



NATIONAL COMPETENCY STANDARDS FOR INSTRUMENTATION (TECHNICIAN)

**Department of Occupational Standards
Ministry of Labour and Human Resources
Thimphu, Bhutan.**



NATIONAL COMPETENCY STANDARDS FOR INSTRUMENTATION (TECHNICIAN)

**Department of Occupational Standards
Ministry of Labour and Human Resources
Thimphu, Bhutan.**

First Publication 2014

© Department of Occupational Standards (DOS), MoLHR & PCAL

FOREWORD

The Department of Occupational Standards of the Ministry of Labour and Human Resources proudly presents the revised National Competency Standards (NCS) for Instrumentation (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 department since its establishment in the latter half of 2003. The main aim of developing 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.

Sonam Rinchen

Director

Department of Occupational Standards

INTRODUCTION

A. 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

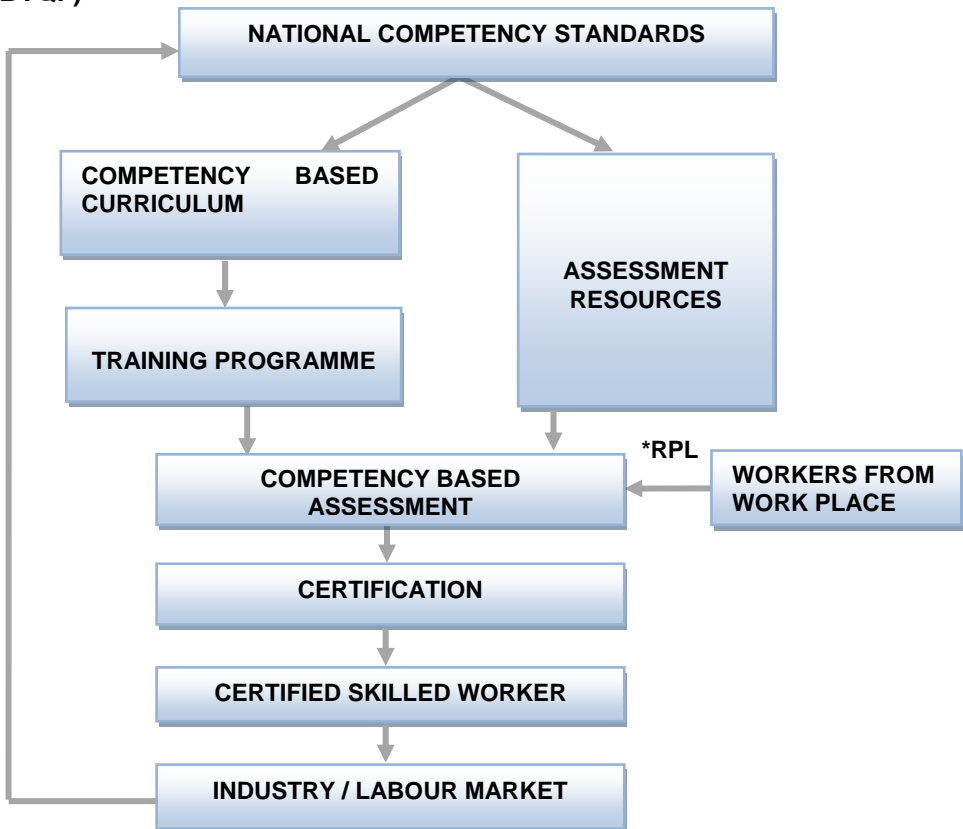
Competency Standards serve a number of purposes including:

- 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.

B. Bhutan Vocational Qualification 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

BVQF Levels

The Bhutan Vocational Qualification Framework has three levels classified based on the competency of the skilled workers. The three levels are:

- National Certificate Level 3 (NC III) -Master Craftsman
- National Certificate Level 2 (NC II) -Craftsman
- National Certificate Level 1 (NC I) -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.

PURPOSE

This qualification is designed for people interested in a career as Instrumentation (Technician).

The first of the qualifications is the National Certificate Level 2. It provides school leavers / technician with generic and industry specific skills and demands a level of performance that will enable new recruits to the industry to be immediately productive.

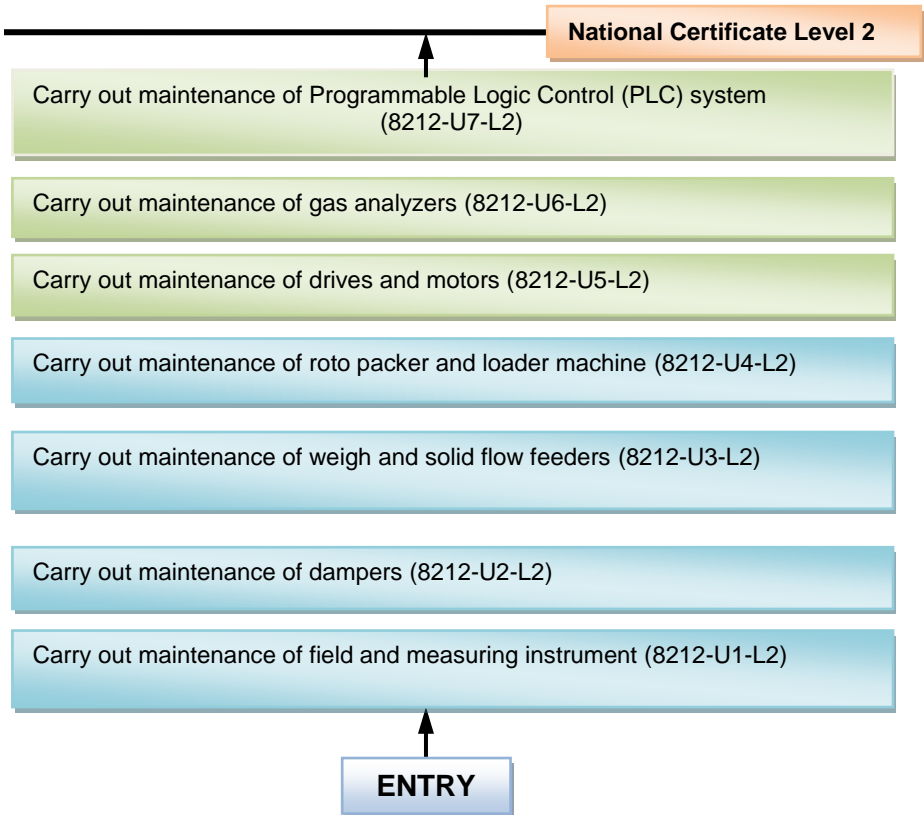
The qualification comprises of eight units of Competency Standards that cover the essential knowledge and skills required to carry out instrumentation works.

This qualification prepares people for entry into the Level 3 National Certificate which is currently the final achievement in this qualification pathway.

A diagram of the qualification pathway provided are as follows.

PACKAGING OF QUALIFICATION FOR INSTRUMENTATION (TECHNICIAN)

The National Competency Standards for the Instrumentation (Technician) comprises eight units of competencies. The packaging of qualifications is shown below:



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).

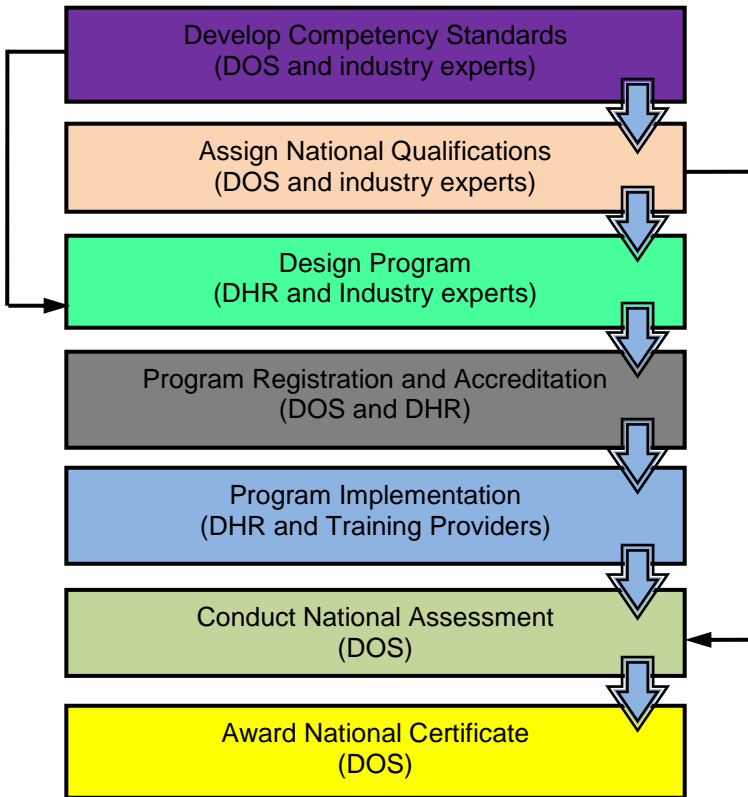
The coding of the National Competency Standards forms the basis of the identification code for the Vocational Education and Training Management Information System (VET – MIS) both in terms of economic sector identification and that of the individual standard.

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 8212 to the occupations related to cement industry's trades. Therefore, in the Bhutan context, the occupation instrumentation (Technician) has been assigned the code 8212 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 8212-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 8212-U1-L2.

Implementation and operational procedures for National Competency Standard (NCS)



Key:

MoLHR – Ministry of Labour and Human Resources

DHR – Department of Human Resources

DOS – Department of Occupational Standards

NATIONAL COMPETENCY STANDARDS FOR INSTRUMENTATION(TECHNICIAN)

Validation date : 27/06/2014

Endorsement date : 30/06/2014

Date of Review : 27/06/2014

Technical Advisory Committee (TAC) members involved in the validation of NCS for Instrumentation Technician:

This NCS was validated by Field Engineers, senior supervisors and Instrumentation Technicians.

Subject experts involved during the development workshop of Instrumentation (Technician) NCS:

1. Pema Dorji
2. Dechen Dorji
3. Dhanya Psd. Koirala
4. Milan Gurung

TABLE OF CONTENTS
NATIONAL COMPETENCY STANDARDS FOR
INSTRUMENTATION (TECHNICIAN)

UNIT TITLE	ELEMENTS OF COMPETENCE	PAGE
Carry out maintenance of field and measuring instrument	<ol style="list-style-type: none"> 1. Prepare for work 2. Maintain field instrument 3. Maintain measuring instrument 4. Complete the work 	16
Carry out maintenance of dampers	<ol style="list-style-type: none"> 1. Prepare for work 2. Maintain Dampers 3. Complete the work 	20
Carry out maintenance of weigh and solid flow feeders	<ol style="list-style-type: none"> 1. Prepare for work 2. Maintain weigh feeders 3. Maintain flow feeders 4. Complete the work 	23
Carry out maintenance of roto packer and loader machine	<ol style="list-style-type: none"> 1. Prepare for work 2. Maintain roto packer 3. Maintain loader machine 4. Complete the work 	27
Carry out maintenance of drives and motors	<ol style="list-style-type: none"> 1. Prepare for work 2. Maintain Drives 3. Maintain Motors 4. Complete the work 	31
Carry out Maintenance of gas analyzers	<ol style="list-style-type: none"> 1. Prepare for work 2. Maintain gas analyzers 3. Complete the work 	35

Carry out maintenance of Programmable Logic Control (PLC) system	<ol style="list-style-type: none">1. Prepare for work2. Maintain PLC system3. Complete the work	38
--	---	----

UNIT TITLE : Carry out maintenance of field and measuring instrument

DESCRIPTOR : This unit covers the competencies required to identify, test, install and maintain various field & measuring instruments applicable for cement manufacturing process control & monitoring according to manufacturer's specification / instruction conforming to standards and regulations for efficient performance, while ensuring the safety of personnel and property.

CODE : **8212-U1-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use required tools and equipment as per the job requirement 1.2 Select and use required Personal Protective Equipments as per the job requirement 1.3 Select and use required materials as per the job requirement
2. Maintain field Instrument	2.1 Identify the defects and take necessary action as per the job requirement 2.2 Install and test-commission various field instruments (thermocouple, sensors, valves, timers) and take necessary action as per job requirement 2.3 Conduct test to ascertain electrical conditions of all field instruments in accordance with circuit diagrams & instructions already prescribed 2.4 Inspect visually the condition of thermo couple for physical defects and take necessary action as per the job requirement

	<p>2.5 Inspect visually the condition of limit switches (pressure, proximity, level) for physical defects and take necessary action as per the job requirement</p> <p>2.6 Inspect visually & check the condition of pneumatic instrument components (solenoid valves & blocks) and take necessary action as per the job requirement.</p> <p>2.7 Check the connections of field instrument & required power supply and take necessary action as per the job requirement</p> <p>2.8 Check the condition of sequence timer of dust collector & air blaster and take necessary action as per the job requirement</p>
<p>3. Maintain Measuring Instrument</p>	<p>3.1 Identify the defects and take necessary action as per the job requirement</p> <p>3.2 Check the condition of transmitter (pressure and temperature) and take necessary action as per the job requirement</p> <p>3.3 Check the power supply and connections of measuring instrument and take necessary action as per the job requirement</p> <p>3.4 Cross check the local readings with control room readings and take necessary action as per the job requirement</p> <p>3.5 Calibrate the instrument if necessary as per the job requirement</p>

RANGE STATEMENT

pneumatic instrument components may include but limited to:

- Limit switch
- Coils
- solenoid valves
- blocks

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

ASSESSMENT GUIDE

Form of assessment

- 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 written form of assessment.

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.
- The candidate must complete the assessment in an accepted time frame.

Critical aspects

- Following Occupational health and safety regulations applicable at worksite.
- Check the condition of field and measuring instrument and take necessary action as per the job requirement

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • OHS • Drawings, specification and manuals • First Aids • Working principles of field and measuring instrument • Basic electrical and Electronics 	<ul style="list-style-type: none"> • Interpretation of drawings, specification and Manual • Communication • Teamwork • Problem solving • Coordination • House keeping

UNIT TITLE : Carry out maintenance of dampers

DESCRIPTOR : This unit covers the competencies required to carry out maintenance of damper & its actuator according to manufacturer's specification / instruction conforming to standards and regulations for efficient performance, while ensuring the safety of personnel and property.

CODE : **8212-U2-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for works	1.1 Select and use required tools and equipments as per the job requirement 1.2 Select and use required materials as per the job requirement. 1.3 Select and use PPE as per the job requirement
2. Maintain Dampers	2.1 Check the conditions of feeder & its accessories and take necessary action as per the job requirement. 2.2 Compare the physical position of damper with readings in the control room and take necessary action as per the job requirement 2.3 Check the condition of position transducer, limit switches, and opening & closing indication of damper and take necessary action as per the job requirement 2.4 Check the physical condition of dampers and take necessary action as per the job requirement

RANGE STATEMENT

Feeder and its accessories may include:

- Fuse
- Breakers
- Relays
- Contactors

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

Tools and equipment may include:

- Multi-meter
- Test lamp
- Electrician tool set
- Mechanical tool set

ASSESSMENT GUIDE

Form of assessment

- 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 written form of assessment.

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.
- The candidate must complete the assessment in an accepted time frame.

Critical aspects

- Compare the physical position of actuator with readings in the control room and take necessary action as per the job requirement

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• OHS• First Aid• Drawings and Specifications• Motors• Calibration• Working principles of damper	<ul style="list-style-type: none">• Interpretation of drawings and specifications• Communication• Teamwork• Coordination• Problem Solving• House keeping

UNIT TITLE : Carry out maintenance of weigh and solid flow feeders

DESCRIPTOR : This unit covers the competencies required to carry out maintenance of weigh feeder and solid flow feeder used for dynamic weighing of various materials at different stages of cement manufacturing process according to manufacturer's specification / instruction conforming to standards and regulations for efficient performance, while ensuring the safety of personnel and property.

CODE : 8212-U3-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use tools and equipments as per the job requirement 1.2 Select and use PPE as per the job requirement 1.3 Select and use required materials as per the job requirement
2. Maintain Weigh Feeders	2.1 Identify the faults and take necessary actions as per the job requirement. 2.2 Check the data on the display unit and take necessary action as per the job requirement 2.3 Identify, select & operate system in different mode (Local/Remote) 2.4 Check the connections and take necessary action as per the job requirement 2.5 Test the condition of main & control power supply, control & protective components (contactors, relays, cards, fuses) and take necessary action as per the job

	<p>requirement</p> <p>2.6 Check the condition of rollers, belts, sensors (loadcells,tachometer, belt sway switches) and take necessary actions as per the job requirement</p> <p>2.7 Check the material flow and take necessary action as per the job requirement.</p>
3. Maintain solid flow feeder	<p>3.1 Identify the faults and take necessary actions as per the job requirement.</p> <p>3.2 Check the data on the display unit and take necessary action as per the job requirement</p> <p>3.3 Identify, select & operate system in different mode (Local/Remote)</p> <p>3.4 Check the connections and take necessary action as per the job requirement</p> <p>3.5 Test the condition of main & control power supply, control & protective components (contactors, relays, cards, fuses) and take necessary action as per the job requirement</p> <p>3.6 Check the condition of sensors (loadcells, tachometer, high/low level limit switches),vibrators, conveyor screws and take necessary actions as per the job requirement</p> <p>3.7 Check the condition of measuring pan and take necessary action as per the job requirement</p> <p>3.8 Check the material flow and take necessary action as per the job requirement</p>

RANGE STATEMENT

Materials may include:

- Drive
- High/Low level limit switches
- Bet sway switches
- Techo
- Input output card
- Milliamps transducers
- Main controller unit

Data may include:

- Readings
- Fault alarms
- Indications

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

ASSESSMENT GUIDE

Form of assessment

- 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 written form of assessment.

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.
- The candidate must complete the assessment in an accepted time

frame.

Critical aspects

- Check the data on the display unit and take necessary action as per the job requirement

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Drawings and specifications• Data and Readings• Occupational Health and Safety regulations• First Aid• Basic electrical and electronics• Operating principles of weigh and solid flow feeders• Basic knowledge on Drives	<ul style="list-style-type: none">• Interpretation of Data and readings• Interpretation of manuals and specifications• Planning• Communication• Team work• Coordination• Problem solving• House keeping

UNIT TITLE : Carry out maintenance of roto packer and loader machine

DESCRIPTOR : This unit covers the competencies required to maintain roto-packer system used for automatic packing of cement and & the truck loader machine used for conveying cement bags ultimately to trucks according to manufacturer's specification / instruction conforming to standards and regulations for efficient performance, while ensuring the safety of personnel and property.

CODE : **8212-U4-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use require materials as per the job requirement. 1.2 Select and use required tools and equipments as per the job requirement 1.3 Select and use PPE as per the job requirement
2. Maintain Roto Packer	2.1 Check the packing spouts and take necessary action as per the job requirement 2.2 Parameterize the master electronic controller unit to specified value as per the standard practices 2.3 Calibrate the weighing system if necessary as per the job requirement 2.4 Check the condition of sensors and switches and take necessary action as per the job requirement 2.5 Check the conditions of control panel and take necessary action as per the job

	<p>requirement</p> <p>2.6 Check the condition of slip ring and carbon brush and take necessary action as per the job requirement</p> <p>2.7 Check the pneumatic valves and take necessary action as per the job requirement</p> <p>2.8 Check the conditions of impeller motor, rotary feeder, rotary drive, pneumatic & motorized flow control gate and bag discharge drive and take necessary action as per the job requirement</p> <p>2.9 Check the conditions of load cell and take necessary action as per the job requirement</p>
3. Maintain Loader	<p>3.1 Check the connections and take necessary action as per the job requirement</p> <p>3.2 Check the condition of sensors and switches and take necessary action as per the job requirement</p>

RANGE STATEMENT

Tools, equipment and materials may include but not limited to:

- Electrician tool set
- Mechanical tool set
- Multi meter
- Test lamp

ASSESSMENT GUIDE

Form of assessment

- 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 written form of assessment.

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.
- The candidate must complete the assessment in an accepted time frame.

Critical aspects

- Following Occupational health and safety regulations applicable at worksite.
- Parameterize the master electronic controller unit to the specified value as per the standard practices

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • .OHS • Drawings, specifications and manuals • First aid • Basic programming • Basic electrical and electronics • Roto packer and loader 	<ul style="list-style-type: none"> • Interpretation of Drawings, specification and manuals • Team Work • Communication • Coordination • Problem Solving • House keeping

UNIT TITLE : Carry out maintenance of drives and motors

DESCRIPTOR : This unit covers the competencies required to maintain DC motors with or without variable speed drives according to manufacturer's specification / instruction conforming to standards and regulations for efficient performance, while ensuring the safety of personnel and property.

CODE : **8212-U5-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for Work	1.1 Select and use required tools and equipments as per the job requirement 1.2 Select and use required PPE as per the job requirement 1.3 Select and use required materials as per the job requirement
2. Monitor and test conditions of motor	2.1 Install electric motors in the identified location in accordance with manufacturer's manual. 2.2 Check visually for mechanical defects in accordance with standard practices. 2.3 Check electrical defects of motors such as loose or burnt electrical connection. 2.4 Observe any faults while motor is running with power supply connected with suitable control and protective device using specified test instruments.

	<p>2.5 Check the condition of carbon brushes and replace if necessary as per the job requirement</p> <p>2.6 Check the condition of bearings and service as per the job requirement</p> <p>2.7 Check the condition of rotor, stator & commutator and service as per the job requirement</p> <p>2.8 Check the motor body and winding temperature and take necessary action as per the job requirement</p> <p>2.9 Check the condition of cooling fan and take necessary action as per the job requirement</p>
<p>3. Maintain Drives</p>	<p>3.1 Identify the faults and take necessary actions as per the job requirement.</p> <p>3.2 Test the condition of main & control power supply, control & protective components (contactors, relays, electronic cards, fuses), transducers and take necessary action as per the job requirement</p> <p>3.3 Identify, select & operate system in different modes (local/remote/panel)</p> <p>3.4 Identify and test input/output signal reporting (LR, CA, DH, DF, ON Command) to/from PLC and take necessary action as per job requirement</p> <p>3.5 Test Input/output analog signals (setpoint, feedback) to/from PIC and take necessary action as per job requirement</p>
<p>4. Complete the work</p>	<p>7.1 Conduct trial run and take necessary actions as per the job requirement</p> <p>7.2 Update maintenance record as per the job requirement</p> <p>7.3 Inform to the concern personnel and issue clearance as per the job requirement</p>

RANGE STATEMENT

Tools and equipment may include but not limited to:

- Spanner set
- Multi-meter
- Tester
- Screw driver

Materials may include but not limited to:

- Bearings
- Nuts and bolts
- Carbon brush

Faults may include:

- Vibration
- Temperature
- Abnormal sound
- Motor load
- Spark

Personal protective equipment may include but not limited to:

- Mask
- Safety goggle
- Helmet
- Ear muff
- Safety shoe
- Respiratory mask
- Working dress
- Safety belt
- gloves

ASSESSMENT GUIDE

Form of assessment

- 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 written form of assessment.

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.
- The candidate must complete the assessment in an accepted time frame.

Critical aspects

- Read the motor load and temperature and take necessary action as per the job requirement.
- Identify the faults as per the standard practices

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Drawings and specifications • Occupational health and safety (OHS) Regulations. • First Aids • Motor ratings • Types of motors, drives • Working principles of Motors • Basic Electrical Knowledge 	<ul style="list-style-type: none"> • .Interpretation of Drawings and Specification • Problem solving • Communication • Teamwork • Troubleshooting • Coordination • House keeping

UNIT TITLE : Carry out maintenance of Gas Analyzers

DESCRIPTOR : This unit covers the competencies required to maintain flue gas analysers used particularly for acquiring CO & O₂ percentage according to manufacturer's specification / instruction conforming to standards and regulations for efficient performance, while ensuring the safety of personnel and property.

CODE : **8212-U6-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select, and prepare the required tools and equipment 1.2 Select and use required materials as per the job requirement 1.3 Select and use required PPE as per the job requirement
2. Maintain Gas Analyzer	2.1 Identify the faults and take necessary actions as per the job requirement. 2.2 Check the data (readings, Fault alarms, indications) on the display unit and take necessary action as per the job requirement 2.3 Check & test the condition of main & control power supply, control & protective components (contactors, relays, electronic cards, fuses),transducers and take necessary action as per the job requirement 2.4 Identify, select & operate system in different modes (local/remote/panel) 2.5 Identify and test input/output signal reporting (LR, CA, DH, DF, ON Command) to/from PLC and take necessary action as per job requirement 2.6 Test Input analog signals (Co, O ₂ feedback) to PIC and take necessary action as per job

	requirement
2.7	Check the sample gas/cleaning air flow system and take necessary action as per the job requirement
2.8	Check the condition of sample probe and take necessary action as per the job requirement
2.9	Check the condition of filters and take necessary action as per the job requirement
2.10	Check the condition of cooling system and take necessary action as per the job requirement

RANGE STATEMENT

Materials may include but not limited to:

- Analyzer
- Probe
- Ceramic filters

Personal protective equipment may include:

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

ASSESSMENT GUIDE

Form of assessment

- 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 written form of assessment.

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.
- The candidate must complete the assessment in an accepted time frame.

Critical aspects

- Check the sample gas/cleaning air flow system and take necessary action as per the job requirement
- Check the data on the display unit and take necessary action as per the job requirement

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• OHS• First Aid• Drawings ,Specifications and manuals• Working principles of Gas Analyzers• Basic Electrical and Electronics	<ul style="list-style-type: none">• Interpretation of drawings , specifications and manuals• Communication• Teamwork• Coordination• Problem solving• House keeping

UNIT TITLE : Carry out maintenance of Programmable Logic Control (PLC) system

DESCRIPTOR : This unit covers the competencies required to carry out minor maintenance of Programmable Logic Control (PLC) used for manufacturing process & control automation according to manufacturer's specification / instruction conforming to standards and regulations for efficient performance, while ensuring the safety of personnel and property.

CODE : **8212-U7-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use required materials as per the job requirement. 1.2 Select and use required tools and equipments as per the job requirement 1.3 Select and use PPE as per the job requirement
2 Maintain PLC	2.1 Identify the faults as per the LED indications on module 2.2 Identify different signal modules (DI, DO, AI, AO) and take necessary action as per job requirement 2.3 Identify & Check the terminals inside IO panels and take necessary action as per the job requirement 2.4 Check & test the condition of input power supply to IO panel, input/output power of SMPS and take necessary action as per job requirement 2.5 Check the conditions of breakers and fuses and take necessary action as per the job requirement

RANGE STATEMENT

Tools, equipment and materials may include but not limited to:

- Signal modules
- SMPS
- MCB
- Interface relay cards

ASSESSMENT GUIDE

Form of assessment

- 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 written form of assessment.

Assessment context

- Competency may be assessed in the actual work place or in a simulated workplace setting.

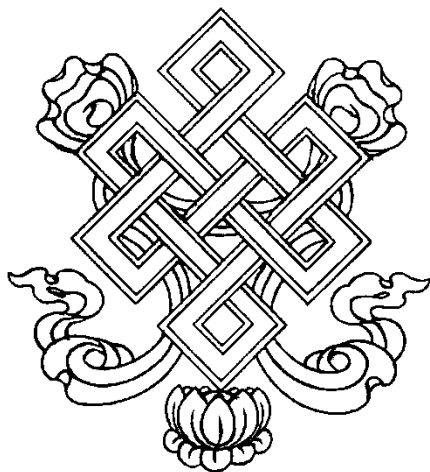
Assessment condition

- The candidate shall have access to all required tools, equipment, materials and documents.
- The candidate must complete the assessment in an accepted time frame.

Critical aspects

- Following Occupational health and safety regulations applicable at worksite.
- Identify the faults as per the LED indications on module

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • OHS • First Aid • Drawings, specifications and Manuals. • Basic fundamentals of programmable logic controller (PLC). • Field instruments • Basic electrical and electronics 	<ul style="list-style-type: none"> • Interpretation of Drawing, specifications and manual • Communication • Teamwork • Problem solving • Coordination



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