



**NATIONAL COMPETENCY STANDARDS
FOR
EARTHMOVING EQUIPMENT
TECHNICIAN (NC2 & NC3)**

**Department of Occupational Standards
Ministry of Labour and Human Resources
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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 Earthmoving Equipment 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 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. We 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

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PACKAGING OF QUALIFICATIONS

National Certificate Level 3

Perform Engine Overhaul
(7233-U7-L3)

Perform Servicing of Transmission System
(7233-U6-L3)

Perform Servicing of Hydraulic and Control Unit System
(7233-U5-L3)

National Certificate Level 2

Perform Servicing of Steering and Brake System
(7233-U4-L2)

Perform Servicing of Lubrication, Cooling and Fuel System
(7233-U3-L2)

Perform Servicing of Tyres, Undercarriage & Attachments
(7233-U2-L2)

Perform Servicing of Basic Electrical Components
(7233-U1-L2)

ENTRY



OVERVIEW OF UNIT COMPETENCIES

National Certificate - Level 2

UNIT TITLE	ELEMENTS OF COMPETENCE
Perform Servicing of Basic Electrical System	<ol style="list-style-type: none">1. Prepare for work2. Service basic electrical components
Perform Servicing of Tyres, Undercarriages & Attachments	<ol style="list-style-type: none">1. Service tyre2. Service undercarriage3. Service attachments
Perform Servicing of Lubrication, Cooling and Fuel System	<ol style="list-style-type: none">1. Service lubrication system2. Service cooling system1. Service fuel system
Perform Servicing of Steering and Brake System	<ol style="list-style-type: none">1. Service steering system2. Service brake system

National Certificate - Level 3

UNIT TITLE	ELEMENTS OF COMPETENCE
Perform Servicing of Hydraulic & Control Unit System	<ol style="list-style-type: none">1. Service hydraulic system2. Service control unit system
Perform Servicing of Transmission System	<ol style="list-style-type: none">1. Service final drive2. Service clutch system3. Service gear box
Perform Engine Overhauling	<ol style="list-style-type: none">1. Overhaul engine2. Service intake system3. Service exhaust system

UNIT TITLE : **Perform Servicing of Basic Electrical System**

DESCRIPTOR: This unit covers the competencies required to prepare for servicing of basic electrical system and to perform the actual servicing of basic electrical system.

CODE : **7233-U1-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use PPE as per the job requirement following standard procedure. 1.2 Select tools and materials as per the job requirement following standard procedure.
2. Service basic electrical components	2.1 Diagnose the faults in basic electrical components following standard procedure. 2.2 Remove and replace the faulty electrical components following standard procedure. 2.3 Service basic electrical components following standard procedure. 2.4 Test the electrical components following standard procedure.

RANGE STATEMENT

PPE may include but not limited to:

- Helmet
- Goggles
- Mask
- Safety shoes/boots
- Gloves
- Workshop dress

Tools may include but not limited to:

- Pliers
- Mini socket box
- Screw Driver set
- Multimeter

Materials may include but not limited to:

- Marking cloth
- Insulation tape
- Spare parts as required
- Wire

Faults in basic electrical components may include but not limited to:

- Breakage
- Blown out fuse
- Blown out bulbs
- Wear and tear
- Loose connection

Basic electrical components may include but not limited to:

- Fuse
- Bulb
- Solenoid switch
- Alternator
- Self-starter
- Battery
- Horn
- Relay

Critical aspects:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Diagnose the faults in basic electrical components.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupation Health and safety (OHS) regulations • Basic First aid • Basic electrical circuit • Instrument panel/cluster • Types of fuses and its function • Types of bulbs and its function • Working principle of starting and charging system 	<ul style="list-style-type: none"> • Team work • Negotiation • Communication skills • Problem solving • Analytical Skills • Time Management

UNIT TITLE : Perform Servicing of Tyres, Undercarriage and Attachments

DESCRIPTOR: This unit covers the competencies required to service tyre, undercarriage and attachments.

CODE : 7233-U2-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Service wheel/tyre	<p>1.1 Select and use PPE as per the job requirement following standard procedure.</p> <p>1.2 Select tools, materials and equipment as per the job requirement following standard procedure.</p> <p>1.3 Diagnose the faults in the tyre following standard procedure.</p> <p>1.4 Remove and disassemble the tyre following the standard procedure.</p> <p>1.5 Repair/Replace the defective tyre following standard procedure.</p> <p>1.6 Assemble the tyre following the standard procedure.</p> <p>1.7 Check the tyre following standard procedure.</p>
2. Service undercarriage	<p>2.1 Diagnose the faults in undercarriage components following standard procedure.</p> <p>2.2 Remove and disassemble the undercarriage components following standard procedure.</p> <p>2.3 Repair/Replace the defective undercarriage components following standard procedure.</p> <p>2.4 Assemble undercarriage components following standard procedure.</p> <p>2.5 Adjust the track chain following standard procedure.</p>

5. Service attachments	<p>3.1 Diagnose the attachments faults and take necessary action following standard procedure</p> <p>3.2 Dismount the attachments following the standard procedure.</p> <p>3.3 Repair/Replace the defective components of attachments as per the job requirement following standard procedure.</p> <p>3.4 Assemble the attachments following standard procedure</p> <p>3.5 Test the attachments following standard procedure</p>
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RANGE STATEMENT	
PPE may include but not limited to:	
<ul style="list-style-type: none"> • Helmet • Goggles • Mask 	<ul style="list-style-type: none"> • Safety shoes/boots • Gloves • Workshop dress
Tools may include but not limited to:	
<ul style="list-style-type: none"> • Heavy hand tool set • Tire lever • Wheel brace • Grease gun 	<ul style="list-style-type: none"> • Valve key • Heavy duty hammer • Stretcher
Materials may include but not limited to:	
<ul style="list-style-type: none"> • Marking cloth • Grease • Cold patch 	<ul style="list-style-type: none"> • Spare parts as required • Vulcanizing fluid
Faults in tyres & undercarriage may include but not limited to	
<ul style="list-style-type: none"> • Leakage • Breakage 	<ul style="list-style-type: none"> • Wear and tear • Misalignment
Equipment may include but not limited to	
<ul style="list-style-type: none"> • Air compressor • Forklift • Track pin remover • Hydraulic press 	<ul style="list-style-type: none"> • Tyre changer • Pressure gauge • Track press
Undercarriage may include but not limited to:	
<ul style="list-style-type: none"> • Sprocket • Track shoe • Track roller • Travel motor 	<ul style="list-style-type: none"> • Carrier roller • Idler • Track link • Chain guard
Attachments may include but not limited to:	
<ul style="list-style-type: none"> • Rock breaker • Bucket • Blade 	<ul style="list-style-type: none"> • Ripper • Stone crusher • Sieve

Critical aspects:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Diagnose the faults in tyre, undercarriage and attachments.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupation Health and safety (OHS) regulations • Basic First aid • Types of tyres • Construction of tyres • Dimension of tyres • Components of undercarriage and its functions • Types of tracks • Functions of attachments 	<ul style="list-style-type: none"> • Team work • Negotiation • Communication skills • Problem solving • Analytical Skills • Time Management

UNIT TITLE : **Perform Servicing of Lubrication, Cooling and Fuel System.**

DESCRIPTOR: This unit covers the competencies required to service lubrication, cooling and fuel system.

CODE : **7233-U3-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Service lubrication system	1.1 Select and use PPE as per the job requirement following standard procedure. 1.2 Select tools, materials and equipment as per the job requirement following standard procedure. 1.3 Diagnose the fault in lubrication system following standard procedure. 1.4 Change the lubricants as per the job requirement following standard procedure. 1.5 Replace the defective lubricant hoses as per the job requirement following standard procedure. 1.6 Perform greasing as per the job requirement following standard procedure. 1.7 Test/run the lubrication system and check for leakages following standard procedure.
2. Service cooling systems	2.1 Troubleshoot the cooling system following standard procedure. 2.2 Remove and disassemble the cooling system components following standard procedure. 2.3 Repair /replace the defective cooling components as per the job requirement following standard procedure. 2.4 Assemble the cooling system components following standard procedure. 2.5 Change coolant as per the job requirement following the standards procedure.

	<p>2.6 Adjust fan-belt tension following standard procedure</p>
<p>3. Service fuel system</p>	<p>3.1 Troubleshoot fuel system following standard procedure.</p> <p>3.2 Remove and disassemble the components of fuel system following standard procedure.</p> <p>3.3 Repair /Replace the defective components as per the job requirement following standard procedure.</p> <p>3.4 Assemble the fuel system components following standard procedure.</p> <p>3.5 Set fuel injection timing following standard procedure.</p> <p>3.6 Bleed the fuel system following standard procedure.</p> <p>3.7 Test the fuel system following standard procedure.</p>

RANGE STATEMENT	
PPE may include but not limited to:	
<ul style="list-style-type: none"> • Helmet • Goggles • Mask 	<ul style="list-style-type: none"> • Safety shoes/boots • Gloves • Workshop dress
Tools may include but not limited to:	
<ul style="list-style-type: none"> • Light duty hand tool set • SST (special service tool) • DE-spanner set 	<ul style="list-style-type: none"> • Filter clamp • Ring spanner set
Materials may include but not limited to:	
<ul style="list-style-type: none"> • Lubricants • Cleaning materials • Rust remover • Distilled water 	<ul style="list-style-type: none"> • Marking cloth • Spare parts as required • Coolant • Fuel
Equipment may include but not limited to:	
<ul style="list-style-type: none"> • Grease gun 	<ul style="list-style-type: none"> • Lubricant dispenser/oil gun
Faults in lubricating system, cooling system and fuel system may include but not limited to:	
<ul style="list-style-type: none"> • Leakage • Breakage • Blockage 	<ul style="list-style-type: none"> • Wear and tear • Cracks
Lubricants may include but not limited to:	
<ul style="list-style-type: none"> • Engine oil • Gear/transmission oil 	<ul style="list-style-type: none"> • Grease • Hydraulic oil
Cooling system components may include but not limited to:	
<ul style="list-style-type: none"> • Water pump • Hose • Radiator • Fan belt 	<ul style="list-style-type: none"> • Pressure cap • Thermostat valve • Coolant • Fan
Components of fuel system may include but limited to:	
<ul style="list-style-type: none"> • O-ring 	<ul style="list-style-type: none"> • Injector nozzles

- | | |
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| <ul style="list-style-type: none">• Fuel Injection Pump (FIP)• Fuel filter• Banjo washer• Solenoid switch | <ul style="list-style-type: none">• Feed pump• High pressure pipe• Banjo bolt• Common rail assembly |
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Critical aspects:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Change the lubricants to required level.
- Troubleshoot the cooling system faults following standard procedure.
- Troubleshoot fuel system following standard procedure.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethics and Integrity • Occupation Health and safety (OHS) regulations • Basic First Aid • Types of lubricants • Types of lubrication system • Working principle of lubrication system • Grade of lubricants • Components of lubrication system • Components of cooling systems and its functions • Working principle of cooling systems • Types of coolants • Types of cooling system • Properties of coolant • Ratio of coolant • Components of fuel systems • Working principle of fuel system • Types of fuel • Fuel additives • Function of fuel system components 	<ul style="list-style-type: none"> • Team work • Negotiation • Communication skills • Problem solving • Analytical Skills • Time Management

UNIT TITLE : Perform Servicing of Steering and Brake System

DESCRIPTOR: This unit covers the competencies required to service steering and brake system.

CODE : 7233-U4-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Service steering system	1.1 Select and use PPE as per the job requirement following standard procedure. 1.2 Select tools and materials as per the job requirement following standard procedure. 1.3 Diagnose the faults in the steering system following standard procedure. 1.4 Remove and disassemble the steering components following the standard procedure. 1.5 Repair/Replace the defective components as per the job requirement following standard procedure. 1.6 Lubricate/grease the components as per the job requirement following standard procedure. 1.7 Assemble the components following standard procedure. 1.8 Set wheel alignment following standard procedure. 1.9 Test the steering system following standard procedure
2. Service brake system	2.1 Diagnose the fault in brake system following standard procedure. 2.2 Remove and disassemble the brake components following the standard procedure. 2.3 Repair/Replace the defective components as per the job requirement following standard procedure. 2.4 Assemble the components following standard procedure. 2.5 Bleed the brake system following standard

	procedure 2.6 Adjust and test the brake following standard procedure.
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RANGE STATEMENT

PPE may include but not limited to:

- Helmet
- Goggles
- Mask
- Safety shoes/boots
- Gloves
- Workshop dress

Tools may include but not limited to:

- Heavy duty hand tool set
- Tie rod end removal
- SST
- Adjustable wrench
- Jack
- Tyre lever
- Pipe wrench

Materials may include but not limited to:

- Marking cloth
- Brake fluids
- Power steering fluids
- Spare parts as required
- Grease

Faults in steering components may include but not limited to:

- Leakage
- Breakage
- Wear and tear
- Hard steering

Steering components may include but not limited to:

- Steering wheel
- Steering column
- Steering rack
- Tie rod
- Steering gear box
- O-ring

Faults in brake system may include but not limited to:

- Leakage
- Breakage
- Brake jam
- Wear and tear
- Brake failure

Brake components may include but not limited to:

<ul style="list-style-type: none">• Master cylinder• Counter plate• Piston seals• Reservoir tank	<ul style="list-style-type: none">• Brake pipe• Friction plate• Brake fluid (hydraulic oil)
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Critical aspects:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Troubleshoot the steering and brake system following standard procedure.
- Bleed the brake system following the standard procedure
- Test the brake following standard procedure.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethics and Integrity• Occupational Health and safety (OHS) regulations• Basic First Aid• Working principle of steering and brake system• Components of steering and brake system• Types of steering and brake systems• Wheel alignment• Types of brake fluids• Waste Management	<ul style="list-style-type: none">• Team work• Negotiation• Communication skills• Problem solving• Analytical Skills• Time Management

UNIT TITLE : **Perform Servicing of Hydraulic and Control Unit System**

DESCRIPTOR: This unit covers the competencies required to service hydraulic and control system.

CODE : **7233-U5-L3**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Service hydraulic system	<p>1.1 Select and use PPE as per the job requirement following standard procedure.</p> <p>1.2 Select tools and materials as per the job requirement following standard procedure.</p> <p>1.3 Troubleshoot/diagnose the faults in hydraulic system following standard procedure.</p> <p>1.4 Remove and disassemble the hydraulic components following standard procedure.</p> <p>1.5 Repair/Replace the defective components as per the job requirement following standard procedure.</p> <p>1.6 Assemble the components following the standard procedure.</p> <p>1.7 Change hydraulic oil as per the job requirement following standards procedures.</p> <p>1.8 Calibrate the hydraulic pressure as per the manufactures' specifications following standards procedures.</p> <p>1.9 Bleed the hydraulic system following standard procedure.</p> <p>1.10 Test the hydraulic system following standard procedure.</p>
2. Service control unit system	<p>2.1 Troubleshoot fault in the control unit system components following standard procedure.</p> <p>2.2 Repair/replace the defective control components following standard procedure.</p> <p>2.3 Fix the control components following standard procedure.</p>

	2.4 Test the control unit system components following standard procedure.
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RANGE STATEMENT

PPE may include but not limited to:

- Helmet
- Goggles
- Mask
- Safety shoes/boots
- Gloves
- Workshop dress

Tools may include but not limited to:

- Heavy duty hand tool set
- Star Allen key
- Screw driver set
- SST
- Allen key set
- Hydraulic pressure gauge

Materials may include but not limited to:

- Marking cloth
- Spare parts as required
- Hydraulic oil

Faults in hydraulic and control system may include but not limited to:

- Leakage
- Breakage
- Wear and tear
- Blockage

Hydraulic components may include but not limited to:

- Hydraulic pump
- Pressure pipe
- Hydraulic cylinder
- Hydraulic tank
- Swivel joint
- Solenoid valve
- O-ring
- Seals
- Swing motor
- Track motor
- Control valve
- Hydraulic Filter set

Control system components may include but not limited to:

- Joystick
- Safety lever
- Control valve
- Pilot control/shut off valve

Critical aspects:

- Demonstrate compliance with safety regulations applicable to work operations at all times.
- Troubleshoot the hydraulic system following standard procedure.
- Bleed the hydraulic system following the standard procedure
- Troubleshoot fault in the control system following standard procedure.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethics and Integrity• Occupation Health and safety (OHS) regulations• Basic First aid• Working principle of hydraulic system• Types of hydraulic fluids• Types of O-ring• Components of hydraulic systems• Fluid pressure• Method of bleeding• Components of control unit systems and its functions• Working principle of control unit system	<ul style="list-style-type: none">• Team work• Negotiation• Communication skills• Problem solving• Analytical Skills• Time Management

UNIT TITLE : Perform Servicing of Transmission System

DESCRIPTOR: This Unit Covers the Competencies Required to Service Final Drive and Transmission System.

CODE : 7233-U6-L3

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Service final drive	<p>1.1 Select and use PPE as per the job requirement following standard procedure.</p> <p>1.2 Select tools and materials as per the job requirement following the standard procedure.</p> <p>1.3 Diagnose the fault in final drive component following standard procedure.</p> <p>1.4 Remove and disassemble the final drive components following standard procedure.</p> <p>1.5 Repair/Replace the defective components following standard procedure.</p> <p>1.6 Assemble the final drive components following standard procedure.</p> <p>1.7 Set backlash as per the job requirement following the standard procedure.</p> <p>1.8 Check the lubricant level following standard procedures.</p> <p>1.9 Test the final drive system following standard procedure.</p>
2. Service transmission system	<p>2.1 Troubleshoot the faults in transmission system following standard procedure.</p> <p>2.2 Remove and disassemble the transmission system following standard procedure.</p> <p>2.3 Repair/Replace the defective transmission system components as per the job requirement following standard procedure.</p> <p>2.4 Assemble the transmission system</p>

	<p>components following standard procedure.</p> <p>2.5 Test the transmission system following standard procedure.</p>
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RANGE STATEMENT

PPE may include but not limited to:

- Helmet
- Goggles
- Mask
- Safety shoes/boots
- Gloves
- Workshop dress

Tools may include but not limited to:

- Heavy duty hand tool set
- Allen key set
- Torque wrench
- Special Service Tools (SST)

Materials may include but not limited to:

- Marking cloth
- Spare parts as required
- Transmission oil
- Gasket set

Faults may include but not limited to:

- Leakages
- Breakages
- Gear disengagement
- Wear and tear
- Damages
- Gear lock

Final drive may include but not limited to:

- Differential gear
- Propeller shaft
- Star gear
- Sun and planetary gear
- Cross bearing
- Axle
- Seal

Transmission system components may include but not limited to:

- Gears
- Fluid coupling
- Linkages
- Solenoid

Critical aspects:

- Demonstrate compliance with safety regulations applicable to work operations at all times.
- Set backlash as per the job requirement following standard procedure.
- Diagnose the fault in transmission system component following standard procedure.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethics and Integrity• Occupation Health and safety (OHS) regulations• Basic First aid• Functions of final drive and transmission system• Gear ratio• Importance of torque• Types of transmission system• Waste management	<ul style="list-style-type: none">• Team work• Communication• Problem solving• Interpersonal relationship• Creativity• Time Management

UNIT TITLE : **Perform Engine Overhaul**

DESCRIPTOR: This unit covers the competencies required to prepare for engine overhauling and to perform engine overhauling.

CODE : **7233-U7-L3**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Overhaul engine	1.1 Select and use PPE as per the job requirement following standard procedure. 1.2 Select tools and materials as per the job requirement following the standard procedure. 1.3 Diagnose the engine faults following standard procedure. 1.4 Dismount the engine following standard procedure. 1.5 Disassemble the engine components following the standard procedure. 1.6 Repair/Replace the defective engine components following standard procedure. 1.7 Assemble the engine components applying specified torque where necessary following standard procedure. 1.8 Set the engine as per manufactures' specifications following standard procedures. 1.9 Test the engine following the standard procedure. 1.10 Mount the engine components following standard procedures.

<p>2. Service intake system</p>	<p>2.1 Diagnose the intake system faults following standard procedure</p> <p>2.2 Dismount the intake components following standard procedure.</p> <p>2.3 Disassemble the intake components following the standard procedure.</p> <p>2.4 Replace the defective intake components as per the job requirement following standard procedure.</p> <p>2.5 Assemble and mount the intake components following standard procedure.</p>
<p>3. Service exhaust system</p>	<p>3.1 Diagnose the exhaust system faults following standard procedure.</p> <p>3.2 Dismount the exhaust components following standard procedure.</p> <p>3.3 Disassemble the exhaust components following the standard procedure.</p> <p>3.4 Repair/Replace the defective exhaust components as per the job requirement following standard procedure.</p> <p>3.5 Assemble and mount the exhaust components following standard procedure.</p> <p>3.6 Test turbo charger following the standard procedure.</p>

RANGE STATEMENT

PPE may include but not limited to:

- Helmet
- Goggles
- Mask
- Safety shoes/boots
- Gloves
- Workshop dress

Tools may include but not limited to:

- Hand tool set
- SST
- Torque wrench
- Star socket
- Piston Ring clamp
- Filler gauge

Engine, intake system, exhaust system faults may include but not limited to:

- Leakages
- Breakages
- Over consumption of fuel/lubrication
- Blockage
- Over heating
- Engine knocking
- Low torque
- Wear and tear

Engine components may include but not limited to:

- Piston
- Crank shaft
- Connecting rod
- Push rod
- Valve
- Oil pump
- Valve seal set
- Injector set
- Cam shaft
- Oil sump
- Cylinder head
- Cylinder block
- Bearing
- Gasket set
- Piston ring set

Set the engine may include but not limited to:

- Fuel injection timing
- Tappet clearance
- Thrust play
- Timing chain
- Warpage of cylinders
- Main journals
- Cylinder liner
- Engine compression pressure
- Torque

Intake components may include but not limited to:

- Pre-filter
- Air filter
- Filter housing
- Intake manifolds

Exhaust components may include but not limited to:

- Exhaust manifold
- Turbo charger
- Muffler

Critical aspects:

- Demonstrate compliance with safety regulations applicable to work operations at all times.
- Diagnose the engine faults following standard procedure.
- Assemble the engine components applying specified torque following standard procedure.
- Set the engine as per manufactures' specifications following standard procedures.
- Diagnose the intake system and exhaust system faults following standard procedure.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethics and Integrity• Occupation Health and safety (OHS) regulations• Basic First aid• Components of engine• Working principle of engine• Types of engines• Functions of engine• Engine tuning• Firing order• Components of intake and exhaust system• Working principle of intake and exhaust system• Functions of intake and exhaust system• Environment Act	<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

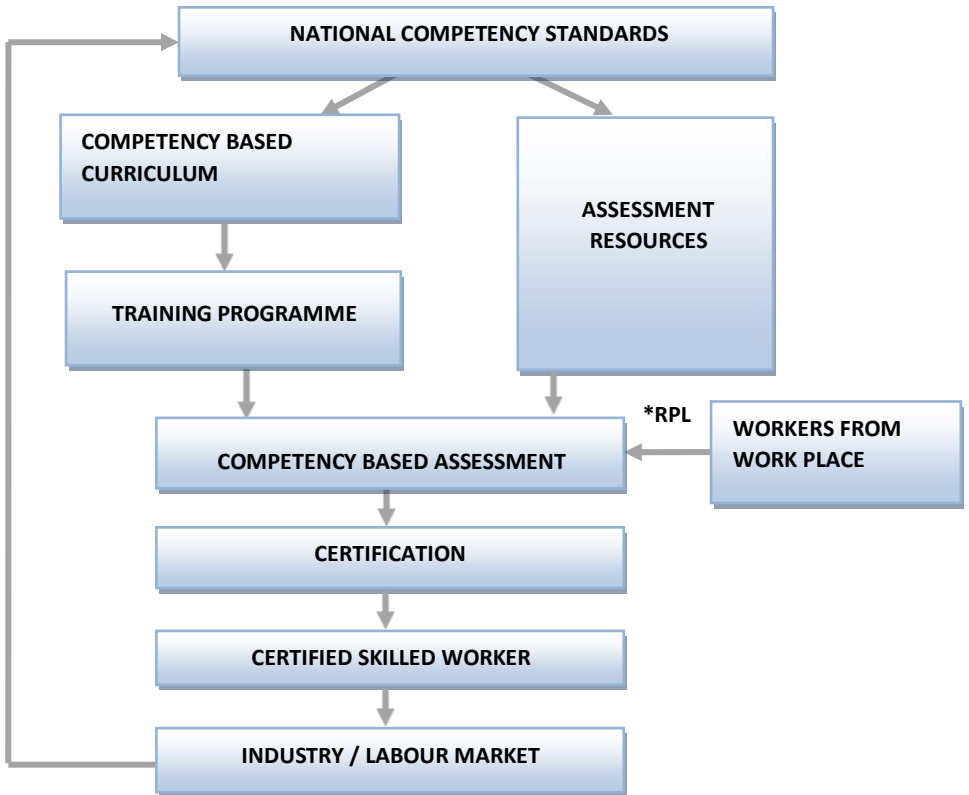
Competency Standards serve a number of purposes including:

- 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

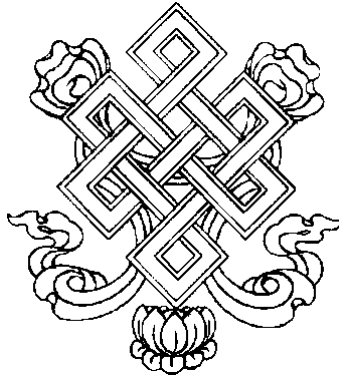
- Continuous assessment together with collected evidence of performance will be used.
- Evidence of the performance shall be based on practical demonstration.
- Knowledge can be assessed through diagrams, in writing or orally (viva- voce).

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.



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