



**NATIONAL COMPETENCY STANDARDS
FOR
MECHANIC (HYDRO POWER PLANT)**

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



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First Publication 2014

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FOREWORD

The Department of Occupational Standards of the Ministry of Labour and Human Resources proudly presents National Competency Standards (NCSs) for Mechanic (Hydro power plant) 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 Competency 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.

Director
Department of Occupational Standards
Ministry of Labour and Human Resources

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

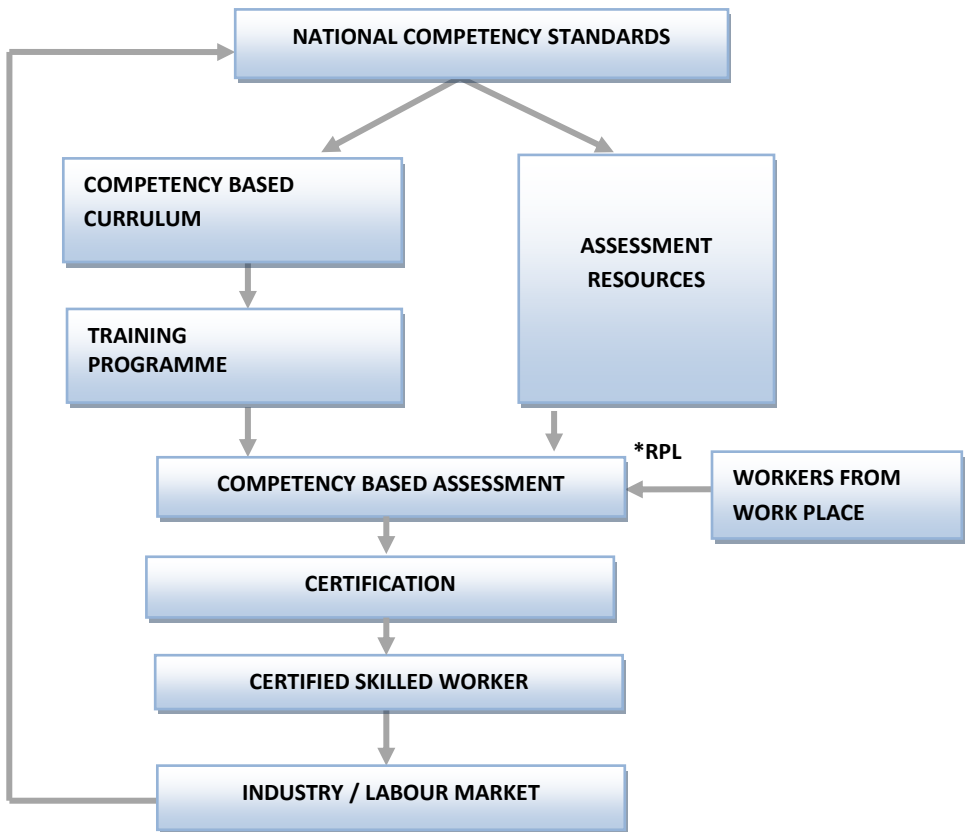
Competency Standards serve a number of purposes including:

- 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 TVET 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)
- National Certificate Level 2 (NC II)
- National Certificate Level 1 (NC I)

BVQF Level Descriptors

The qualification levels are decided based on level descriptors. The detail of the qualification level descriptor is as follows:

National Certificate Level 1

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none">• Are narrow in range.• Are established and familiar.• Offer a clear choice of routine responses.• Involve some prioritizing of tasks from known solutions.	<ul style="list-style-type: none">• Basic operational knowledge and skill.• Utilization of basic available information.• Known solutions to familiar problems.• Little generation of new ideas.	<ul style="list-style-type: none">• In directed activity.• Under general supervision and quality control.• With some responsibility for quantity and quality.• With no responsibility for guiding others.

National Certificate Level 2

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> • Require a range of well developed skills. • Offer a significant choice of procedures requiring prioritization. • Are employed within a range of familiar context. 	<ul style="list-style-type: none"> • Some relevant theoretical knowledge. • Interpretation of available information. • Discretion and judgments. • A range of known responses to familiar problems 	<ul style="list-style-type: none"> • In directed activity with some autonomy. • Under general supervision and quality checking. • With significant responsibility for the quantity and quality of output. • With some possible responsibility for the output of others.

National Certificate Level 3

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> • Requires a wide range of technical or scholastic skills. • Offer a considerable choice of procedures requiring prioritization to achieve optimum outcomes. • Are employed in a variety of familiar and unfamiliar contexts. 	<ul style="list-style-type: none"> • A broad knowledge base which incorporates some theoretical concepts. • Analytical interpretation of information. • Informed judgment. • A range of sometimes innovative responses to concrete but often unfamiliar problems. 	<ul style="list-style-type: none"> • In self-directed activity. • Under broad guidance and evaluation. • With complete responsibility for quantity and quality of output. • With possible responsibility for the output of others.

PURPOSE

This suite of two qualifications is designed for people interested in a career as Mechanic (Hydro Power Plant)

The first of the qualifications is the National Certificate in Mechanic (Hydro Power Plant) Level 2. The qualification comprises four unit titles that cover the essential knowledge and skills required for Mechanic (Hydro Power Plant).

The Level 2 qualification recognizes the skills and knowledge required for people working as a skilled Mechanic (hydro power plant) and builds on the skills and knowledge that candidates will have gained through the successful completion of the Level 1 certificate. This qualification prepares people for entry into the National Certificate Level 3.

The qualification level 3 includes three unit titles that cover the knowledge and skills needed to maintain governor, auxiliary and generator.

The National Certificate in Mechanic (Hydro Power Plant) Level 3 is currently the final achievement in this qualification pathway. Candidates wishing to be admitted into training will already hold the National Certificate Level 2. The Level 3 qualification recognizes the competencies required to work as a highly skilled Mechanic (Hydro Power Plant).

A diagram of the qualification pathway provided by these three National Certificates follows.

**PACKAGING OF QUALIFICATIONS FOR MECHANIC
(HYDRO POWER PLANT)**



CODING USED FOR NATIONAL COMPETENCY STANDARDS

The coding and classification system developed in Bhutan is logical, easy to use, and also aligned with international best practises. The Bhutanese coding and classification system is based on the International Standard Classification of Occupations, 2008 (ISCO-08) developed by the International Labour Organisation (ILO).

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

Coding the individual National Competency Standards

Coding the individual Competency Standard has a multiple purpose:

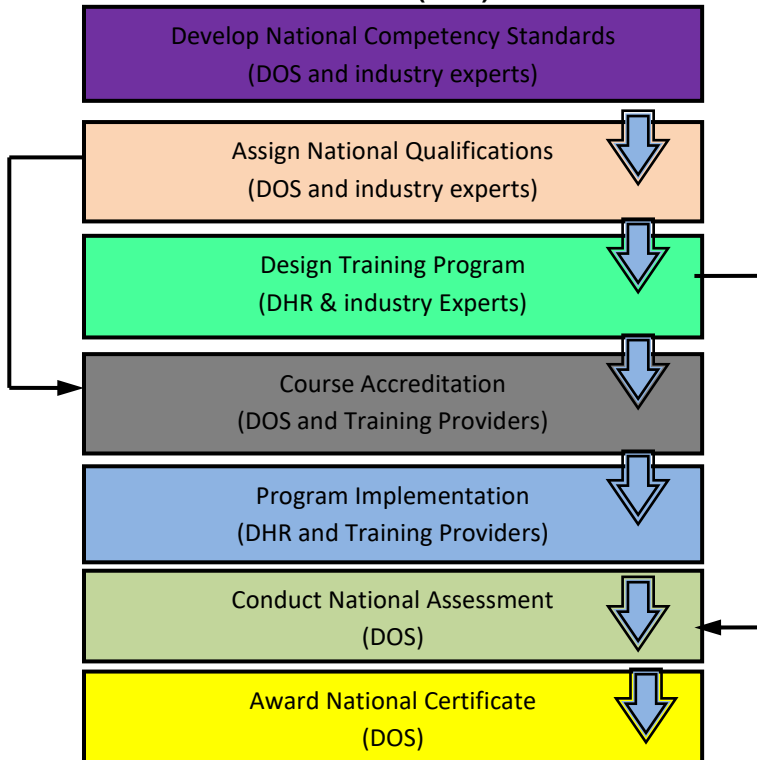
- to identify the level,
- to identify to which module the standard belongs,
- to identify in which order the standard is clustered within that module.

A job can include a number of competencies described in the National Competency Standards.

However, in order to follow a logical order, only National Competency Standards related to each other and following a logical sequence in terms of training delivery, from the simple to the complex, are clustered into a unit. Some standards are so complex that they need to stand alone.

To illustrate with an example the ILO assigns the code 3115 to the occupation Mechanical engineering technicians and related workers. Therefore, in the Bhutan context, the occupation Mechanic (Hydro Power Plant) has been assigned the code 3115 in the National Coding System. The first Unit is assigned the code Unit1, the first National Competency Standard clustered into the first Unit (U1) is designated the code 3115 U1. Levels are assigned the code L and follow a logical progression from the National Certificate Level 2 (NC II) to the National Certificate Level 3 (NC III). Therefore the National Certificate Level 3 is assigned the code L3.

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 MECHANIC
(HYDRO POWER PLANT)**

Validation date : 08/05/2014

Endorsement date : 12/05/2014

Date of Review : 08/05/2017

Technical Advisory Committee (TAC) members for Power Sector involved in the validation of NCS:

National Competency Standard was validated by the Operation and Maintenance division/unit heads

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UNIT TITLE : Maintain Turbine and its components

DESCRIPTOR: This unit covers the competencies required to maintain turbine and its components as per the standard operating procedures following safety measures at workplaces.

CODE : 3115-U1-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use required Personal Protective Equipments (PPE) as per the Job requirement 1.2 Select and use required tools and equipments as per the job requirement. 1.3 Select required materials as per the job requirement.
2. Maintain turbine	2.1 Check the conditions of runners/clearance for defects and carry out necessary corrective action as per the job requirement 2.2 Conduct DPT (Dye Penetration Test) as per the standard procedures 2.3 Check the conditions of bush and replace where necessary as per the job requirement. 2.4 Check the condition of stud and replace where necessary as per the job requirement 2.5 Check the condition of runner guide and take necessary action as per the job requirement
3. Maintain Nozzle/Guide vane	3.1 Check the condition of liner and replace if necessary as per the job requirement. 3.2 Check the conditions of tips and replace if necessary as per the job requirement 3.3 Check the conditions of deflector housing and service as per the job requirement 3.4 Check the conditions of piston and replace if

	<p>necessary as per the job requirement</p> <p>3.5 Check the conditions of cup seal and o-ring, wiper seal and replace as per the job requirement</p> <p>3.6 Check the conditions of cylinder and replace as per the job requirement</p> <p>3.7 Check the condition of end cap and replace if necessary as per the job requirement</p> <p>3.8 Check the conditions of feedback cone and replace if necessary as per the job requirement</p> <p>3.9 Check the conditions of lever and replace if necessary as per the job requirement</p> <p>3.10 Check the conditions of nuts and bolts and take necessary actions as per the job requirement</p> <p>3.11 Test nozzle opening and closing as per the standard operating procedures</p> <p>3.12 Check and maintain the clearance (top, bottom, bedding gap) and take necessary actions as per the standard procedures.</p>
4. Complete the work	<p>4.1 Maintain reports as per the standard operating procedures</p> <p>4.2 Conduct test to ensure proper functioning as per the standard operating procedures</p> <p>4.3 Ensure clean working environment as per the Standard Operating Procedures.</p>

RANGE STATEMENT
<p>PPE may include but not limited to:</p> <ul style="list-style-type: none"> • Helmet, • Safety shoe • Working dress • Hand Glove • Goggles
<p>Tools and Equipments may include but not limited to:</p> <ul style="list-style-type: none"> • Vernier caliper • Hammer Power pack (PP) set

- Filler gauge
- Allen key set
- Spanner set,
- Sling
- Chain pulley

Materials may include but not limited to:

- O-ring
- Cup seal
- Grease
- Vapor seal
- Thread seal
-

Defects may include but not limited to:

- Cracks
- Wear and tear
- Broken parts

ASSESSMENT GUIDE

Form of assessments

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

Assessment context

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

Assessment condition

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

Critical aspect

- Check the conditions of runners/clearance and carry out necessary corrective action as per the job requirement
- Conduct Dye Penetration Test as per the Standard operating procedures

- Test nozzle opening and closing as per the standard operating procedures

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Interpretation of drawing s and specifications • Measurement units • Occupational Health and safety regulations (OHS) • Company rules • First Aids • Basic lubrication principles • Basic material Science • Hoist mechanism • Technical signs and symbols, signals • Machine and Equipment Tolerance • Working principles of Turbine and Nozzle/guide vane • Types of Turbine • Basic welding 	<ul style="list-style-type: none"> • Usage of tools and equipments • Communication skills • Work planning skills • Team work • Lathe & grinding machine operating skills • Problem Solving

UNIT TITLE : Maintain Diesel Generator

DESCRIPTOR: This unit covers the competencies required to maintain diesel generator following standard practices

CODE : 3115-U2-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 personal protective equipments (PPE) as per the job requirement. 1.3 Select required materials as per the job requirement
2. Maintain Diesel Generator	2.1 Check the conditions of filters(oil filter, fuel filter, air filter) and replace as per the standard operating procedures 2.2 Check the conditions of oil and lubricants and take necessary actions as per the standard operating procedures. 2.3 Check for oil or water leakages and take necessary actions as per the standard operating procedures 2.4 Check coolants and take necessary actions as per the standard operating procedures 2.5 Check cell voltage and specific gravity as per the specifications and take necessary actions as per the standard operating procedures 2.6 Check belt tension and adjust if necessary as per the standard operating procedures 2.7 Check nuts and bolts and take necessary actions as per the standard operating procedures. 2.8 Check for any abnormal noise, vibrations and

	take necessary actions as per the standard operating procedures.
3. Complete the work	<p>3.1 Maintain reports as per the standard operating procedures</p> <p>3.2 Conduct test to ensure proper functioning as per the standard operating procedures</p> <p>3.3 Ensure clean working environment as per the Standard Operating Procedures.</p>

RANGE STATEMENT

Tools and Equipments may include but not limited to:

- Spanner set
- Screw driver set
- Allen Key
- Hammer
- Mallet
- Hydrometer

Materials may include but not limited to:

- Filter
- Oil
- Grease
- Gasket
- O-ring

ASSESSMENT GUIDE

Form of assessments

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

Assessment context

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

Assessment condition

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

Critical aspect

- Maintain diesel generator effectively as per the standard practices.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Measurement units• Occupational Health and safety regulations (OHS)• Company rules• First Aids• Basic lubrication principles• Hoist mechanism• Basic Technical signs and symbols• Machine and Equipment Tolerance• Basic maintenance• Basic welding	<ul style="list-style-type: none">• Usage of tools and equipments• Communication skills• Work planning skills• Team work• Planning skills

UNIT TITLE : Maintain Inlet valve

DESCRIPTOR: This unit covers the competencies required to maintain inlet valve and butterfly valve as per the standard practices following safety measures.

CODE : 3115-U3-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 personal protective equipments (PPE) as per the job requirement. 1.3 Select required materials as per the job requirement
2. Maintain Inlet Valve	2.1 Overhaul MIV as per the standard operating procedures 2.2 Check the conditions of seal housing and service as per the standard operating procedures 2.3 Check and replace seals as per standard operating procedures 2.4 Check and service oil pumping unit as per the standard procedures. 2.5 Check and service valves as per the standard operating procedures 2.6 Check and service bypass pipeline and de compression/air release/clack valves as per the standard operating procedures 2.7 Check the condition of pressure gauge and take necessary action as per standard procedures. 2.8 Check the condition of servo motor and take necessary action as per the standard operating procedures 2.9 Check for the leakages in nitrogen bank and take corrective actions as per job requirement 2.10 Charge nitrogen bank to the required pressure

		as per specification
	2.11	Set MIV /Butterfly valve chamber opening and closing time to required value as per the specifications.
	2.12	Set PRV (pressure relieve valve) pressure to the required value as per specification
	2.13	Check the conditions of nuts and bolts and tightened as per the job requirement
3. Complete the work	3.1	Maintain reports as per the standard operating procedures
	3.2	Conduct test to ensure proper functioning as per the standard operating procedures
	3.3	Ensure clean working environment as per the Standard Operating Procedures.

RANGE STATEMENT

Tools and Equipments may include but not limited to:

- Spanner set
- Screw driver set
- Allen Key
- Hammer
- Mallet
- Gauges
- Torque wrench
- Grinding machine

Materials may include but not limited to:

- Seal
- Grease
- Gasket
- O-ring

Seals may include but not limited to:

- Door seal
- Maintenance seal
- Service seal

ASSESSMENT GUIDE

Form of assessments

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

Assessment context

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

Assessment condition

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

Critical aspect

- Set MIV /Butterfly valve chamber opening and closing time to required value as per the specifications.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Circuit diagrams • Measurement units • Occupational Health and safety regulations (OHS) • Company rules • First Aids • Basic lubrication principles • Hoist mechanism • Basic Technical signs and symbols • Machine and Equipment Tolerance • Working principles of inlet valves • Control panels • Basic welding 	<ul style="list-style-type: none"> • Usage of tools and equipments • Communication skills • Work planning skills • Team work • Lathe & grinding machine operating skills • Problem solving

UNIT TITLE : **Maintain Gates**

DESCRIPTOR: This unit covers the competencies required to maintain gates ensuring clean working environment following standard practices.

CODE : **3115-U4-L2**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use required Personal Protective Equipments (PPE) as per the Job requirement 1.2 Select and use required tools and equipments as per the job requirement. 1.3 Select required materials as per the job requirement.
2. Maintain gates	2.1 Provide stop log to the required position as per the job requirement. 2.2 Check the conditions of rubber seal and replace where necessary as per the job requirement 2.3 Check the conditions of roller and service as per the job requirement 2.4 Check the conditions of power pack and its component and service where necessary following standard operating procedures. 2.5 Check the conditions/level of oil and take necessary actions as per the job requirement 2.6 Check the condition of gear box and its components and service where necessary following standard operating procedures 2.7 Check the condition of brake shoe and adjust as per standard operating procedures 2.8 Check the condition of steel wire rope and

	service as per standard operating procedures
	2.9 Check the condition of skin plate and service as per the standard operating procedures
3. Complete the work	3.1 Maintain reports as per the standard operating procedures
	3.2 Conduct test to ensure proper functioning as per the standard operating procedures
	3.3 Ensure clean working environment as per the Standard Operating Procedures.

RANGE STATEMENT

Tools and Equipments may include but not limited to:

- Hole punch
- Hammer
- Screw driver set
- Spanner set
- Crow bar
- Scissor

Materials may include but not limited to:

- Lock tight
- Hydraulic jack
- Grease
- Tube
- Rubber seal
- Jute or cloths
- Nut and bolts

ASSESSMENT GUIDE

Form of assessments

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

Assessment context

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

Assessment condition

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

Critical aspect

- Lowering and lifting of stop log to the required position as per the job requirement.
- Efficient sealing of gates as per the standard operating procedures

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Circuit diagrams • Measurement units • Occupational Health and safety regulations (OHS) • Company rules • First Aids • Basic lubrication principles • Hoist mechanism • Technical signs and symbols • Machine and Equipment Tolerance • Types of gates • Types of seals • Basic Welding • Basic estimation • Grinding • Drilling 	<ul style="list-style-type: none"> • Usage of tools and equipments • Communication skills • Work planning skills • Team work • Grinding machine operating skills • Problem solving

UNIT TITLE : Maintain Governor

DESCRIPTOR: This unit covers the competencies required to maintain governor system following safety measures at workplaces

CODE : 3115-U5-L3

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use required Personal Protective Equipments (PPE) as per the Job requirement 1.2 Select and use required tools and equipments as per the job requirement. 1.3 Select required materials as per the job requirement.
2. Maintain Governor system	2.1 Overhaul governor as per the standard operating procedures 2.2 Check the conditions of pump component and service as per the standard operating procedures. 2.3 Check and clean Oil Pumping Unit (OPU) tank as per the job requirement. 2.4 Fill the Oil Pumping Unit Tank with filtered servo forty six to the required level as per the specification. 2.5 Set pressure setting valve to the required value as per the specifications 2.6 Check the conditions of loading and unloading valves and service if necessary, as per the job requirement 2.7 Inspect pump casing and repair if necessary as per the job requirement. 2.8 Overhaul hydro mechanical cabinet (HMC) as per the standard operating procedures

	2.9	Set deflector opening and closing time to required value as per specification
	2.10	Set mechanical setting of HMC to required value as per specification
	2.11	Balance HMC to the required position as per the specification
	2.12	Set control pressure for HMC to required value as per specification
	2.13	Set flapper height for EHT (Electric Hydraulic Transducer) to required height as per specifications
	2.14	Set deflector gap to required value as per specifications
	2.15	Check deflector vs nozzle correlation and take necessary action as per the standard operating procedures
	2.16	Overhaul needle control cabinet (NCC) as per the standard operating procedures
	2.17	Check the conditions of valves and service if necessary as per the standard operating procedures
	2.18	Overhaul deflector servo motor and accumulator as per the job requirement
	2.19	Check pistons, disc spring and piston shaft and service as per the job requirement
	2.20	Replace Seal as per the job requirement.
	2.21	Conduct test to check for leakages and take necessary actions as per the job requirement
	2.22	Check the conditions of filter elements and service if necessary as per the job requirement.
	2.23	Check pressure gauge setting to the required value as per specification.
	2.24	Check nuts and bolts and tightened as per the job requirement
	2.14	Check for the leakages in nitrogen bank and

	take corrective actions as per job requirement
3. Complete the work	<p>3.1 Maintain reports as per the standard operating procedures</p> <p>3.2 Conduct test to ensure proper functioning as per the standard operating procedures</p> <p>3.3 Ensure clean working environment as per the Standard Operating Procedures.</p>

RANGE STATEMENT
<p>Tools and equipments may include but not limited to:</p> <ul style="list-style-type: none"> • Wrench set • Allen key set • Spanner set • Nitrogen kit
<p>Materials may include but not limited to:</p> <ul style="list-style-type: none"> • Gasket • O-ring • Nitrogen cylinder • Filters <p>Pump components may include but not limited to:</p> <ul style="list-style-type: none"> • Bearings • Screw • O-ring • Gasket • Mechanical seal <p>Seal may include but not limited to:</p> <ul style="list-style-type: none"> • Cup seal • Wiper seal • Piston seal

ASSESSMENT GUIDE

Form of assessments

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

Assessment context

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

Assessment condition

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

Critical aspect

- Maintain governor effectively as per the standard practices.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Circuit diagrams • Measurement units • Occupational Health and safety regulations (OHS) • Company rules • First Aids • Basic lubrication principles • Hoist mechanism • Basic Technical signs and symbols • Machine and Equipment Tolerance • Types of pump • Types of Governor and accumulator • Types of valves • Basic Welding 	<ul style="list-style-type: none"> • Usage of tools and equipments • Communication skills • Work planning skills • Team work • Grinding machine operating skills • Problem solving

UNIT TITLE : Maintain Auxiliary system

DESCRIPTOR: This unit covers the competencies required to maintain generator cooling system, compressor and EOT crane following safety measures at workplaces

CODE : 3115-U6-L3

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use required Personal Protective Equipments (PPE) as per the Job requirement 1.2 Select and use required tools and equipments as per the job requirement. 1.3 Select required materials as per the job requirement.
2. Maintain Generator cooling system	2.1 Overhaul pump as per standard operating system 2.2 Check and service bearing as standard operating procedures 2.3 Check and service the shaft sleeve and sleeve ring as per the standard operating procedures 2.4 Check and service co-axial valve as per standard operating procedures 2.5 Align pump and motor as per standard operating procedures 2.6 Set impeller gap for vertical pump as per the standard operating procedures 2.7 Test run the pump and check the flow as per standard operating procedures 2.8 Check and service duplex strainer as per standard operating procedure 2.9 Check and service non return valve as per standard operating procedures 2.10 Check for leakages in heat exchanger and take

	necessary actions as per standard operating procedures
3. Maintain Compressor	<p>3.1 Overhaul the compressor as per the standard operating procedures</p> <p>3.2 Check and service the pump as per the standard operating procedures</p> <p>3.3 Check the belt tension and adjust to the required tension as per the job requirement</p> <p>3.4 Check and service fans as per the standard operating procedures</p> <p>3.5 Check and replace air filter if necessary as per the job requirement</p> <p>3.6 Check the condition of air reservoir and take necessary action as per job requirement</p> <p>3.7 Check and service the valves as per the standard operating procedures</p> <p>3.8 Check and service/ set the pistons as per the standard operating procedures</p> <p>3.9 Check the condition and level of oil and take necessary action as per the job requirement</p> <p>3.10 Test proper functioning of compressor as per the standard operating procedures</p>
4. Maintain mechanical parts of EOT crane	<p>4.1 Adjust and service brakes as per the standard operating procedures</p> <p>4.2 Check the condition and level of gear oil and take necessary action as per the job requirement</p> <p>4.3 Check the conditions of rope and service, if necessary as per the job requirement</p> <p>4.4 Check and service bearing as per the standard procedures</p> <p>4.5 Check the conditions of track and take necessary actions as per the standard operating procedures</p> <p>4.6 Check and service gear box if necessary, as per</p>

	the standard operating procedures
4.7	Check the conditions of shaft coupling and service if necessary as per the standard operating procedures
4.8	Check nuts and bolts and tightened if necessary as per the job requirement
4.9	Test the proper functioning of EOT crane as per the job requirement

RANGE STATEMENT	
PPE may include but not limited to:	
<ul style="list-style-type: none"> • Helmet • Safety shoe • Working dress 	<ul style="list-style-type: none"> • Hand gloves • Goggles
Tools and Equipment may include but not limited to:	
<ul style="list-style-type: none"> • Alignment kit • Pipe wrench 	<ul style="list-style-type: none"> • Bearing puller • Cir clip pliers torque wrench
Materials may include but not limited to:	
<ul style="list-style-type: none"> • Gasket • O-ring • Grease • Hydraulic oil 	<ul style="list-style-type: none"> • Emery paper • Non setting compound • Gland rope • Shim

ASSESSMENT GUIDE

Form of assessments

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

Assessment context

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

Assessment condition

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

Critical aspect

- Align pump and motor as per standard operating procedures
- Check and service/ set the pistons as per the standard operating procedures
- Check the belt tension and adjust to the required tension as per the job requirement
- Check and service the valves as per the standard operating procedures
- Adjust and service brakes as per the standard operating procedures
- Set impeller gap for vertical pump as per the standard operating procedures

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Measurement units • Occupational Health and safety regulations (OHS) • Company rules • First Aids • Basic lubrication principles • Hoist mechanism • Basic Technical signs and symbols • Machine and Equipment Tolerance • Working principles of pumps, compressor, EOT crane • Basic Welding • Types of Pump • Types of compressor 	<ul style="list-style-type: none"> • Usage of tools and equipments • Communication skills • Work planning skills • Team work • Grinding machine operating skills • Working at height • Problem solving

UNIT TITLE : **Maintain Generator**

DESCRIPTOR : This unit covers the competencies required to maintain generator as per the standard operating procedures following safety measures at workplace

CODE : **3115-U7-L3**

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for work	1.1 Select and use required Personal Protective Equipments (PPE) as per the Job requirement 1.2 Select and use required tools and equipments as per the job requirement. 1.3 Select required materials as per the job requirement.
2. Maintain Generator	2.1 Remove coolers as per the standard operating procedures 2.2 Check/test oil or air cooler leakages and take necessary corrective actions as per the standard operation procedures 2.3 Service coolers as per the standard operating procedures 2.4 Remove and check the condition of thrust pad and take necessary action as per standard operating procedures 2.5 Measures thrust spring length and adjust if necessary, as per standard operating procedures. 2.6 Adjust thrust bolts if necessary as per the job requirement 2.7 Check the condition of Non Return Valve (NRV) and hose pipe and take necessary action as per the standard operating procedures. 2.8 Remove bearing from generator as per the

	<p>standard operating procedures</p> <p>2.9 Inspect turbine guide bearing as per Standard operating procedures.</p> <p>2.10 Check and service of oil slinger as per the standard operating procedures</p> <p>2.11 Set oil slinger gap as per the standard operating procedures</p> <p>2.12 Set oil scrub gap(oil pocket) as per the standard operating procedures</p> <p>2.13 Scrub and polish bearings as per the standard operating procedures</p> <p>2.14 Clean bearing oil chamber/housing as per the standard operating procedures</p> <p>2.15 Set the bearing gaps as per manufacturer's specifications</p> <p>2.16 Check the condition /level of lubricants and take necessary action as per the standard operating procedures</p> <p>2.17 Check the condition of brake jack and take necessary actions as per the standard operating procedures</p> <p>2.18 Center shaft as per the manufacturer's specification</p> <p>2.19 Tight nuts and bolts to the required torque as per the job requirement</p>
<p>3. Complete the work</p>	<p>3.1 Maintain reports as per the standard operating procedures.</p> <p>3.2 Conduct test to ensure proper functioning as per the standard operating procedures.</p> <p>3.3 Ensure clean working environment as per the Standard Operating Procedures.</p>

RANGE STATEMENT

PPE may include but not limited to:

- Helmet
- Safety shoes
- Mask
- Hand gloves
- Working dress

Tools and Equipments may include but not limited to:

- Spanner set
- Dial gauge,
- Screw driver
- Torque wrench,
- Jack
- Micro meter
- Block level
- Filler gauge

Materials may include but not limited to:

- Oil
- Gasket
- Shim
- Nuts and bolts
- Stud
- Colgate powder
- Blue matching
- Cloth piece

Coolers may include but not limited to:

- UGB cooler
- LGB cooler
- TGB cooler

Bearings may include but not limited to:

- Thrust bearing
- UGB
- LGB
- TGB

ASSESSMENT GUIDE

Form of assessments

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

Assessment context

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

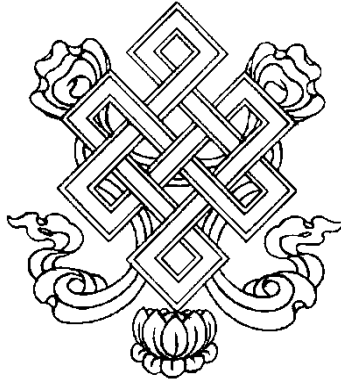
Assessment condition

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

Critical aspect

- Center the shaft as per the job requirement
- Set the bearing gap as per the standard practices

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Measurement units• Occupational Health and safety regulations (OHS)• Company rules• First Aids• Basic lubrication principles• Basic Hoist mechanism• Basic Technical signs and symbols• Machine and Equipment Tolerance• Working principles of generator• Basic Welding• Tools and equipments	<ul style="list-style-type: none">• Usage of tools and equipments• Communication skills• Work planning skills• Team work• Grinding machine operating skills• Coordination



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