



**NATIONAL COMPETENCY STANDARDS  
FOR  
WELDER  
NC2 & NC3**

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



**NATIONAL COMPETENCY STANDARDS  
FOR  
WELDER  
NC2 & NC3**

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

First publication 2011

First Revision 2014

Second Revision 2019

Third Revision 2022

© Department of Occupational Standards (DOS),

## Table of Contents

Foreword .....	2
Acknowledgement .....	3
Packaging of Qualifications .....	4
Overview of the Unit Competencies .....	5
<b>Annexures:</b>	
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 Welder as part of TVET reform initiative for improving the quality of Vocational Education and Training System in Bhutan. The standards represent the fruits of hard work and invaluable experiences gained by the department since its establishment in the latter half of 2003. The main aim of developing National Competency Standards is to set up a well-defined nationally recognized Vocational Qualification and Certification system that will help set a benchmark for the Technical Vocational Education and Training (VET) System in our country aligned to international best practices.

National Competency Standards is one of the base pillars in the Bhutan Vocational Qualification Framework (BVQF) and is the first step in its implementation. The standards are developed to ensure that employees or vocational graduates possess and acquire the desired skills, knowledge and attitude required by industries and employers. In order to ensure this close match in supply and demand of skills, knowledge and attitude, standards have been developed in close consultation and partnership with industry experts and validated by the Technical Advisory Committees for the concerned economic sectors.

A vocational education and training system based on National Competency Standards shall ensure that delivered training is of a high quality and relevant to the needs of the labour market. As a result, future TVET graduates will be better equipped to meet the need and expectations of industries and employers. This positive impact on the employability of TVET graduates will enhance the reputation of vocational education and training and make it attractive to school leavers.

While acknowledging the existing level of cooperation and collaboration, the ministry earnestly requests employers and training providers to extend the fullest support and cooperation in implementing the National Competency Standards. The ultimate objective is to build a competent and productive national workforce that will contribute to the continued socio-economic progress of our country.

I gratefully acknowledge the valuable contributions made by experts from industries during the consultation, verification and validation processes of the standards. I look forward to improved engagement and active participation of the industry and employers in the development of a quality assured demand driven TVET system in the near future.

Department of Occupational Standards,  
Ministry of Labour and Human Resources

## ACKNOWLEDGEMENT

**Revision Date** : 3<sup>rd</sup> September, 2022.

**Endorsement date** : 12<sup>th</sup> September, 2022

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

### **Subject experts involved during the consultation workshop:**

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

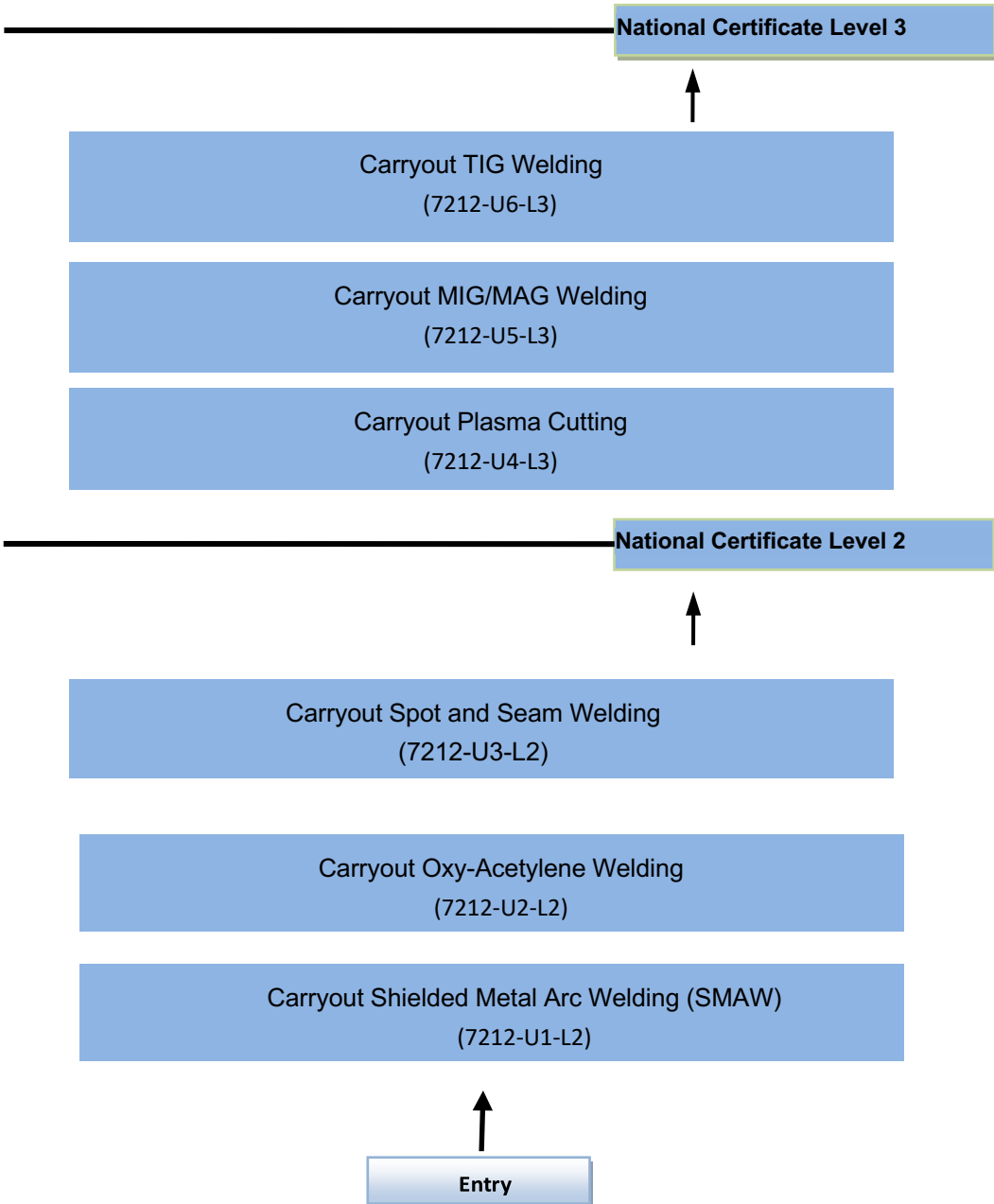
### **Field experts involved during the validation workshop:**

1. Sangay Penjor, Druk Ferro Alloys Ltd
2. Sonam Tanang, Tashi Metals Pvt. Ltd
3. Hem Kumar Limbu, Ugyen Ferro Alloys Pvt. Ltd
4. Kinley Wangchuk, Bhutan Carbide & Chemical Ltd
5. Sabyasachi Singha, Saint Gobain Ceramic Materials Bhutan Pvt. Lt
6. Teg Gurung, Bhutan Ferro Alloys Ltd

### **Development group (Facilitator):**

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

## PACKAGING OF QUALIFICATIONS



## OVERVIEW OF UNIT COMPETENCIES

### National Certificate - Level 2

UNIT TITLE	ELEMENTS OF COMPETENCE	PAGE
Carryout Shielded Metal Arc Welding (SMAW)	<ol style="list-style-type: none"><li>1. Set up for SMAW process</li><li>2. Perform SMAW</li><li>3. Perform arc cutting</li><li>4. Perform post SMAW work</li></ol>	7
Carryout Oxy-acetylene welding	<ol style="list-style-type: none"><li>1. Set up for Oxy-acetylene welding</li><li>2. Perform Oxy-acetylene welding</li><li>3. Perform Oxy-acetylene cutting</li><li>4. Perform brazing work</li><li>5. Perform post welding / cutting work</li></ol>	12
Carryout spot and seam welding	<ol style="list-style-type: none"><li>1. Set up for welding work</li><li>2. Perform spot welding</li><li>3. Perform seam welding</li><li>4. Perform post welding work</li></ol>	17



### **National Certificate - Level 3**

<b>UNIT TITLE</b>	<b>ELEMENTS OF COMPETENCE</b>	<b>PAGE</b>
Carryout plasma cutting	<ol style="list-style-type: none"><li>1. Set up for plasma cutting</li><li>2. Perform plasma cutting</li><li>3. Perform post welding work</li></ol>	22
Carryout MIG/MAG Welding	<ol style="list-style-type: none"><li>1. Set up for MIG/MAG process</li><li>2. Perform MIG/MAG welding</li><li>3. Perform post MIG/MAG work</li></ol>	26
Carryout TIG Welding	<ol style="list-style-type: none"><li>1. Set up for TIG process</li><li>2. Perform TIG welding</li><li>3. Perform post TIG work</li></ol>	30

**UNIT TITLE** : **Carryout Shielded Metal Arc Welding (SMAW)**

**DESCRIPTOR:** This unit covers the competencies required to set up for SMAW process and carryout Shielded Metal Arc Welding following standard procedures.

**CODE** : **7212-U1-L2**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Set up for SMAW process	1.1 Select and use <b>PPE</b> as per the job requirement. 1.2 Select required <b>tools, materials and equipment</b> as per the job requirement. 1.3 Assess the work area for <b>hazards</b> as per the job requirement following standard procedures. 1.4 <b>Set up arc welding machine</b> as per the job requirement following standard procedures
2. Perform SMAW	2.1 Read and interpret the drawing following the standard procedure. 2.2 <b>Prepare</b> base metal as per the job requirement following standard procedures. 2.3 Apply <b>distortion prevention measures</b> as per the job requirement following standard procedures 2.4 Align and tack weld base / parent metal as per the job requirement following standard procedures 2.5 Maintain the arc length and electrode angle as per the job requirement following standard procedures. 2.6 Weld <b>base metal</b> in all <b>positions</b> as per the job requirement following standard procedures. 2.7 Carry out <b>finishing work</b> following standard procedures. 2.8 Inspect weld <b>defects</b> as per the standard procedures.

<p>3. Perform arc cutting</p>	<p>3.1 Set the welding parameters for arc cutting following standard procedure.</p> <p>3.2 Maintain arc length following the standard procedures.</p> <p>3.3 Cut metal as per the job requirement following standard procedures</p> <p>3.4 Check cut surface as per the job requirement following standard procedures.</p> <p>3.5 Carry out <b>finishing work</b> as per the standard procedures.</p>
<p>4. Perform post SMAW work</p>	<p>4.1 Clean work area as per the job requirement following standard procedures.</p> <p>4.2 Maintain and store tools and equipment as per the standard procedures.</p> <p>4.3 Compile the work completion reports as per the standard procedure.</p>

## RANGE STATEMENT

### Personal Protective Equipment (PPE) may include but not limited to conducting:

- Welding helmet
- Welding shield
- Safety shoes
- Work dress
- Leather gloves
- Mask (Dust and gas mask)
- Ear muff
- Goggles
- Leather apron

### Tools and equipment may include but not limited to:

- Welding Electrode
- Grinding Wheel
- Cutting Wheel
- Emery Paper
- Buffer Wheel
- Base Metals

### Set up arc welding machine may include but not limited to:

- Current setting
- Cable connections
- Welding polarity

### Preparation of materials may include but not limited to:

- Cleaning
- Punching

### Distortion prevention measures may include but not limited to:

- Bracing
- Tacking
- Pre- heating
- Bolting
- Clamping

### Hazards may include but not limited to:

- Electric shock
- Arc radiation
- Fire
- Fumes and gases
- Heat
- Confined space

### Positions may include but not limited to:

- Fillet weld in flat position (1F)
- Fillet weld in horizontal position (2F)
- Groove weld in flat position (1G)
- Groove weld in horizontal position (2G)
- Groove weld in Vertical position(3G)

<ul style="list-style-type: none"> <li>• Fillet weld in Vertical position(3F)</li> <li>• Fillet weld in overhead position(4F)</li> </ul>	<ul style="list-style-type: none"> <li>• Groove weld in overhead position(4G)</li> </ul>
<p><b>Defects may include but not limited to:</b></p> <ul style="list-style-type: none"> <li>• Undercut</li> <li>• Incomplete penetration</li> <li>• Over lap</li> <li>• Porosity / blow holes</li> <li>• Slag inclusion</li> <li>• Crack</li> </ul>	
<p><b>Finishing work may include but not limited to:</b></p> <ul style="list-style-type: none"> <li>• Brushing</li> <li>• Chipping</li> <li>• Filing</li> <li>• Grinding</li> <li>• Polishing</li> </ul>	
<p><b>Work completion records may include but not limited to:</b></p> <ul style="list-style-type: none"> <li>• Maintenance record</li> <li>• Job card</li> <li>• Checklist</li> </ul>	
<p><b>Base metal may include but not limited to:</b></p> <ul style="list-style-type: none"> <li>• Mild steel</li> <li>• Cast iron</li> <li>• Stainless steel</li> </ul>	

<p><b>Critical aspects:</b></p> <ul style="list-style-type: none"> <li>• Demonstrate compliance with occupational health and safety regulations applicable to worksite operation.</li> <li>• Align and tack weld base metal as per the job requirement following standard procedures.</li> </ul>
--

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Ethics and Integrity</li> <li>• OHS regulations</li> <li>• Basic First Aid</li> <li>• Interpretation of drawings and specifications</li> <li>• Welding symbols</li> <li>• Safety signs and Symbols</li> <li>• Properties of base metal (ferrous and non-ferrous)</li> <li>• Hazards in using electricity for welding</li> <li>• Different types of welding electrode and their specifications</li> <li>• Principles of operation of welding rectifier, transformer and generator / converter</li> <li>• Testing of welds</li> <li>• Economic use of materials</li> <li>• Basic estimation &amp; costing</li> <li>• Hard facing and rebuilding</li> <li>• Current setting calculation</li> </ul>	<ul style="list-style-type: none"> <li>• Team work</li> <li>• Communication</li> <li>• Problem solving</li> <li>• Interpersonal relationship</li> <li>• Creativity</li> <li>• Time Management</li> </ul>

**UNIT TITLE : Carryout Oxy-acetylene Welding**

**DESCRIPTOR:** This unit covers the competencies required to set up for Oxy-acetylene welding and carryout Oxy-acetylene welding following standard procedures.

**CODE : 7212-U2-L2**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Set up for Oxy-acetylene welding	1.1 Select and use <b>PPE</b> as per the job requirement following standard procedures. 1.2 Select required <b>tools &amp; equipment and materials</b> as per the job requirement following standard procedure. 1.3 Assess the work area for <b>hazards</b> as per the job requirement following standard procedure 1.4 Set up Oxy-acetylene welding equipment as per the job requirement following standard procedures.
2. Perform Oxy-acetylene welding	2.1 Prepare base metal as per the job requirement following standard procedures. 2.2 Align and tack weld base metal into position as per the job requirement following standard procedures. 2.3 Apply <b>distortion prevention measures</b> as per the job requirement following standard procedures. 2.4 Weld materials in various <b>positions</b> as per the job requirement following standard procedures. 2.5 Inspect weld <b>defects</b> as per the job requirement following standard procedures
3. Perform oxy-acetylene cutting	3.1 Cut metal as per the job requirement following standard procedures. 3.2 Check cut surface following standard procedures. 3.3 Carry out <b>finishing work</b> on the cut surfaces following standard procedure.

<p>4. Perform brazing work</p>	<p>4.1 Prepare base metal as per the job requirement following standard procedures</p> <p>4.2 Align base metal as per the job requirement following standard procedures.</p> <p>4.3 Apply <b>distortion prevention measures</b> as per the job requirement</p> <p>4.4 Check brazed surface / joints for <b>defects</b> as per the job requirement following standard procedures.</p>
<p>5. Perform post welding / cutting work</p>	<p>5.1 Clean the work area following the standard procedures.</p> <p>5.2 Maintain and store tools and equipment following the standard procedures.</p> <p>5.3 Prepare the <b>work completion reports</b> following the standard procedures.</p>



## RANGE STATEMENT

### Personal protective equipment (PPE) may include but not limited to:

- Safety shoes
- Work dress
- Leather gloves
- Mask (Dust and gas musk)
- Ear muff
- Gas welding goggles
- Leather apron

### Tools and equipment may include but not limited to:

- Gas welding set
- Flash back arrestor
- Wire brush
- Nozzles
- Wrench
- Valve key
- Spark lighter

### Materials may include but not limited to:

- Filler rods
- Flux
- Oxygen
- Teflon tape
- Base metal
- Acetylene

### Set oxy-acetylene welding equipment may include but not limited to:

- Equipment setting
- Flame setting
- Gas pressure setting
- Heating torch
- Selection of nozzle
- Gas cutting torch
- Gas welding torch

### Hazards may include but not limited to:

- Fire
- Explosion
- Fumes and gases
- Heat
- Confined space

### Distortion prevention measures may include but not limited to:

- Bracing
- Pre-heating
- Tacking
- Bolting
- Clamping

### Positions may include but not limited to:

- Fillet weld in flat position (1F)
- Fillet weld in horizontal position (2F)
- Fillet weld in Vertical position(3F)
- Fillet weld in overhead position(4F)
- Groove weld in flat position (1G)
- Groove weld in horizontal position (2G)
- Groove weld in Vertical position(3G)
- Groove weld in overhead position(4G)

### Defects may include but not limited to:

- Undercut
- Lack of fusion
- Overlap
- Porosity / blow holes
- Slag inclusion
- Cracks

**Finishing work may include but not limited to:**

- Grinding
- Filing
- Applying primer
- Chipping
- Brushing

**Work completion details may include but not limited to:**

- Maintenance record
- Job card
- Checklist

**Critical aspects:**

- Demonstrate compliance with occupational health and safety regulations applicable to worksite operation.
- Apply distortion prevention measures as per the job requirement.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Ethics and Integrity</li> <li>• OHS regulations</li> <li>• Basic First aid</li> <li>• Types of measuring and marking tools</li> <li>• Properties of materials</li> <li>• Identification of welding gases and their properties</li> <li>• Types of flame and flame setting</li> <li>• Standards and codes related to gas welding</li> <li>• Basic estimation and costing</li> <li>• Types of testing</li> <li>• Definition of gouging</li> </ul>	<ul style="list-style-type: none"> <li>• Team work</li> <li>• Communication</li> <li>• Problem solving</li> <li>• Interpersonal relationship</li> <li>• Creativity</li> <li>• Time Management</li> </ul>

**UNIT TITLE : Carryout Spot and Seam Welding**

**DESCRIPTOR:** This unit covers the competencies required to set up for welding and carryout spot and seam welding following standard procedures.

**CODE : 7212-U3-L2**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Set up for welding work	1.1 Select and use <b>PPE</b> as per the job requirement following standard procedures. 1.2 Select required <b>tools &amp; equipment, materials</b> as per the job requirement following standard procedures. 1.3 Assess the work area for <b>hazards</b> as per the job requirement following standard procedures. 1.4 Set <b>spot welding machine</b> following standard procedures. 1.5 Set seam welding machine following standard procedures. 1.6 Check and maintain the cooling system as per the job requirement following standard procedures. 1.7 <b>Prepare</b> base metal as per the job requirement following standard procedures.
2. Carryout Spot welding	2.1 Perform spot welding as per the job requirement following standard procedures. 2.2 Check weld <b>defects</b> as per the job requirement following standard procedures
3. Carryout Seam welding	3.1 Perform Seam welding as per the job requirement following standard procedure. 3.2 Check weld <b>defects</b> as per the job requirement following standard procedures.

4. Carry out post welding work	4.1 Clean the work area following the standard procedures. 4.2 Maintain tools and equipment following the standard procedures. 4.3 Compile the <b>work completion reports</b> following the standard procedures.
--------------------------------	--

## RANGE STATEMENT

### Personal protective equipment (PPE) may include but not limited to:

- Safety shoes
- Work dress
- Leather gloves
- Dust mask
- Ear muff
- Goggles
- Leather apron
- Safety helmet

### Tools and equipment may include but not limited to:

- Hammer
- Punch
- Guillotine machine
- Drilling machine
- Spot welding machine
- Tri-square
- Measuring tape
- Scriber
- Hand grinder
- Snip
- Seam welding machine

### Materials may include but not limited to:

- Copper sheet
- Aluminum sheet
- MS sheets

### Hazards may include but not limited to:

- Electric shock
- Fire / spark
- Heat
- Confined space

### Set spot welding machine may include but not limited to:

- Current setting
- Time Setting
- Copper electrode fixing

### Work completion report may include but not limited to:

- Maintenance record
- Job card
- Checklist

### Preparation of materials may include but not limited to:

- Marking
- Cutting
- Folding
- Grinding
- Cleaning

### Defects may include but not limited to:

- Over burnt
- Lack of fusion

**Critical aspects:**

- Demonstrate compliance with occupational health and safety regulations applicable to worksite operation.
- Align and spot weld base metal as per the job requirement following standard procedures
- Align and seam weld base metal as per the job requirement following standard procedures

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Ethics and Integrity</li> <li>• OHS regulations</li> <li>• Basic First Aid</li> <li>• Safety signs and Symbols</li> <li>• Properties of base metal</li> <li>• Interpretation of drawings and specifications</li> <li>• Hazards in using electricity</li> <li>• Working principles of spot and seam welding machine</li> <li>• Application of spot and seam welding</li> <li>• Basic estimation and costing</li> </ul>	<ul style="list-style-type: none"> <li>• Team work</li> <li>• Communication</li> <li>• Problem solving</li> <li>• Interpersonal relationship</li> <li>• Creativity</li> <li>• Time Management</li> </ul>



**UNIT TITLE : Carryout Plasma Cutting**

**DESCRIPTOR:** This unit covers the competencies required to set up for plasma cutting and carryout plasma cutting following standard procedures.

**CODE : 7212-U4-L3**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Set up for plasma cutting	1.1 Select and use PPE as per the job requirement. 1.2 Select required tools & equipment and materials as per the job requirement. 1.3 Assess the work area for hazards as per the job requirement following standard procedures. 1.4 Set plasma cutting equipment as per the job requirement following standard procedures.
2. Carry out plasma cutting	2.1 Prepare base metal as per the job requirement following standard procedures. 2.2 Set the current and air pressure as per the job requirement following standard procedures. 2.3 Perform plasma cutting as per the job requirement following standard procedures. 2.4 Check cut surface for defects as per the job requirement following standard procedures
3. Carry out post cutting work	3.1 Carry out finishing work as per the job requirement following standard procedures 3.2 Clean the work area following the standard procedures 3.3 Maintain tools and equipment following the standard procedures 3.4 Compile the work completion report as per the following standard procedures

## RANGE STATEMENT

### Personal protective equipment (PPE) may include but not limited to:

- Safety goggles
- Welding Screen
- Safety shoes
- Work Dress
- Mask (gas and Dust)
- Ear muff
- Leather apron
- Leather gloves

### Tools and equipment may include but not limited to:

- Air compressor
- Shielding cap
- Plasma cutting equipment
- Nozzle/ Electrodes

### Materials may include but not limited to:

- Mild Steel plate
- Stainless steel
- Aluminium
- High speed steel
- Copper

### Hazards may include but not limited to:

- Electric shock
- Arc radiation
- Fire
- Explosion
- Fumes and gases
- Heat
- Confined space

### Set plasma cutting equipment may include but not limited to:

- Current setting
- Air / gas pressure setting

### Preparation of materials may include but not limited to

- Marking
- Cleaning

### Finishing work may include but not limited to:

- Grinding
- Chipping
- Cleaning

### Work completion report may include but not limited to:

- Maintenance record
- Job card
- Checklist

**Critical aspects:**

- Demonstrate compliance with occupational health and safety regulations applicable to worksite operation.
- Set the current and air pressure as per the job requirement following standard procedures
- Select the nozzle based on the thickness of the base metal as per the job requirement following standard procedures.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Ethics and Integrity</li> <li>• Basic First Aid</li> <li>• Interpretation of drawings and specifications</li> <li>• Types of measuring and marking tools</li> <li>• Properties of materials</li> <li>• Working principles of plasma cutting equipment</li> <li>• Importance of current and pressure setting</li> <li>• Differences between Oxy-acetylene and plasma cutting</li> </ul>	<ul style="list-style-type: none"> <li>• Team work</li> <li>• Communication</li> <li>• Problem solving</li> <li>• Interpersonal relationship</li> <li>• Creativity</li> <li>• Time Management</li> </ul>

**UNIT TITLE : Carryout MIG/MAG Welding**

**DESCRIPTOR:** This unit covers competencies required to set up for welding work and carryout MIG/MAG welding following standard procedure.

**CODE : 7212-U5-L3**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Set up for MIG/MAG process	1.1 Select and use <b>PPE</b> as per the job requirement following standard procedure. 1.2 Select required <b>tools &amp; equipment and materials</b> as per the job requirement following standard procedure. 1.3 Assess the work area for <b>hazards</b> as per the job requirement following standard procedures. 1.4 <b>Set up Welding machine</b> as per the job requirement following standard procedures.
2. Perform MIG / MAG welding	2.1 <b>Prepare</b> base metal as per the job requirement following standard procedures. 2.2 Tack weld base metal as per the job requirement following standard procedures. 2.3 Apply <b>distortion prevention measures</b> as per the job requirement. 2.4 Weld base metals in all <b>positions</b> as per the job requirement following the standard procedure.
3. Carry out post welding work	3.1 Perform <b>finishing work</b> as per the job requirement following standard procedures 3.2 Check weld <b>defects</b> as per the job requirement following standard procedures. 3.3 Conduct penetrant test following the standard procedure 3.4 Clean the work area following the standard procedures 3.5 Maintain tools and equipment following the standard procedures

	3.6 Prepare <b>work completion reports</b> following the standard procedures
--	--

<b>RANGE STATEMENT</b>	
<b>Personal protective equipment (PPE) may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Safety shoes</li> <li>• Work dress</li> <li>• Leather gloves</li> <li>• Mask (Dust and gas)</li> <li>• Goggles</li> </ul>	<ul style="list-style-type: none"> <li>• Ear muff</li> <li>• Welding helmet</li> <li>• Welding shield</li> <li>• Leather apron</li> </ul>
<b>Tools and equipment may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Guillotine machine</li> <li>• Grinder</li> <li>• Dye penetrant kit</li> <li>• MIG/MAG machine set</li> </ul>	<ul style="list-style-type: none"> <li>• Shielding gas cylinder</li> <li>• Files</li> <li>• High speed cutter</li> </ul>
<b>Materials may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Filler wire</li> <li>• Shielding gas</li> </ul>	<ul style="list-style-type: none"> <li>• Stainless steel plates/ sheets/ bars</li> </ul>
<b>Hazards may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Electric shock</li> <li>• Arc radiation</li> <li>• Fire</li> <li>• Confined space</li> </ul>	<ul style="list-style-type: none"> <li>• Explosion</li> <li>• Fumes and gases</li> <li>• Heat</li> </ul>
<b>Set up welding machine may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Gas flow setting</li> <li>• Current setting</li> </ul>	<ul style="list-style-type: none"> <li>• Wire feeding set up</li> </ul>
<b>Preparation of materials may include but not limited to</b>	
<ul style="list-style-type: none"> <li>• Marking</li> <li>• Cutting</li> </ul>	<ul style="list-style-type: none"> <li>• Cleaning</li> <li>• Grinding</li> </ul>
<b>Finishing work may include but not limited to:</b>	
<ul style="list-style-type: none"> <li>• Cleaning</li> </ul>	<ul style="list-style-type: none"> <li>• Surface grinding</li> </ul>

**Work completion report may include but not limited to:**

- Maintenance record
- Checklist
- Job card

**Defects may include but not limited to:**

- Undercut
- Porosity / blow holes
- Lack of fusion
- Cracks
- Over lap

**Positions may include but not limited to:**

- Fillet weld in flat position (1F)
- Groove weld in flat position (1G)
- Fillet weld in horizontal position (2F)
- Groove weld in horizontal position (2G)
- Fillet weld in Vertical position(3F)
- Groove weld in Vertical position(3G)
- Fillet weld in overhead position(4F)
- Groove weld in overhead position(4G)

**Critical Aspect:**

- Demonstrate compliance with safety regulations applicable to work operations at all times.
- Align and tack weld base metal as per the job requirement following standard procedures

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Ethics and Integrity</li> <li>• OHS regulations</li> <li>• Basic First Aid</li> <li>• Interpretation of drawings and specifications</li> <li>• MIG / MAG welding process</li> <li>• Welding symbols and specification</li> <li>• Types of tests</li> <li>• Types of shielding gases</li> <li>• Welding codes and standards</li> <li>• Basic estimation and costing</li> </ul>	<ul style="list-style-type: none"> <li>• Team work</li> <li>• Communication</li> <li>• Problem solving</li> <li>• Interpersonal relationship</li> <li>• Creativity</li> <li>• Time Management</li> </ul>



**UNIT TITLE** : **Carryout TIG Welding**

**DESCRIPTOR:** This unit covers the competencies required to set up and carryout TIG welding.

**CODE** : **7212-U6-L3**

<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1 Set up for TIG process	1.1 Select and use <b>PPE</b> as per the job requirement. 1.2 Select required <b>tools &amp; equipment and materials</b> as per the job requirement following the standard procedure. 1.3 Assess the work area for <b>hazards</b> as per the job requirement following standard procedures. 1.4 <b>Set up TIG welding machine</b> as per the job requirement following standard procedures
2 Perform TIG welding	2.1 <b>Prepare</b> base metal as per the job requirement following standard procedures. 2.2 Tack weld base metal as per the job requirement following standard procedures. 2.3 Apply <b>distortion prevention measures</b> as per the job requirements following the standard procedure. 2.4 Weld base metal in different <b>positions</b> as per the job requirement following standard procedures.
3 Carryout post TIG work	3.1 Perform <b>finishing work</b> as per the job requirement following standard procedures. 3.2 Conduct penetrant test as per the job requirement following standard procedures. 3.3 Check weld <b>defects</b> as per the job requirement following standard procedures. 3.4 Clean the work area following the standard procedures 3.5 Maintain tools and equipment following the standard procedures. 3.6 Compile the <b>work completion reports</b> following

the standard procedures.

## RANGE STATEMENT

### Personal protective equipment (PPE) may include but not limited to:

- Safety shoes
- Work dress
- Leather gloves
- Mask (Dust and gas mask)
- Leather apron
- Ear muff
- Welding helmet
- Welding shields
- Goggles

### Tools and equipment may include but not limited to:

- Guillotine machine
- Grinder
- Dye penetrant kit
- TIG welding machine set
- Shielding gas cylinder.

### Materials may include but not limited to:

- Welding Torch
- Filler rod
- Tungsten electrodes
- Shielding gas
- Stainless steel plates/ sheets/ Bars

### Hazards may include but not limited to:

- Electric shock
- Arc radiation
- Fire
- Confined space
- Explosion
- Fumes and gases
- Heat

### Set up welding machine may include but not limited to:

- Gas flow setting
- Current setting

### Preparation of materials may include but not limited to

- Marking
- Cutting
- Cleaning
- Grinding

### Finishing work may include but not limited to:

- Cleaning
- Grinding

### Work completion report may include but not limited to:

- Maintenance record
- Job card
- Checklist

**Defects may include but not limited to:**

- Undercut
- Lack of fusion
- Over lap
- Porosity / blow holes
- Cracks

**Positions may include but not limited to:**

- Fillet weld in flat position (1F)
- Fillet weld in horizontal position (2F)
- Fillet weld in Vertical position(3F)
- Fillet weld in overhead position(4F)
- Groove weld in flat position (1G)
- Groove weld in horizontal position (2G)
- Groove weld in Vertical position(3G)
- Groove weld in overhead position(4G)

**Critical Aspect:**

- Demonstrate compliance with safety regulations applicable to work operations at all times.
- Align and tack weld base metal as per the job requirement following standard procedures.

<b>UNDERPINNING KNOWLEDGE</b>	<b>UNDERPINNING SKILLS</b>
<ul style="list-style-type: none"> <li>● Ethics and Integrity</li> <li>● OHS regulations</li> <li>● Basic First Aid</li> <li>● Interpretation of drawings and specifications</li> <li>● TIG welding process</li> <li>● Welding symbols and specification</li> <li>● Types of Tests</li> <li>● Types of shielding gases</li> <li>● Welding codes and standards</li> <li>● Basic estimation &amp; costing</li> </ul>	<ul style="list-style-type: none"> <li>● Team work</li> <li>● Communication</li> <li>● Problem solving</li> <li>● Interpersonal relationship</li> <li>● Creativity</li> <li>● Time Management</li> </ul>

## **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**

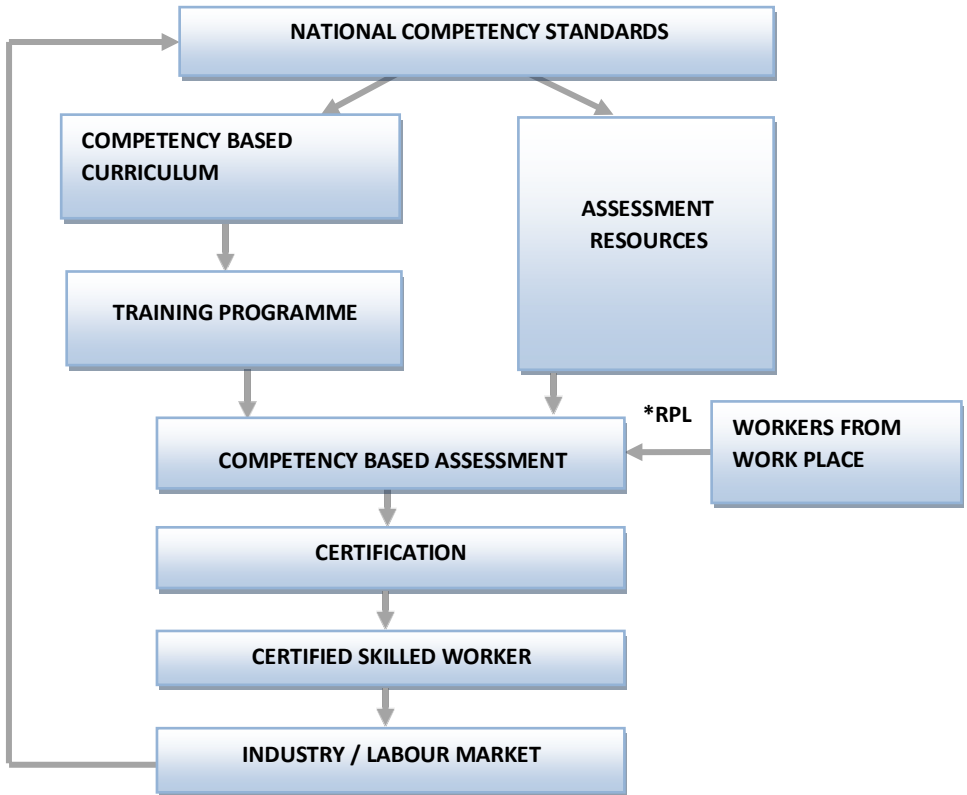
Competency Standards serve a number of purposes including:

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

## National Certificate Level 2 (Craftsman)

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

## National Certificate Level 3 (Master Craftsman)

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



## **1.5 CODING USED FOR NATIONAL COMPETENCY STANDARDS**

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

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

Coding the individual unit competency standard is to identify the level in qualification package to which it belongs.

While packaging, in order to follow a logical order, only competency standards related to each other and following a logical sequence in terms of training delivery, from the simple to the complex, are clustered into a qualification package.

## **1.6 ASSESSMENT GUIDE**

### **Form of assessments**

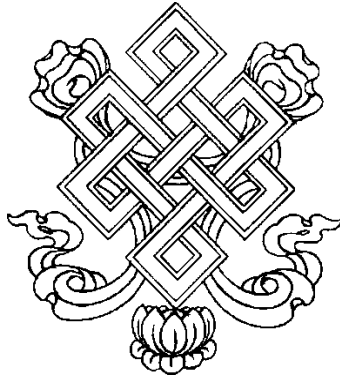
- Continuous assessment together with collected evidence of performance will be used.
- Evidence of the performance shall be based on practical demonstration.
- Knowledge can be assessed through diagrams, in writing or orally (viva- voce).

### **Assessment context**

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

### **Assessment condition**

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



Department of Occupational Standards  
Ministry of Labour & Human Resources  
Thongsel Lam, Lower Motithang  
P.O. Box 1036, Thimphu Tel:  
02-331611 Fax: 02-326873  
[www.molhr.gov.bt](http://www.molhr.gov.bt)