFICATIONS



OVERVIEW OF NATIONAL COMPETENCY STANDARDS

1. Perform Installation of SCADA Software	1.1 Prepare to Install SCADA Software 1.2 Carry out Installation of SCADA Software
2. Carryout Maintenance and Troubleshooting of SCADA System	2.1 Perform Maintenance of the SCADA System 2.2 Perform Troubleshooting of SCADA System
3. Carryout System Configuration	3.1 Perform Network and Database Configuration 3.2 Perform Communication Protocol Configuration 3.3 Perform HMI Configuration 3.4 Perform Process Configuration

UNIT TITLE	Perform Installation of SCADA Software
DESCRIPTOR	This unit deals with skills, knowledge and attitudes required to prepare to install SCADA Software and successfully carry out installation of the SCADA Software.
CODE	3139-U1-L3
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare to Install SCADA Software	1.1 Identify client requirement following standard procedures 1.2 Identify computer hardwares requirement following standard procedures 1.3 Identify Application Softwares requirement following standard procedures
2. Carry out Installation of SCADA Software	2.1 Install SCADA Application Softwares following instruction manual 2.2 Perform Operating System configuration following standard procedures 2.3 Perform license installation following standard procedures 2.4 Complete the installation of SCADA software following standard procedures

RANGE STATEMENT	
Application Softwares may include but not limited to:	
• PLC Softwares	• HMI
Operation system may include but not limited to	
• Windows XP	• Window 7
Critical Aspects:	
• Perform OS configuration following standard procedures	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupational Health and Safety Regulations • First Aid • Computer Hardware, Networking and Software • Types of SCADA Softwares • Basic Working Principles of SCADA System • Economic Use of Resources 	<ul style="list-style-type: none"> • Team work • Communication • Problem Solving • Interpersonal Relationship • Creativity • Time Management

UNIT TITLE	Carryout Maintenance and Troubleshooting of SCADA System
DESCRIPTOR	This unit deals with the skills, knowledge and attitude required to perform periodic maintenance of the SCADA System, and perform troubleshooting of the SCADA system
CODE	3139-U2-L3
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Perform Maintenance of the SCADA System	<p>1.1 Perform periodic maintenance of the SCADA system following standard procedures</p> <p>1.2 Perform update of softwares related to SCADA System following standard procedures</p> <p>1.3 Maintain inventory of mandatory spares following standard procedures</p> <p>1.4 Update the As-built drawings as per modification in the system following standard procedures</p> <p>1.5 Maintain report of maintenance following standard procedures</p>
2. Perform Troubleshooting of SCADA System	<p>2.1. Identify faults in the SCADA system following standard procedures</p> <p>2.2. Rectify SCADA system faults following standard procedures</p> <p>2.3. Report field equipment faults to relevant personnel for rectification following standard procedures</p>

RANGE STATEMENT	
Periodic maintenance may include but not limited to:	
<ul style="list-style-type: none"> • Rebooting of Equipment • Checking of Communication Cables 	<ul style="list-style-type: none"> • Cleaning and Dusting
Faults may include not limited to:	
<ul style="list-style-type: none"> • Alarms • Field equipment • Network 	<ul style="list-style-type: none"> • Software • Hardware
Critical Aspects	
<ul style="list-style-type: none"> • Identify faults in the SCADA system following standard procedures 	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupational Health and Safety Regulations • First Aid • Technical Drawing and Interpretation • Basic Electrical and Instrumentation 	<ul style="list-style-type: none"> • Team work • Communication • Problem solving • Interpersonal relationship • Creativity • Time Management

UNIT TITLE	Carryout System Configuration
DESCRIPTOR	This unit deals with the skills, knowledge and attitude required to perform Network and database configuration, perform communication protocol configuration, perform HMI configuration and perform Process configuration
CODE	3139-U3-L3
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Perform Network and Database Configuration	1.1 Configure LAN/WAN following standard procedures 1.2 Setup Network configuration following standard procedures 1.3 Setup database configuration following standard procedures 1.4 Maintain database back-up following standard procedures
2. Perform Communication Protocol Configuration	2.1. Define protocol for different types of communications as per the job requirement 2.2. Check the communication protocol compatibility of the secondary equipment following standard procedures 2.3. Configure the communication Protocol following standard procedures
3. Perform HMI Configuration	3.1 Configure Displays and Graphical representation of the process plant 3.2 Configure alarms and trends following standard procedures 3.3 Configure reports of the process plants following standard procedures
4. Perform Process Configuration	4.1. Configure PLC Inputs/Outputs as per the address 4.2. Build automatic function-logic as per the process requirement 4.3. Perform process loading to the server and clients

Critical Aspects
<ul style="list-style-type: none"> All four elements of competence are critical in this unit

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> Ethics and Integrity Occupational health and Safety regulations First Aid IP Structure Network topology Serial/COM ports ((Physical Interface (RS-485, RS-232) PLC and its Languages Field Equipment 	<ul style="list-style-type: none"> Team work Communication Problem solving Interpersonal relationship Creativity Time Management

- | | |
|---|--|
| <ul style="list-style-type: none">• General Arrangement/Wiring Diagram• Logic Diagram• Sequence Diagram• Time Synchronization• Cyber Security | |
|---|--|

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

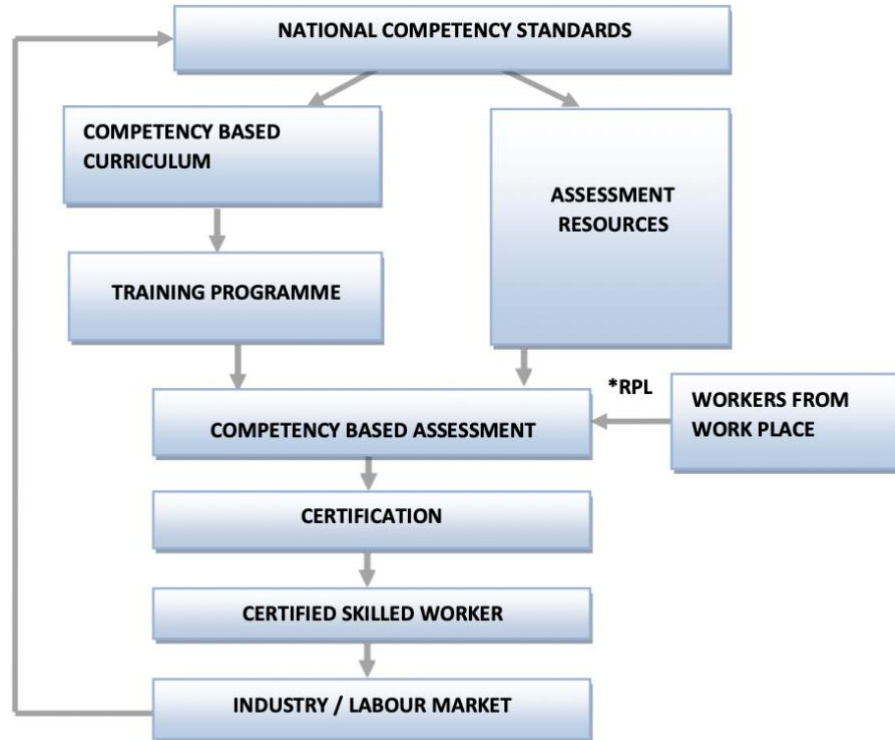
National Competency Standards serve a number of purposes including:

- 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 five levels classified based on the competency of the skilled workers. The three levels are:

National Diploma 2 (ND2)

National Diploma1 (ND1)

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.

National Diploma 1 (ND1)

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> • Require wide range of specialized technical or scholastic skills. • Involve a wide choice of standard procedures • Are employed in a variety of routine & non-routine contexts 	<ul style="list-style-type: none"> • A broad knowledge based with substantial depth in some areas • Analytical interpretation of wide range of data • Determination of appropriate methods & procedures in response to a range of concrete problems with same theoretical elements 	<ul style="list-style-type: none"> • Self-directed and sometimes directed activity • Under broad general guidelines for functions • With full responsibility for the nature, quantity & quality of outcomes • With possible responsibility for the achievement of team output

National Diploma 2 (ND2)

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> • Require a wide range of technical or scholastic skills. • Offer a wide choice of standard and non- standard procedures • Are employed in a variety of routine and non- routine contexts 	<ul style="list-style-type: none"> • Specialist knowledge with depth in more than one area • Analysis reformatting and evaluation of a wide range of information • Formulation of appropriate responses to resolve both concrete and abstract 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 quality and quantity of output of others

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

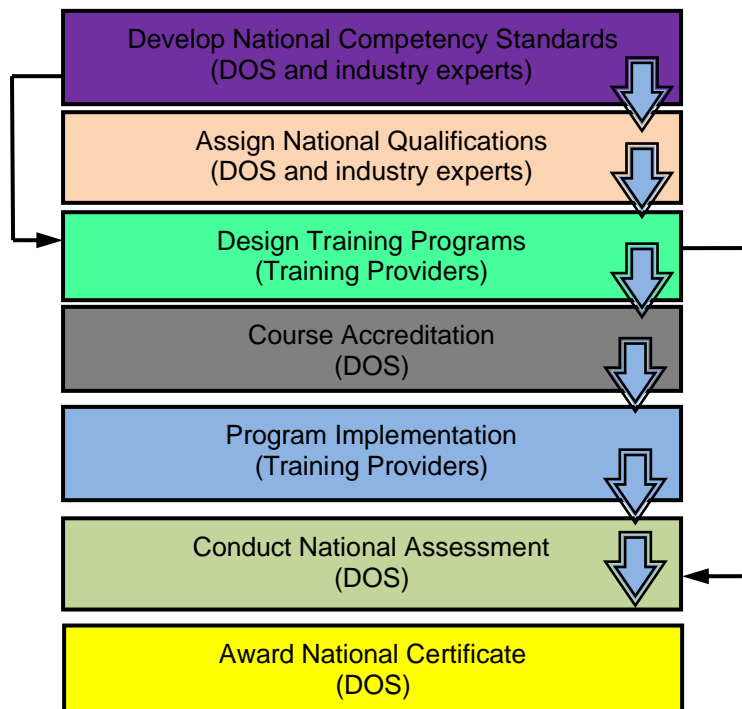
Coding the individual skills standard has a multiple purpose:

- 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.

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

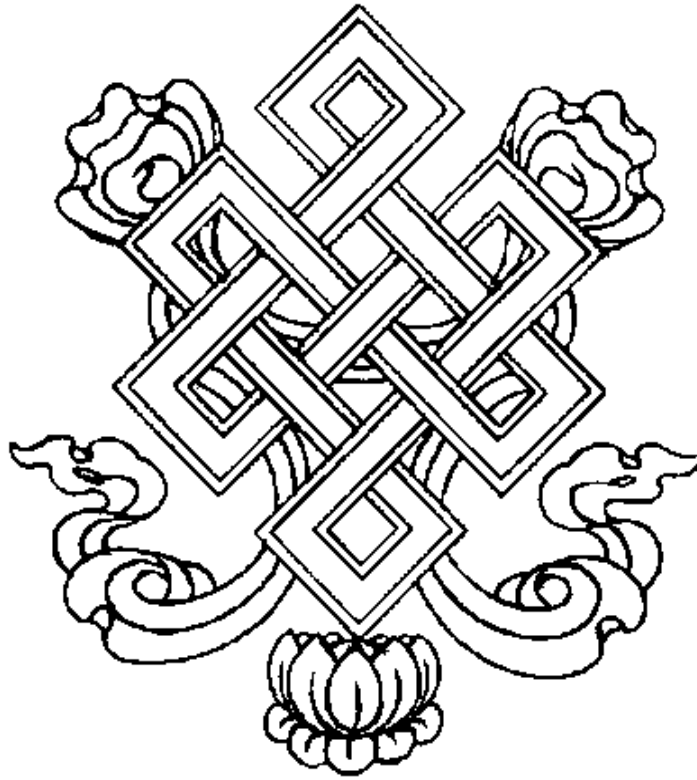
- Continuous assessment together with collected evidence of performance will be used.
- Evidence of the performance shall be based on practical demonstration.
- Knowledge can be assessed through diagrams, in writing or orally (viva-voce).

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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