

# **ESWATINI GOVERNMENT**

**MINISTRY OF LABOUR AND SOCIAL SECURITY  
DIRECTORATE OF INDUSTRIAL AND VOCATIONAL TRAINING –DIVT  
APPRENTICESHIP JOB TRAINING GUIDE  
TRADE: WELDING AND BOILER MAKING (FABRICATION)**

## **FIRST-YEAR**

### **Apply and maintain safety rules and regulations in a welding and fabrication workshop**

**Element 1: Locate potential hazards in the work area**

**Element 2: Limit damage to persons or property in the case of an emergency**

**Element 3: Follow procedures that apply to illness or injury in the work area**

**Apply basic entrepreneurship skills – Unit ID: MEW 200**

**Element 1: Demonstrate basic knowledge of the characteristics of an entrepreneur**

**Element 2: Apply basic skills to generate a business idea**

**Element 3: Apply market research skills**

**Communicate in a welding and fabrication environment**

**Element 1: Find and use available learning resources**

**Element 2: Use learning strategies**

**Element 3: Manage welding and fabrication occupational learning materials**

**Element 4: Plan and gather relevant information for a given context and purpose**

**Element 5: Function in a team**

**Element 6: Reflect on how characteristics of the workplace and occupational context affect learning**

**Use basic welding definitions and symbols – Unit ID: MEW 203**

**Element 1:** Know the basics of welded joints and their terminology

**Element 2:** Identify, sketch, and describe welding symbols used by industry

**Braze metals using the oxy-fuel brazing process Unit ID: MEW 204**

**Element 1:** Describe the oxy-fuel brazing process

**Element 2:** Prepare equipment prior to brazing

**Element 3:** Prepare workpieces prior to brazing

**Element 4:** Braze workpiece

**Element 5:** Inspect brazed workpiece

**Element 6:** Complete brazing activities

**Cut materials using the oxy-fuel gas cutting process – Unit ID: MEW 205**

**Element 1:** Describe the oxy-fuel cutting process

**Element 2:** Prepare for the oxy-fuel-cutting operation

**Element 3:** Cut material

**Element 4:** Care and storage of cutting equipment, tools, and materials

**Demonstrate knowledge of fabrication machinery, materials, and processes – Unit ID: MEW 206**

**Element 1:** Demonstrate knowledge of fabrication machinery and machinery components

**Element 2:** Demonstrate knowledge of common fabrication materials and processes

**Weld workpieces using the oxy-acetylene gas welding process in all positions – Unit ID: MEW 207**

**Element 1:** Describe and explain the oxy-acetylene gas welding process

**Element 2:** Select, assemble and conduct pre-operational checks of oxy-acetylene gas welding equipment

**Element 3:** Prepare workpieces prior to welding

**Element 4:** Weld metals with oxy-acetylene gas welding process

**Element 5:** Inspect welded work piece for defects

**Element 6:** Care for and store welding consumables and equipment

**Weld carbon steel workpieces using cored wire in all positions – Unit ID: MEW 208**

**Element 1:** Describe the cored-wire welding process

**Element 2:** Select, set up and conduct pre-operational checks of cored-wire welding equipment

**Element 3:** Prepare workpieces prior to welding

**Element 4:** Weld workpieces

**Element 5:** Inspect welded work piece for defects

**Element 6:** Care for and store welding consumables and equipment.

**Weld carbon steel work-pieces using the shielded metal arc welding process in all positions – Unit ID: MEW 209**

**Element 1:** Describe the shielded metal arc welding process

**Element 2:** Select, set up and conduct pre-operational checks of shielded metal arc welding equipment

**Element 3:** Prepare workpieces prior to welding

**Element 4:** Weld workpieces

**Element 5:** Inspect welded work piece for defects in compliance with drawing specifications

**Element 6:** Care for and store welding consumables and equipment.

**Draw and interpret simple plate, pipe and structural steel plate drawings- Unit ID: MEW 210**

**Element 1:** Demonstrate methods of construction to produce basic plate, pipe and structural steel plate drawings and sketches

**Element 2:** Draw and interpret basic plate, pipe and structural steel engineering projections

**Element 3:** Interpret and draw a development using the parallel-line method

**Element 4:** Interpret and draw a development using the radial-line method

**Element 5:** Interpret and draw a development using Radial-line method



**Use and maintain hand and power tools in welding and fabrication operations – Unit ID: MEW 211**

**Element 1:** Identify and select welding and fabrication hand and power tools

**Element 2:** Inspect welding and fabrication hand and power tools for serviceability

**Element 3:** Use welding and fabrication hand and power tools

**Element 4:** Maintain and care of welding and fabrication of hand and power tools

**Weld carbon steel workpieces, using the gas metal arc welding process in all positions – Unit ID: MEW 212**

**Element 1:** Describe the gas metal arc welding process and related equipment

**Element 2:** Select, set up and conduct pre-operational checks of gas metal arc welding equipment

**Element 3:** Prepare workpieces prior to welding

**Element 4:** Weld workpieces

**Element 5:** Inspect welded work piece for defects

**Element 6:** Care for and store welding consumables and equipment.

## **SECOND - YEAR**

### **Weld similar material using the shielded metal arc welding process in all positions- Unit ID: MEW300**

**Element 1:** Describe the shielded metal arc welding process

**Element 2:** Select, set up and conduct pre-operational checks of shielded metal arc welding equipment

**Element 3:** Prepare workpieces prior to welding

**Element 4:** Weld workpieces

**Element 5:** Inspect welded work piece for defects in compliance with drawing specifications

**Element 6:** Care for and store welding consumables and equipment.

**Draw and interpret complex plate, pipe and structural steel plate drawings – Unit ID: MEW 301**

**Element 1:** Demonstrate methods of construction to produce complex plate, pipe and structural steel plate drawings and sketches

**Element 2:** Draw and interpret complex plate, pipe and structural steel engineering projections

**Element 3:** Interpret and draw a development using the parallel-line method

**Element 4:** Interpret and draw a development using the radial-line method

**Element 5:** Interpret and draw a development using triangulation method

**Element 6:** Interpret and draw a development using Radial-line method

**Use welding definitions and symbols – Unit ID: MEW 302**

**Element 1:** Demonstrate knowledge of welded joints and their terminology

**Element 2:** Identify, sketch and describe welding symbols used by industry

**Weld similar materials using the gas metal arc welding process in all positions – Unit ID:MEW 303**

Special Notes:

- For assessment purposes only flat and horizontal positions will be considered.

**Element 1:** Describe the gas metal arc welding process and related equipment

**Element 2:** Select, set up and conduct pre-operational checks of gas metal arc welding equipment

**Element 3:** Prepare workpieces prior to welding

**Element 4:** Weld workpieces

**Element 5:** Inspect welded workpiece for defects

**Element 6:** Care for and store welding consumables and equipment.

**Butt-weld a pipe in position – Unit ID: MEW 304**

**Element 1:** Explain the factors critical to butt-welding pipes in position

**Element 2:** Prepare to butt-weld a pipe in position.

**Element 3:** Butt-weld the pipe in position

**Element 4:** Complete the butt-welding process and prepare for operation and/or production

**Cut metals using the manual plasma cutting process – Unit ID: MEW 305**

**Element 1:** Prepare to Cut metals using the manual plasma cutting process

**Element 2:** Cut metal using the manual plasma cutting process to industry standard

**Lift and move a load using mechanical lifting equipment – Unit ID:MEW 306**

**Element 1:** Explain the factors critical to lifting and moving loads

**Element 2:** Prepare to lift and move a load

**Element 3:** Lift and move the load

**Element 4:** Make the load available for production purposes



**Perform destructive testing on welded specimens – Unit ID: MEW 307**

**Element 1:** Explain and describe the destructive testing process

**Element 2:** Select and conduct pre-operational checks of destructive testing equipment

**Element 3:** Prepare specimen prior to destructive testing process

**Element 4:** Perform destructive testing

**Element 5:** Inspect test specimen

**Remove material with the shields metal arc gouging process – Unit ID:MEW 308**

**Element 1:** Describe the fundamental principles of the shielded metal arc gouging process

**Element 2:** Identify, select and set up gouging equipment

**Element 3:** Gouge material

**Element 4:** Care and store gouging consumables and equipment

**Join metals using the resistance/spot welding process – Unit ID: MEW 309**

**Element 1:** Prepare for welding using the RW process

**Element 2:** Join metals using the RW process

**Element 3:** Assess and repair RW welds

**Demonstrate team spirit and work values – Unit ID: MEW 310**

**Element 1:** Develop effective workplace relationship

**Element 2:** Contribute to work group activities

**Element 3:** Define the purpose of work

**Element 4:** Apply work values/ethics

**Element 5:** Deal with ethical problems

**Element 6:** Maintain integrity of conduct in the workplace

**Write a technical report- Unit ID: MEW 315**

**Element 1:** Collect information for writing the report.

**Element 2:** Plan the writing of the report.

**Element 3:** Write the report.

**Element 4:** Revise the report

## THIRD-YEAR

### Weld similar materials using the gas metal arc welding process in all positions – Unit ID: MEW 303

**Element 1:** Describe the gas metal arc welding process and related equipment

**Element 2:** Select, set up and conduct pre-operational checks of gas metal arc welding equipment

**Element 3:** Prepare workpieces prior to welding

**Element 4:** Weld workpieces

**Element 5:** Inspect welded workpiece for defects

**Element 6:** Care for and store welding consumables and equipment.

**Demonstrate and apply knowledge of welding aluminium and stainless steel – Unit ID: MEW 311**

**Element 1:** Demonstrate knowledge of aluminium and stainless steel from a welding perspective

**Element 2:** Demonstrate knowledge of the GTAW process for welding aluminium and stainless steel

**Element 3:** Demonstrate knowledge of the GMAW process for welding aluminium

**Element 4:** Weld aluminium and stainless steel

**Gouge steel using the air carbon arc gouging process – Unit ID: MEW 312**

**Element 1:** Prepare to gouge steel using the air carbon arc gouging process

**Element 2:** Gouge steel using the air carbon arc gouging process

**Weld carbon steel workpieces using the gas tungsten arc welding process in the downhand position – Unit ID: MEW313**

**Element 1:** Describe and explain the gas tungsten arc welding process

**Element 2:** Select, assemble and conduct pre-operational checks of gas tungsten arc welding equipment

**Element 3:** Prepare workpieces prior to welding

**Element 4:** Weld workpieces

**Element 5:** Inspect welded workpiece for defects in compliance with drawing specifications

**Element 6:** Care for and store welding consumables and equipment.

**Join ferrous and non-ferrous metal components by torch brazing – Unit ID: MEW 314**

**Element 1:** Demonstrate knowledge of torch brazing principles

**Element 2:** Prepare to torch braze ferrous and non-ferrous metal components

**Element 2:** Join metals by torch brazing

**Element 4:** Assess and repair brazed joints

**Element 5:** Complete brazing activities

**Hard face surfaces as part of welding and fabrication operations – Unit ID: MEW 407**

**Element 1:** Demonstrate understanding of the hardfacing process.

**Element 2:** Prepare to hard face a component.

**Element 3:** Hard face a component.

**Element 4:** Inspect hardfaced components for defects.

**Element 5:** Care for and store hard facing consumables and equipment.

**Special Notes:**

- **Fourth year and fifth years are in two sections, Welding or Boilermaking (Fabrication).**

**FORTH-YEAR (WELDING)**

**Weld pipe within the aluminium material group, using the gas tungsten arc welding process in all positions – Unit ID: MEW 400**

**Element 1:** Describe and assemble gas tungsten arc welding equipment.

**Element 2:** Select and conduct pre-operational checks of gas tungsten arc welding equipment.

**Element 3:** Prepare pipes prior to welding.

**Element 4:** Weld pipes.

**Element 5:** Inspect welded pipe.

**Element 6:** Care for and store welding consumables and equipment.



**Weld pipe within the stainless-steel material group, using the gas tungsten arc welding process in all positions – Unit ID: MEW 401**

**Element 1:** Describe and assemble gas tungsten arc welding equipment.

**Element 2:** Select and conduct pre-operational checks of gas tungsten arc welding equipment.

**Element 3:** Prepare pipes prior to welding.

**Element 4:** Weld pipes.

**Element 5:** Inspect welded pipe.

**Element 6:** Care for and store welding consumables and equipment.

**Weld aluminium in all positions using the gas metal arc welding process – Unit ID: MEW 404**

**Element 1:** Prepare to weld aluminium in all positions using the GMAW process.

**Element 2:** Weld aluminium to industry standard in all positions using the GMAW process.

**Element 3:** Inspect and repair GMAW aluminium welds.

**Weld carbon steel workpieces using the gas tungsten arc welding process in all positions – Unit ID: MEW 405**

**Element 1:** Describe and explain the gas tungsten arc welding process.

**Element 2:** Select, assemble and conduct pre-operational checks of gas tungsten arc welding equipment.

**Element 3:** Prepare workpieces prior to welding.

**Element 4:** Weld workpieces.

**Element 5:** Inspect welded workpiece for defects in compliance with drawing specifications.

**Element 6:** Care for and store welding consumables and equipment.

**Weld dissimilar materials using the shielded metal arc welding process in all positions – Unit ID: MEW 406**

**Element 1:** Prepare workpieces prior to welding.

**Element 2:** Weld workpieces of dissimilar materials.

**Element 3:** Inspect welded workpiece for defects in compliance with drawing specifications.

**Produce business plans for a new venture – Unit ID: MEW 411**

**Element 1:** Identify, gather and analyse the relevant information needed to compile a plan for a new business venture

**Element 2:** Formulate an ethical framework for the operational plans of a venture

**Element 3:** Establish and prioritise business, financial and/or operations goals and objectives for a new venture

**Element 4:** Design and present business, financial and/or marketing plans based on a budget for a new venture

**FIFTH-YEAR ( WELDING)**

**Weld steel pressure pipe using the manual metal arc welding process with cellulosic electrodes- Unit ID: MEW 402**

**Element 1:** Prepare to weld steel pressure pipe using the MMAW process with cellulosic electrodes.

**Element 2:** Weld steel pressure pipe using the MMAW process with cellulosic electrodes.

**Element 3:** Inspect and repair welds.

**Weld carbon steel pressure pipe, using the gas tungsten arc welding process in all positions – Unit ID: MEW 403**

**Element 1:** Describe and assemble gas tungsten arc welding equipment.

**Element 2:** Select and conduct pre-operational checks of gas tungsten arc welding equipment.

**Element 3:** Prepare pipes prior to welding.

**Element 4:** Weld pipes.

**Element 5:** Inspect welded pipe.

**Element 6:** Care for and store welding consumables and equipment.

**Demonstrate knowledge of welding technology- Unit ID: MEW 408**

**Element 1:** Demonstrate knowledge of the physics of welding

**Element 2:** Demonstrate knowledge of welding and cutting processes

**Demonstrate knowledge of welding metallurgy – Unit ID: MEW 409**

**Element 1:** Demonstrate knowledge of the role of carbon and manganese in weldable steels

**Element 2:** Demonstrate knowledge of the effects of welding on steels.

**Element 3:** Demonstrate knowledge of the weldability of metals.

**Supervise workers at level 2 and 3 – Unit ID: MEW 410**

**Element 1:** Plan the work methods and organize resources with individuals and teams.

**Element 2:** Update and achieve work objectives, delegate, control and organise individuals and team.

**Element 3:** Supervise and manage production, work and services of individuals and teams.



**Tender to secure a new venture – Unit ID: MEW 412**

**Element 1:** Identify information sources of available business and new markets that can be accessed

**Element 2:** Tender documents are analysed for viability in the new venture context

**Element 3:** Calculation of costs, revenue and profit of a specific tender are carried out

**Element 4:** Complete tender documents

**FORTH-YEAR BOILERMAKING ( FABRICATION)**

**Produce business plans for a new venture – Unit ID: MEW 411**

**Element 1:** Identify, gather and analyse the relevant information needed to compile a plan for a new business venture

**Element 2:** Formulate an ethical framework for the operational plans of a venture

**Element 3:** Establish and prioritise business, financial and/or operations goals and objectives for a new venture

**Element 4:** Design and present business, financial and/or marketing plans based on a budget for a new venture

**Develop and fabricate from complex drawings – Unit ID: MEF 413**

**Element 1:** Prepare for laying out, marking out and forming and shaping of materials

**Element 2:** Mark out templates and patterns

**Element 3:** Lay out and mark out structural sections

**Element 4:** Mark out surface developments

**Element 5:** Cut out, form and shape materials

**Identify, interpret, and produce working piping drawings – Unit ID: MEF 415**

**Element 1:** Demonstrate an understanding of piping draughting.

**Element 2:** Identify and draw schematic drawings.

**Element 3:** Identify, describe and draw isometric layouts and flow diagrams.

**Identify, interpret and produce working structural steel drawings – Unit ID: MEF 416**

**Element 1:** Demonstrate an understanding of structural steel detailing.

**Element 2:** Demonstrate an understanding of beams, plate and box girders.

**Element 3:** Identify detail and draw columns.

**Element 4:** Calculate detail and draw lattice, girders and bracing.

**Cut, drill, punch, assemble, and mechanically join plates and structural steelwork – Unit ID: MEF 417**

**Element 1:** Prepare for work activity.

**Element 2:** Perform mechanical cutting, drilling, and punching of materials.

**Element 3:** Perform assembly and mechanical joining of materials.

## **FIFTH-YEAR BOILER MAKING (FABRICATION)**

### **Demonstrate knowledge of welding technology – Unit ID: MEW 408**

**Element 1:** Demonstrate knowledge of the physics of welding.

**Element 2:** Demonstrate knowledge of welding and cutting processes.

### **Demonstrate knowledge of welding metallurgy – Unit ID: MEW 409**

**Element 1:** Demonstrate knowledge of the role of carbon and manganese in weldable steels

**Element 2:** Demonstrate knowledge of the effects of welding on steels.

**Element 3:** Demonstrate knowledge of the weldability of metals.

**Supervise workers at level 2 and 3 – Unit ID: MEW 410**

**Element 1:** Plan the work methods and organize resources with individuals and teams.

**Element 2:** Update and achieve work objectives, delegate, control and organise individuals and team.

**Element 3:** Supervise and manage production, work and services of individuals and teams.

**Element 4:** Evaluate performance of individuals and teams.

**Tender to secure a new venture – Unit ID: MEW 412**

**Element 1:** Identify information sources of available business and new markets that can be accessed

**Element 2:** Tender documents are analysed for viability in the new venture context

**Element 3:** Calculation of costs, revenue and profit of a specific tender are carried out

**Element 4:** Complete tender documents



**Demonstrate and apply knowledge of advanced heavy fabrication trade practice – Unit ID: MEF 414**

**Element 1:** Demonstrate knowledge of advanced heavy fabrication trade practice.

**Element 2:** Fabricate complex objects using heavy fabrication materials.