



**NATIONAL COMPETENCY STANDARDS
FOR
MECHANICAL FITTER
NC2 & NC3**

**Department of Occupational Standards
Ministry of Labour and Human Resources
Thimphu, Bhutan.
(September 2022)**



**NATIONAL COMPETENCY STANDARDS
FOR
MECHANICAL FITTER
NC2 & NC3**

**Department of Occupational Standards
Ministry of Labour and Human Resources
Thimphu, Bhutan.
(September 2022)**

First publication 2011

First Revision 2014

Second Revision 2019

Third Revision 2022

© Department of Occupational Standards (DOS),

Table of Contents

Foreword	2
Acknowledgement	3
Packaging of Qualifications	4
Overview of the Unit Competencies	5
Annexures:	
1.1 National Competency Standards (NCS)	i
1.2 Purpose of National Competency Standards	i
1.3 Bhutan Vocational Qualifications Framework (BVQF)	ii
1.4 BVQF Levels	iii
1.5 Coding used for National Competency Standards	v
1.6 Assessment Guide	v

FOREWORD

The Department of Occupational Standards of the Ministry of Labour and Human Resources proudly presents the revised National Competency Standards (NCS) for Mechanical Fitter 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 department 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 validated by the Technical Advisory Committees for the concerned economic sectors.

A vocational education and training system based on National Competency Standards 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.

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 implementing the National Competency Standards. The ultimate objective is to build a competent and productive national workforce that will contribute to the continued socio-economic progress of our country.

I gratefully acknowledge the valuable contributions made by experts from industries during the consultation, verification 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.

Department of Occupational Standards,
Ministry of Labour and Human Resources

ACKNOWLEDGEMENT

Revision Date : 3rd September, 2022.

Endorsement date : 12th September, 2022

Date of Review : 2025 (max. 3 years).

Subject experts involved during the consultation workshop:

1. Pema Zangmo Asst. Instructor, TTI Khuruthang, Punakha
2. Rinzin Norbu, Asst, Lecturer, TTIK, Khuruthang, Punakha
3. Sonam Dem, Asst. Instructor, TTI, Khuruthang, Punakha
4. Ash Bdr. Subba, Instructor, TTI, Khuruthang, Punakha

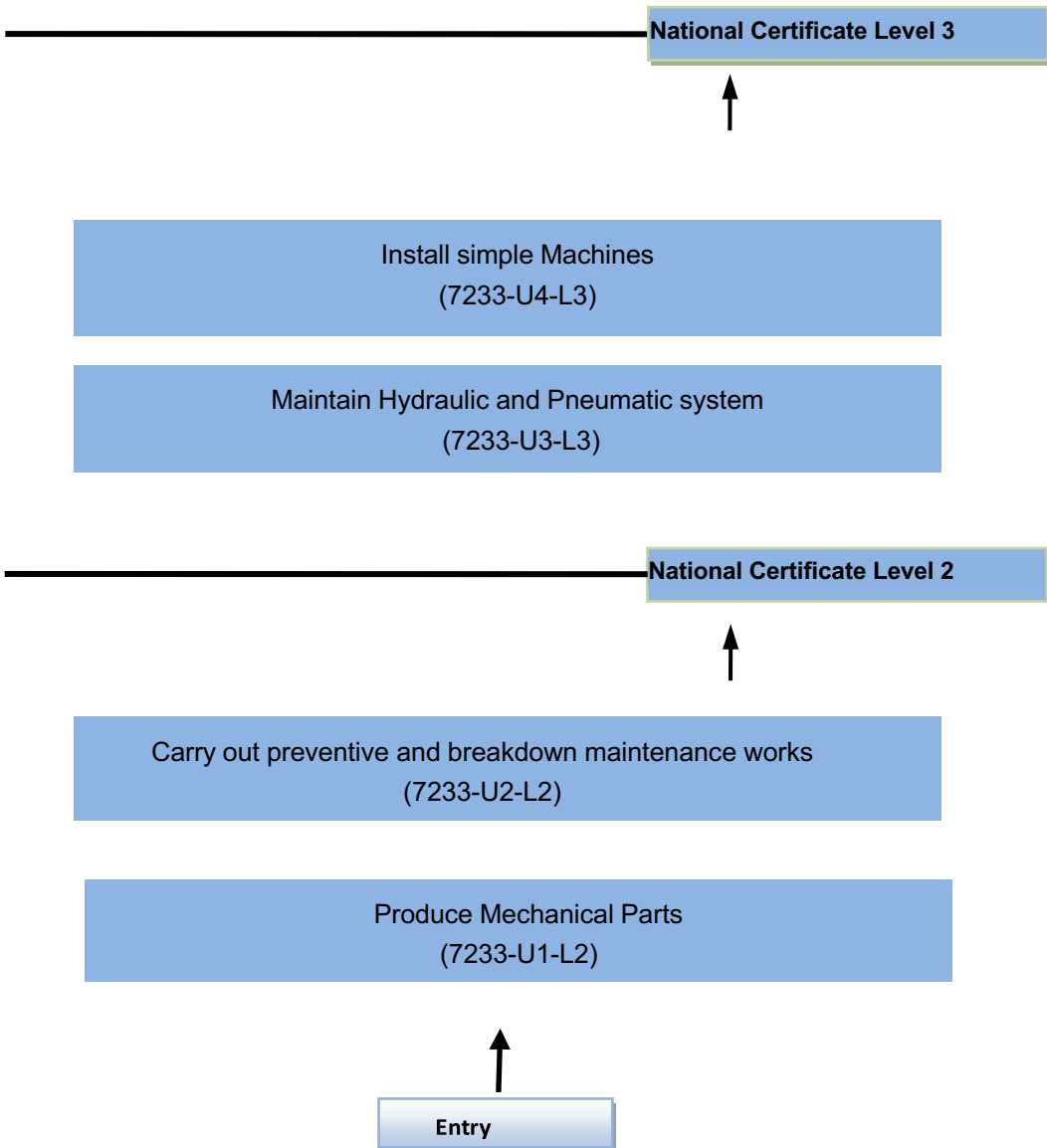
Field experts involved during the validation workshop:

1. Gembo Dorji, Druk Ferro Alloys Ltd
2. Bhakta Bahadur Monge, Tashi Metals Pvt. Ltd
3. Rup Tshering, Bhutan Silicon Metals Pvt. Ltd
4. Teg Gurung, Bhutan Ferro Alloys Ltd
5. Manoj Kumar Chettri, Ugyen Ferro Alloys Pvt. Ltd
6. Lobzang Dorji, Bhutan Carbide & Chemical Ltd
7. Ujjal Mukherjee, Saint Gobain Ceramic Materials Bhutan Pvt. Ltd

Development group (Facilitator):

1. Karma Loday, Specialist, Department of Occupational Standards (DOS), MoLHR, Thimphu.
2. Rinzin Namgay, Engineer, Department of Occupational Standards (DOS), MoLHR, Thimphu.

PACKAGING OF QUALIFICATIONS



OVERVIEW OF UNIT COMPETENCIES

National Certificate - Level 2

UNIT TITLE	ELEMENTS OF COMPETENCE	PAGE
Produce Mechanical Parts	<ol style="list-style-type: none">1. Produce mechanical parts manually2. Produce mechanical parts using machine tools	6
Carryout maintenance of machines	<ol style="list-style-type: none">1. Carryout preventive maintenance work2. Carryout breakdown maintenance work	9

National Certificate - Level 3

UNIT TITLE	ELEMENTS OF COMPETENCE	PAGE
Maintain Hydraulic and Pneumatic system	<ol style="list-style-type: none">1. Maintain Hydraulic system2. Maintain Pneumatic system	13
Install simple Machines	<ol style="list-style-type: none">1. Prepare for installation of Machine2. Install the machine	16

UNIT TITLE : **Produce Simple Mechanical Parts**

DESCRIPTOR: This unit covers the competencies required to produce parts manually and by using machine tools.

CODE : **7233-U1-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Produce mechanical parts manually	1.1 Prepare simple technical drawing as per the job requirement following standard procedure 1.2 Use tools and materials as per the job requirement following standard procedures 1.3 Measure and mark the materials as per the drawing following standard procedures 1.4 Perform manual operations to produce mechanical parts as per job requirement following the standard procedure. 1.5 Measure the product using measuring instruments following standard procedure.
2. Produce mechanical parts using machine tools	2.1 Interpret technical drawing as per the job requirement following standard procedure. 2.2 Use tools and materials as per the job requirement following standard procedures. 2.3 Cut the base metals as per the drawing following standard procedures. 2.4 Set the machine tools as per the job requirement following standard procedures. 2.5 Perform machine tool operations to produce mechanical parts as per the job requirement following standard procedures. 2.6 Measure the product using measuring instruments following standard procedures.

RANGE STATEMENT

Manual Operations may include but not limited to conducting:

- Sawing
- Filing
- Drilling
- Chiseling
- Grinding
- Counter sinking
- Counter boring
- Center punching
- Reaming
- Tapping

Machine tools may include but not limited to:

- Cash memo
- Money receipt
- Pay-in-slip
- Bill / invoice
- Challan
- Purchase order

Machine tool operations may include but not limited to:

- Turning
- Facing
- Drilling
- Knurling
- Taper turning
- Grooving
- Chamfering
- Threading
- Gear cutting
- Boring
- Eccentric turning

Measuring Instruments may include but not limited to:

- Vernier caliper
- Micrometer
- Vernier Height gauge
- Measuring tape
- Dial Gauge
- Bore gauge
- Steel ruler
- Try square
- Thread gauge
- Bevel Protractor

Critical aspects:

- Demonstrate compliance with occupational health and safety regulations applicable to worksite operation.
- Prepare simple technical drawing as per the job requirement following standard procedure
- Measure and mark the materials as per the drawing following standard procedures
- Produce simple machine parts as per the drawing and specifications.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupational Health and Safety (OHS) Regulations • Basic First Aid • Technical drawings • Estimation and costing • Types of machine tools and its application • Corrosion prevention methods • Measuring instruments • Types of cutting tools • Cutting tool geometry 	<ul style="list-style-type: none"> • Team work • Communication • Problem solving • Interpersonal relationship • Creativity • Time Management

UNIT TITLE : Carryout Maintenance of Machines

DESCRIPTOR: This unit covers the competencies required to carry out preventive and breakdown maintenance work.

CODE : 7233-U2-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Carryout preventive maintenance work	1.1 Obtain machine checklist following standard procedures 1.2 Check the level and condition of lubricants following standard procedures 1.3 Check for tightness or alignment of machine parts following standard procedures 1.4 Inspect parameters of machines following standard procedures 1.5 Use inspection tools as per the job requirement following standard procedures 1.6 Perform minor adjustments of machine parts as per the job requirement following standard procedures. 1.7 Maintain records of preventive maintenance following standard procedures
2. Carryout breakdown maintenance work	2.1 Diagnose the faults following standard procedures. 2.2 Select and use required tools and equipment following standard procedures. 2.3 Disassemble the faulty machine parts as per the manufacturer's manual following standard procedures. 2.4 Repair/replace faulty machine parts following standard procedures. 2.5 Assemble the machine parts as per the manufacturer's manual following standard

	<p>procedures.</p> <p>2.6 Conduct functional test following standard procedures.</p> <p>2.7 Maintain records of the breakdown maintenance following standard procedures</p>
--	---

RANGE STATEMENT

Parameters of machines may include but not limited to:

- Pressure
- Temperature
- RPM
- Vibration

Inspection tools may include but not limited to:

- Pyrometer
- Tachometer
- Vibration analyzer
- Infrared camera
- Feeler gauge
- Diagnostic tools
- Laser alignment

Faulty machine parts may include but not limited to:

- Bearing
- Seals
- Shafts
- Bush
- Chain
- Washers
- Shim
- O-ring
- Gears
- Couplings
- Belts
- Nuts and bolts
- Filter

Faults may include but not limited to:

- Vibration
- Overheating
- Non-Functional
- Leakage

Tools and equipment may include but not limited to:

- Hand Tool Set
- Crane
- Jack
- Lifting pulley

Critical aspects:

- Demonstrate compliance with occupational health and safety regulations applicable to worksite operation.
- Inspect parameters of machines following standard procedures
- Diagnose the faults following standard procedures.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupational Health and Safety (OHS) Regulations • Basic First Aid • Technical drawings • Estimation and costing • Inspection tools • Types of lubricants and its grade • Effect of industry wastes on environment 	<ul style="list-style-type: none"> • Team work • Communication • Problem solving • Interpersonal relationship • Creativity • Time Management

UNIT TITLE : **Maintain Hydraulic and Pneumatic System**

DESCRIPTOR: This unit covers the competencies required to maintain hydraulic and pneumatic system.

CODE : **7233-U3-L3**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Maintain hydraulic system	1.1 Diagnose the faults following standard procedures. 1.2 Disassemble the hydraulic components following standard procedures. 1.3 Repair/replace the hydraulic components following standard procedures. 1.4 Assemble the hydraulic components following standard procedures. 1.5 Test the hydraulic system following standard procedures.
2. Maintain pneumatic system	2.1 Diagnose the faults following standard procedures 2.2 Disassemble the pneumatic components following standard procedures 2.3 Repair/replace the pneumatic components following standard procedures 2.4 Assemble the pneumatic components following standard procedures 2.5 Test the pneumatic system following standard procedures

RANGE STATEMENT

Faults may include but not limited to:

- Low pressure
- Cavitation
- Leakages (internal and external leakages)
- Non-actuating
- Components failure

Hydraulic components may include but not limited to:

- Actuators (cylinders, motors)
- Hydraulic tank
- Valves
- Compressor
- Kits
- Pumps (reciprocating, rotary/vane)
- Hose pipes
- Pressure accumulator
-

Pneumatic components may include but not limited to:

- Actuators (cylinders, motors)
- FRL (Filter Regulator Lubricator)
- Fittings
- Hose pipes
- Control valves
- Air Compressor

Critical aspects:

- Demonstrate compliance with occupational health and safety regulations applicable to worksite operation.
- Diagnose the hydraulic and pneumatic faults following standard procedures.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupational Health and Safety (OHS) Regulations • Basic First Aid • Interpretation of Circuit Diagram of hydraulic and pneumatic system • Signs and symbols of hydraulic and pneumatic system • Types of hydraulic pumps • Types of hydraulic oil and its grade • Types of hydraulic hose pipes • Types of compressors, actuators and valves • Basic working principle of hydraulic and pneumatic system 	<ul style="list-style-type: none"> • Team work • Communication • Problem solving • Interpersonal relationship • Creativity • Time Management

UNIT TITLE : **Install Simple Machines**

DESCRIPTOR: This unit covers the competencies required to install simple machines.

CODE : **7233-U4-L3**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare foundation for installation of simple machine	1.1 Prepare the foundation to install simple machine as per the job requirement following standard procedures. 1.2 Check the alignment of foundation bolts as per the drawing following standard procedures
2. Install simple machine	2.1 Unpack and move the machine to the installation site following the standard procedure. 2.2 Assemble the machine as per the job requirement following standard procedures. 2.3 Place the machines on the foundation using handling equipment following standard procedures. 2.4 Level and align the machine as per the manufacturer's manual following standard procedures. 2.5 Test the machine as per the manufacturer's manual following standard procedures.

RANGE STATEMENT

Simple Machines may include but not limited to:

- Reciprocating water Pump
- Centrifugal water pump
- Machine tools
- Rice mill

Handling Tools and equipment may include but not limited to:

- Chain blocks
- Forklift
- D-shackle
- Jack
- Crane
- Max puller
- Sling
- Pulley

Critical aspects:

- Demonstrate compliance with occupational health and safety regulations applicable to worksite operation.
- Level and align the machine as per the manufacturer's manual following standard procedures)

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupational Health and Safety (OHS) Regulations • Basic First Aid • Technical drawings • Foundation layout • Methods of lifting and moving machines • Leveling and alignment technique • Types of D-shackles and sling • Vibration damping of foundation 	<ul style="list-style-type: none"> • Team work • Communication • Problem solving • Interpersonal relationship • Creativity • Time Management

Annexure:

1.1 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.

1.2 Purpose of National Competency Standards

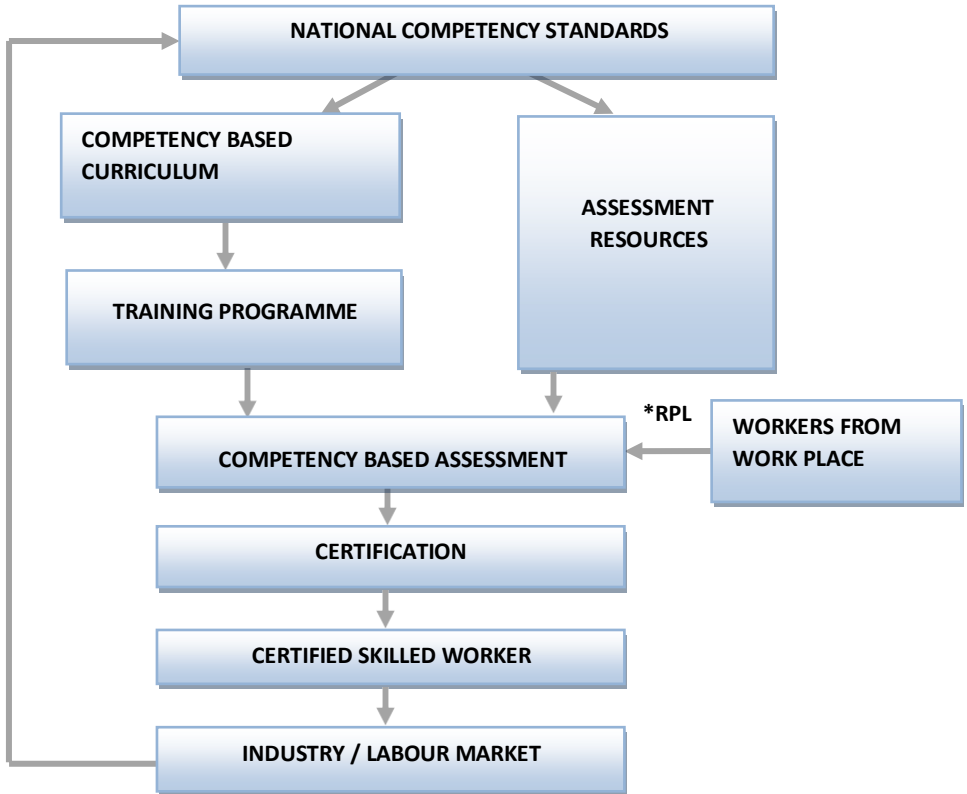
Competency Standards serve a number of purposes including:

- 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.

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 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

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 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)

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 (Craftsman)

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 judgment. • 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 (Master Craftsman)

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.

1.5 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 practices. 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 package.

1.6 ASSESSMENT GUIDE

Form of assessments

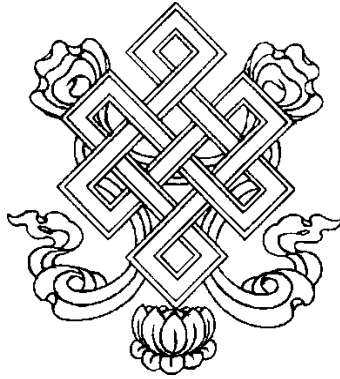
- Continuous assessment together with collected evidence of performance will be used.
- Evidence of the performance shall be based on practical demonstration.
- Knowledge can be assessed through diagrams, in writing or orally (viva- voce).

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, equipment, 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