THE NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

OCCUPATIONAL STANDARDS

OCCUPATION: WELDING TECHNICIAN

LEVEL: NTA LEVEL 4

FEBRUARY 2024

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ABBREVIATIONS

AC	Alternating Current
CBET	Competency Based Education and Training
DC	Direct Current
EWD	Electrode-to-wire Distance
EWPD	Electrode-to-welded Part Distance
ET	Eddy current Testing
MAG	Metal Active Gas Arc Welding
MIG	Metal Inert-gas Welding
MT	Magnetic Particle Testing
NACTVET	National Council for Technical and Vocational Education and Training
NDT	Non-destructive Testing
NOS	National Occupational Standards
OS	Occupational Standards
PT	Penetrant Testing
RT	Radiographic Testing
TET	Technical Education and Training
TIG	Tungsten Inert Gas Welding
TVET	Technical and Vocational Education and Training
UT	Ultrasonic Testing
VPPAW	Variable Polarity Plasma Welding
WFS	Wire Feed Rate

GLOSSARY OF TERMS

Circumstantial Knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.
Competence:	The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based Education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; A product that states the "intended learning outcomes".
Educational/Training Programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks - essentially the same tasks are performed by all employees having the same title. (Example: Welding Technician)
Occupational Area:	This is a broad grouping of related jobs. (Example: food service).
Occupational Standards:	Specific requirements of competences for personnel in a particular occupational area, including knowledge and relevant attitudes. They also act as performance tools of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation.
Performance Criteria:	Indicate expected end results or outcomes in the form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.
Standards:	A set of statements, which, if proved true under working conditions, means that an individual is meeting an expected level and type of performance.

Task Analysis:	The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance criteria, tools and materials needed, as well as safety concerns required for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, consists of two or more definite steps, and leads to products, service, or decisions.
Underpinning Knowledge:	Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification Process:	The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the working conditions.

1.0 INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status, with a high level of human development. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical and Vocational Education and Training (NACTVET) has begun the job of drafting Occupational Standards (OS) that will eventually be adopted as National Occupational Standards (NOS) for use in the delivery of TET that meets the needs of the labour market and the country's economic agenda.

Occupational Standards (OS) are performance criteria that are matched with labour market demands. Each of them describes the functions, performance standards, and understanding or knowledge underpinning a given occupation. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruitment, supervision, and appraisal, as well as TET Standards. They are also helpful for benchmarking and harmonizing job qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current, and consistent in application across all public and private institutions.

However, it must be noted that Occupational Standards are different from Training /Education Standards. Occupational standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical circuits, performs troubleshooting in electrical circuits, etc.), and are usually defined by Employers following procedures as agreed upon by all the stakeholders. On the other hand, Training and Education Standards are developed from the activities defined in the occupational standards, and they specify learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him/her to function at an agreed level in an occupation. Training and Education Standards are used to define curricula in training institutions. It is critical, however, to establish a direct link between the occupational standards and the training standards for both of them to respond collaboratively to the demands of the labour market.

For the purpose of TET delivery, Tanzania has adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the occupational standards. Occupational standards are thus the starting point for developing competency-based training (CBET) programmes. Therefore, it is quite pertinent for TET institutions to use the relevant occupational standards as a benchmark for formulating their

curricula.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training.

The document explains how the occupational standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0 OCCUPATIONAL STANDARD DEVELOPMENT PROCESS

The process of developing these Occupational Standards involved both local and international expertise. The process began with an examination of major documents that guide Tanzanian skills development including the *10-year National Skills Development Strategy (2016-2026).* NACTVET labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a team of experts in consultation with practitioners developed draft occupational standards. The draft document was used to develop an occupational profile for each occupation (DACUM Chart), which is attached as an **Appendix** to every Occupational Standard.

The occupational standards were validated during the stakeholders' forum held on 22nd and 23rd February 2024 at Morogoro. The information from the stakeholders' forum provides insight from the workplace, professional bodies, regulatory bodies and sector ministries regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation.

3.0 THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR WELDING TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by a Welding Technician. However, the occupational standards are not meant to replace individual job descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Welding Technician may perform tasks in a number of key areas of the Occupational Standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

The Welding Technician shall weld and inspect welded joints in various engineering structural parts in a safe environment under the supervision of engineers. In the workshop, technicians complete various welding and inspection tasks, ranging from simple manual shielded metal arc welding of flat butt joints to gas welding of all positions, developing welding procedures, and inspecting welding defects. Generally, the Welding Technicians perform the following duties:

a) Implementation of welding safety operation

b) Formulation of simple welding process

c) Inspection and maintenance of welding equipment

d) Manual Shielded Metal Arc Welding (SMAW) of flat butt joint

e) Manual Shielded Metal Arc Welding (SMAW) of horizontal butt joint

f) Manual Shielded Metal Arc Welding (SMAW) of vertical butt joint

g) Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield

h) Gas Metal Arc Welding (GMAW) of horizontal butt joint with consumable electrode and gas shield

i) Gas Metal Arc Welding (GMAW) of vertical butt joint with consumable electrode and gas shield

j) Manual tungsten inert gas welding of flat butt joint

k) Horizontal and vertical manual tungsten inert gas welding

l) Gas welding of flat fillet joint

m) Gas welding of flat butt joint

n) All-position gas welding

o) Brazing of low carbon steel

p) Inspection of welding defects

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA 4, 5 and 6.

4.0 VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0 OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR WELDING TECHNICIAN – NTA LEVEL 4

<table>
<tr><td>OCCUPATION</td><td>WELDING TECHNICIAN</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>CONDUCT SAFETY OPERATION OF WELDING</td><td>DUTY NO.</td><td>401</td></tr>
<tr><td>TASK TITLE</td><td>CONDUCT PERSONAL PROTECTION</td><td>TASK NO.</td><td>4011</td></tr>
<tr><td>PERFORMANCE CRITERIA</td><td colspan="3">The person performing this task must be able to conduct personal protection in accordance with health and safety precautions for welding operations.</td></tr>
<tr><td>RANGE STATEMENT</td><td colspan="3">The task can be performed in the welding workshop under the supervision of welding engineers or mechanical engineers.
The tools and equipment to be used include:
1. Safety shoes;
2. Protective suits;
3. Welding gloves;
4. Welding masks;
5. Protective goggles.
6. Safety gear</td></tr>
<tr><td colspan="4">EVIDENCE REQUIREMENT</td></tr>
<tr><td colspan="2">PRACTICAL OPERATION</td><td colspan="2">UNDERPINNING KNOWLEDGE</td></tr>
<tr><td colspan="2">The person performing this task must be able to do the following:
1. Comply with health and safety precautions for welding operations;
2. Select appropriate tools, equipment, and safety protective equipment;
3. Use and maintain protective equipment;
4. Deal with safety accidents and take corresponding measures;
5. Store tools and equipment.
6. Observe health, occupational and environmental safety, rules and regulations</td><td colspan="2">Detailed knowledge about:
1.0 Methods
The person performing this task must be able to explain how to:
1.1 Use various protective tools;
1.2 Implement corresponding emergency treatment of accidents.

2.0 Principle
The person performing this task must be able to explain the following principles:
2.1 Safety inspection principles of welding protective equipment;
2.2 Emergency treatment principles of corresponding safety protection appliances.

3.0 Theories
The person performing this task must be able to explain the following:
3.1 Risk factors existing in welding process and precautions for occupational hazards;
3.2 Safety protection standards of protective equipment;</td></tr>
</table>

	3.3 Methods of properly wearing personal safety protection equipment. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Teamwork skills; 4.4 Accident emergency handling skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Protective equipment that meets the requirements are selected and worn according to technical standards and welding procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Safety operation and use of equipment and tools.

OCCUPATION	WELDING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT SAFETY OPERATION OF WELDING	**DUTY NO.**	401
TASK TITLE	PREPARE AND SELECT THE WELDING ENVIRONMENT	**TASK NO.**	4012
PERFORMANCE CRITERIA	The person performing this task must be able to prepare and select the welding environment according to the specific welding operation in accordance with technical standards and health and safety precautions for welding operations.		
RANGE STATEMENT	The task can be performed in the welding workshop under the supervision of welding engineers or mechanical engineers. The tools and equipment to be used include: 1. Thermometer; 2. PH/temperature detector; 3. Windproof shed; 4. Dehumidification instrument. 5. Safety gear		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with health and safety precautions for welding operations; 2. Select appropriate tools, equipment, and safety protective equipment; 3. Use and maintain protective equipment; 4. Choose the operating environment; 5. Use instruments to improve the operating environment; 6. Deal with safety accidents and take corresponding measures; 7. Store tools and equipment. 8. Observe health, occupational and environmental safety, rules and regulations	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Operate related instruments to detect environmental parameters; 1.2 Use instruments and equipment for adjusting environmental conditions. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles for the use of environmental testing instrument; 2.2 The reason why welding requires that the environment must reach a certain parameter. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Welding environment and reasons required by different welding methods; 3.2 Requirements for regulating environment of instruments and equipment.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Management skills; 4.3 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The welding environment that meets the requirements is selected according to the technical standards and health and safety precautions for welding operations.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation and use of equipment and tools; 2. Occupational health and safety.

OCCUPATION	WELDING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	FORMULATE SIMPLE WELDING PROCESS	**DUTY NO.**	402
TASK TITLE	SELECT WELDING METHOD	**TASK NO.**	4021
PERFORMANCE CRITERIA	The person performing this task must be able to select the appropriate welding method according to the specific welding conditions and requirements.		
RANGE STATEMENT	The task can be performed in the welding workshop under the supervision of welding engineers or mechanical engineers. The tools and equipment to be used include: 1. Safety shoes; 2. Protective suits; 3. Welding gloves; 4. Welding masks; 5. Protective goggles; 6. Welding power supply; 7. Straightedge. 8. Safety gear		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with health and safety precautions for welding operations; 2. Select appropriate tools, equipment, and safety protective equipment; 2. Use and maintain protective equipment; 3. Identify and read welding requirements and welding positions; 4. Select the welding method; 5. Prepare instruments and equipment to complete welding; 6. Deal with safety accidents and take corresponding measures; 7. Store tools and equipment. 8. Observe health, occupational and environmental safety, rules and regulations	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select welding method; 1.2 Prepare welding equipment. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Various performance standards of welding base metal; 2.2 Influence of different workpiece thickness and welding position on the selection of welding method. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Identification and understanding of welding requirements under different conditions; 3.2 Welding methods applicable to different welding parts.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Management skills; 4.3 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The welding methods that meet the existing requirements are selected according to the technical standards and welding procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Safety operation and use of equipment and tools.

OCCUPATION	WELDING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	FORMULATE SIMPLE WELDING PROCESS	**DUTY NO.**	402
TASK TITLE	SELECT WELDING MATERIALS	**TASK NO.**	4022
PERFORMANCE CRITERIA	The person performing this task must be able to select the appropriate welding materials according to the specific welding conditions and requirements.		
RANGE STATEMENT	The task can be performed in the welding workshop under the supervision of welding engineers or mechanical engineers. The tools and equipment to be used include: 1. Safety shoes; 2. Protective suits; 3. Welding gloves; 4. Welding masks; 5. Protective goggles; 6. Welding power supply; 7. Straightedge; 8. Welding materials (welding rod, flux, welding wire, gas, etc.); 9. Welding rod dryer. 10. Safety gear		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with health and safety precautions for welding operations; 2. Select appropriate tools, equipment, and safety protective equipment; 3. Use and maintain protective equipment; 4. Prepare welding materials; 5. Store of welding materials; 6. Pretreat welding material; 7. Deal with safety accidents and take corresponding measures. 8. Observe health, occupational and environmental safety, rules and regulations	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select welding materials; 1.2 Store and take welding materials. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Various performance standards of welding materials; 2.2 Selection principles of welding materials for different welding methods. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Welding requirements under different conditions; 3.2 Requirements of welding materials used in different welding methods;

	3.3 Storage requirements of auxiliary materials. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The welding materials that meet the requirements are selected according to the technical standards and welding procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation and use of equipment and tools; 2. Safety operation and use of testing tools. 3. Occupational health and safety; 4. Waste and waste disposal methods.

OCCUPATION	WELDING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT MANUAL SHIELDED METAL ARC WELDING (SMAW) OF FLAT BUTT JOINT	**DUTY NO.**	403
TASK TITLE	CONDUCT FLAT SHIELDED METAL ARC WELDING OF CORNER JOINT OR T JOINT	**TASK NO.**	4031
PERFORMANCE CRITERIA	The person performing this task must be able to complete the flat shielded metal arc welding of corner joint or T joint according to the specific welding process.		
RANGE STATEMENT	The task can be performed in the welding workshop under the supervision of welding engineers or mechanical engineers. The tools and equipment available include: 1. Welding power supply for shielded metal arc welding; 2. Welding cable; 3. Welding tong; 4. Ground clamp; 5. Welding rod; 6. Welding rod drying box; 7. Welding rod insulation barrel; 8. Weldment; 9. Welding console (frame); 10. Angle grinder; 11. Chipping hammer; 12. Steel ruler; 13. Wire brush; 14. Labor protection articles (welding masks (protective glasses), welder gloves, work clothes, insulated shoes, etc.). 15. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety regulations and take safety precautions; 2. Select appropriate operation tools and equipment for this task; 3. Carry out equipment inspection; 4. Prepare weldment groove; 5. Clean before welding; 6. Conduct assembly and positioned welding; 7. Carry out corner joint or backing welding; 8. Carry out filling welding;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Carry out safety inspection of equipment, tools and clamps; 1.2 Carry out groove cleaning, assembly and positioned welding; 1.3 Reserve the reverse deformation of weldments; 1.4 Determine welding parameters; 1.5 Carry out arc ignition, welding and arc closing;

9. Carry out covering welding; 10. Clean the tools, equipment and the workplace; 11. Store the tools and equipment. 12. Observe health, occupational and environmental safety, rules and regulations	1.6 Carry out root cleaning treatment on the back of weld bead at the root of double-sided welding; 1.7 Clean the surface of welded joint; 1.8 Carry out self-inspection on the external quality of welded joints. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principles of shielded metal arc welding 2.2 Principles of stable combustion of welding arc 2.3 Determination principle of welding current **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Standard for determining welding process parameters of flat w shielded metal arc welding for corner joint or T joint of low carbon steel or low alloy steel plate; 3.2 Welding appearance inspection methods and requirements; 3.3 Welding operation essentials of flat shielded metal arc welding for corner joint or T joint of low carbon steel or low alloy steel plate. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Report writing skills;
DESCRIPTION OF THE END PRODUCT / SERVICE	Flat shielded metal arc welding of corner joint or T joint is completed according to the specific welding process
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation and use of equipment and tools; 2. Safety operation and use of testing tools. 3. Occupational health and safety; 4. Waste and waste disposal methods.

OCCUPATION	WELDING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT MANUAL SHIELDED METAL ARC WELDING (SMAW) OF FLAT BUTT JOINT	**DUTY NO.**	403
TASK TITLE	CONDUCT FLAT BUTT WELDING OF LOW CARBON OR LOW ALLOY STEEL PLATES USING SHIELDED METAL ARC WELDING	**TASK NO.**	4032
PERFORMANCE CRITERIA	The person performing this task must be able to complete the flat butt welding of low carbon steel or low alloy steel plate according to the specific welding process.		
RANGE STATEMENT	The task can be performed in the welding workshop under the supervision of welding engineer or mechanical engineer. The tools and equipment to be used include: 1. Welding power supply for shielded metal arc welding; 2. Welding cable; 3. Welding tong; 4. Ground clamp; 5. Welding rod; 6. Welding rod drying box; 7. Welding rod insulation barrel; 8. Weldment; 9. Welding console (frame); 10. Angle grinder; 11. Chipping hammer; 12. Steel ruler; 13. Wire brush; 14. Labor protection articles (welding masks (protective glasses), welder gloves, work clothes, insulated shoes, etc.). 15. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety regulations and take safety precautions; 2. Select appropriate operation tools and equipment for this task; 3. Carry out equipment inspection; 4. Prepare weldment groove; 5. Clean before welding; 6. Conduct assembly and positioned welding; 7. Carry out backing welding;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Carry out safety inspection of equipment, tools and clamps; 1.2 Carry out groove cleaning, assembly and positioned welding; 1.3 Reserve the reverse deformation of weldments; 1.4 Determine welding parameters;

8. Carry out filling welding; 9. Carry out covering welding; 10. Clean the tools, equipment and the workplace; 11. Store the tools and equipment. 12. Observe health, occupational and environmental safety, rules and regulations	1.5 Carry out arc ignition, welding and arc closing; 1.6 Carry out root cleaning treatment on the back of weld bead at the root of double-sided welding; 1.7 Clean the surface of welded joint; 1.8 Carry out self-inspection on the external quality of welded joints. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principles of shielded metal arc welding; 2.2 Principles of stable combustion of welding arc; 2.3 Determination principle of welding current. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Standard for determining welding process parameters of low carbon steel or low alloy steel plate butt shielded metal arc welding; 3.2 Welding appearance inspection methods and requirements; 3.3 Welding operation essentials of flat butt welding of low carbon or low alloy steel plates using shielded metal arc welding. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Report writing skills;
DESCRIPTION OF THE END PRODUCT / SERVICE	Flat butt welding of low carbon steel or low alloy steel plate is completed according to the specific welding process.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation and use of equipment and tools. 2. Safety operation and use of testing tools. 3. Occupational health and safety; 4. Waste and waste disposal methods.

OCCUPATION	WELDING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT GAS METAL ARC WELDING (GMAW) OF FLAT BUTT JOINT WITH CONSUMABLE ELECTRODE AND GAS SHIELD	**DUTY NO.**	404
TASK TITLE	CONDUCT GAS METAL ARC WELDING (GMAW) OF FLAT BUTT JOINT WITH CONSUMABLE ELECTRODE AND GAS SHIELD OF CORNER JOINT OR T JOINT	**TASK NO.**	4041
PERFORMANCE CRITERIA	The person performing this task must be able to complete the Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield of corner joint or T joint according to the specific welding process.		
RANGE STATEMENT	The task can be performed in the welding workshop under the supervision of welding engineer or mechanical engineer. The tools and equipment to be used include: 1. Welding power source for Gas Metal Arc Welding (GMAW); 2. Wire feeder; 3. Welding gun; 4. Control system; 5. Gas supply and water supply system; 6. Weldment; 7. Welding console (frame); 8. Angle grinder; 9. Chipping hammer; 10. Steel ruler; 11. Wire brush; 12. Labor protection articles (welding masks (protective glasses), welder gloves, work clothes, insulated shoes, etc.). 13. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety regulations and take safety precautions; 2. Select appropriate operation tools and equipment for this task; 2. Carry out equipment inspection; 3. Prepare weldment groove; 4. Clean the surface of weldment and welding wire; 5. Conduct assembly and positioned welding; 6. Carry out backing welding;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Carry out safety inspection of equipment, tools and clamps; 1.2 Carry out groove cleaning, assembly and positioned welding; 1.3 Reserve the reverse deformation of weldments; 1.4 Determine welding parameters; 1.5 Carry out arc ignition, welding and arc closing;

7. Carry out filling welding; 8. Carry out covering welding; 9. Clean the tools, equipment and the workplace; 10. Store the tools and equipment. 11. Observe health, occupational and environmental safety, rules and regulations	1.6 Carry out root cleaning treatment on the back of weld bead at the root of double-sided welding; 1.7 Clean the surface of welded joint; 1.8 Carry out self-inspection on the external quality of welded joints. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principle of gas shielded welding; 2.2 Selection principle of welding wire; 2.3 Principle of determining the distance from nozzle to weldment. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Standard for determining welding parameters of Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield of corner joint or T joint of low carbon steel or low alloy steel plate; 3.2 Welding appearance inspection methods and requirements; 3.3 Welding operation essentials of Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield of corner joint or t joint of low carbon steel or low alloy steel plate. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Report writing skills;
DESCRIPTION OF THE END PRODUCT / SERVICE	Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield of corner joint or T joint is completed according to the specific welding process
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation and use of equipment and tools 2. Safety operation and use of testing tools 3. Occupational health and safety 4. Waste and waste disposal methods

OCCUPATION	WELDING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT GAS METAL ARC WELDING (GMAW) OF FLAT BUTT JOINT WITH CONSUMABLE ELECTRODE AND GAS SHIELD	**DUTY NO.**	404
TASK TITLE	CONDUCT GAS METAL ARC WELDING (GMAW) OF FLAT BUTT JOINT WITH CONSUMABLE ELECTRODE AND GAS SHIELD OF LOW CARBON STEEL OR LOW ALLOY STEEL PLATE	**TASK NO.**	4042
PERFORMANCE CRITERIA	The person performing this task must be able to complete the Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield of low carbon steel or low alloy steel plate according to the specific welding process.		
RANGE STATEMENT	The task can be performed in the welding workshop under the supervision of welding engineer or mechanical engineer. The tools and equipment to be used include: 1. Welding power source for Gas Metal Arc Welding (GMAW); 2. Wire feeder; 3. Welding gun; 4. Control system; 5. Gas supply and water supply system; 6. Weldment; 7. Welding console (frame); 8. Angle grinder; 9. Chipping hammer; 10. Steel ruler; 11. Wire brush; 12. Labor protection articles (welding masks (protective glasses), welder gloves, work clothes, insulated shoes, etc.). 13. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety regulations and take safety precautions; 2. Select appropriate operation tools and equipment for this task; 3. Carry out equipment inspection; 4. Prepare weldment groove; 5. Clean the surface of weldment and welding wire;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Carry out safety inspection of equipment, tools and clamps; 1.2 Carry out groove cleaning, assembly and positioned welding; 1.3 Reserve the reverse deformation of weldments; 1.4 Determine welding parameters;

6. Conduct assembly and positioned welding; 7. Carry out backing welding; 8. Carry out filling welding; 9. Carry out covering welding; 10. Clean the tools, equipment and the workplace; 11. Store the tools and equipment. 12. Observe health, occupational and environmental safety, rules and regulations	1.5 Carry out arc ignition, welding and arc closing; 1.6 Carry out root cleaning treatment on the back of weld bead at the root of double-sided welding; 1.7 Clean the surface of welded joint; 1.8 Carry out self-inspection on the external quality of welded joints. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principle of gas shielded welding; 2.2 Selection principle of welding wire; 2.3 Principle of determining the distance from nozzle to weldment. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Standard for determining welding parameters of Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield of low carbon steel or low alloy steel plate; 3.2 Welding appearance inspection methods and requirements; 3.3 Operation essentials of Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield of low carbon steel or low alloy steel plate. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Report writing skills;
DESCRIPTION OF THE END PRODUCT / SERVICE	The weld seam meeting quality requirements is welded according to technical standards and welding procedures.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation and use of equipment and tools. 2. Safety operation and use of testing tools. 3. Occupational health and safety; 4. Waste and waste disposal methods.

OCCUPATION	WELDING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT GAS WELDING	**DUTY NO.**	405
TASK TITLE	CONDUCT GAS WELDING OF CORNER JOINTS OF LOW CARBON STEEL OR LOW ALLOY STEEL PLATES	**TASK NO.**	4051
PERFORMANCE CRITERIA	The person performing this task must be able to complete the gas welding of corner joints of low carbon steel or low alloy steel plates according to the specific welding process.		
RANGE STATEMENT	The task can be performed in the welding workshop under the supervision of welding engineer or mechanical engineer. The tools and equipment to be used include: 1. Oxygen bottle; 2. Acetylene gas bottle; 3. Pressure reducer; 4. Gas hose; 5. Welding wire; 6. Welding torch; 7. Firing gun; 8. Flash-back preventer; 9. Weldment; 10. Welding console (frame); 11. Angle grinder; 12. Chipping hammer; 13. Steel ruler; 14. Wire brush; 15. Labor protection articles (welding masks (protective glasses), welder gloves, work clothes, insulated shoes, etc.). 16. Safety gear		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety regulations and take safety precautions; 2. Select appropriate operation tools and equipment for this task; 3. Carry out equipment inspection; 4. Prepare the weldment groove and clean the weldment; 5. Preheat; 6. Positioned welding and positioned welded seam; 7. Carry out backing welding; 8. Carry out filling welding; 9. Carry out covering welding; 10. Clean the tools, equipment and the workplace; 11. Store the tools and equipment. 12. Observe health, occupational and environmental safety, rules and regulations	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Clean workpieces and welding wires; 1.2 Carry out safety inspection of equipment, tools and clamps; 1.3 Select the materials; 1.4 Reserve the reverse deformation of weldments; 1.5 Select flame energy rate, nozzle dip angle, flame height and welding speed; 1.6 Carry out gas welding ignition, flameout and tempering treatment; 1.7 Determine the position of solder joints and start welding, welding and finishing; 1.8 Clean the joint surface; 1.9 Carry out self-inspection on the external quality of the joints.

	2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Basic principle of gas welding; 2.2 Selection principle of welding gas; 2.3 Principle of determining flame energy rate. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Standard for determining welding parameters of gas welding of corner joints of low carbon steel or low alloy steel plates; 3.2 Welding appearance inspection methods and requirements; 3.3 Essentials of gas welding of corner joints of low carbon steel or low alloy steel plates. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Report writing skills;
DESCRIPTION OF THE END PRODUCT / SERVICE	Gas welding of corner joints of low carbon steel or low alloy steel plates completed according to the specific welding process.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation and use of equipment and tools. 2. Safety operation and use of testing tools. 3. Occupational health and safety; 4. Waste and waste disposal methods.

OCCUPATION	WELDING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT GAS WELDING	**DUTY NO.**	405
TASK TITLE	CONDUCT GAS WELDING OF T- JOINTS OF LOW CARBON STEEL OR LOW ALLOY STEEL PLATES IN FLAT POSITION	**TASK NO.**	4052
PERFORMANCE CRITERIA	The person performing this task must be able to complete the gas welding of T- joints of low carbon steel or low alloy steel plates according to the specific welding process.		
RANGE STATEMENT	The task can be performed in the welding workshop under the supervision of welding engineer or mechanical engineer. The tools and equipment to be used include: 1. Oxygen bottle; 2. Acetylene gas bottle; 3. Pressure reducer; 4. Gas hose; 5. Welding wire; 6. Welding torch; 7. Firing gun; 8. Flash-back preventer; 9. Weldment; 10. Welding console (frame); 11. Angle grinder; 12. Chipping hammer; 13. Steel ruler; 14. Wire brush; 15. Labor protection articles (welding masks (protective glasses), welder gloves, work clothes, insulated shoes, etc.). 16. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety regulations and take safety precautions; 2. Select appropriate operation tools and equipment for this task; 3. Carry out equipment inspection; 4. Prepare the weldment groove and clean the weldment; 5. Preheat; 6. Positioned welding and positioned welded seam; 7. Carry out backing welding;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Clean workpieces and welding wires; 1.2 Carry out safety inspection of equipment, tools and clamps; 1.3 Select the materials; 1.4 Reserve the reverse deformation of weldments; 1.5 Select flame energy rate, nozzle dip angle, flame height and welding speed;

8. Carry out filling welding; 9. Carry out covering welding; 10. Clean the tools, equipment and the workplace; 11. Store the tools and equipment. 12. Observe health, occupational and environmental safety, rules and regulations	1.6 Carry out gas welding ignition, flameout and tempering treatment; 1.7 Determine the position of solder joints and positioned welding, start welding, welding and finishing; 1.8 Clean the joint surface; 1.9 Carry out self-inspection on the external quality of welded joints. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principle of gas welding; 2.2 Selection principle of welding gas; 2.3 Principle of determining flame energy rate. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Standard for determining welding parameters of gas welding of T joints of low carbon steel or low alloy steel plates; 3.2 Welding appearance inspection methods and requirements; 3.3 Essentials of gas welding of T joints of low carbon steel or low alloy steel plates. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Gas welding of T- joints of low carbon steel or low alloy steel plates is completed according to the specific welding process.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation and use of equipment and tools. 2. Safety operation and use of testing tools. 3. Occupational health and safety; 4. Waste and waste disposal methods

APPENDIX: DACUM CHART FOR WELDING TECHNICIAN - NTA LEVEL 4

DUTIES	TASKS	ENABLERS
1.0 Conduct safety operation of welding	1.1 Conduct personal protection. 1.2 Prepare and selecting the welding environment.	**General skills and knowledge** · Cooperating with others using communication skills and report to the superiors · Health and safety prevention knowledge · Emergency treatment of corresponding accidents · Cleaning of the tools, equipment and workplace · Correct storage of tools and equipment · Determination of the environmental requirements such as temperature, humidity and wind force required for safe welding **Tools and equipment** · Safety shoes · Protective suits · Welding gloves · Welding masks · Goggles · Windproof shed · Dehumidifying instrument **Requirements for employees** Teamwork spirit, honesty, pursuit of excellence, meticulous and earnest, good time management, and keeping promises
2.0 Formulate simple welding process	2.1 Select welding method. 2.2 Select welding materials.	**General skills and knowledge** · Cooperating with others using communication skills and report to the superiors · Health and safety prevention knowledge · Emergency treatment of corresponding accidents · Cleaning of the tools, equipment and workplace · Correct storage of tools and equipment · Correct taking and storing welding materials · Selecting welding method according to requirements and conditions

DUTIES	TASKS	ENABLERS
		Tools and equipment · Safety shoes · Protective suits · Welding gloves · Welding masks · Goggles · Welding power supply · Straightedge · Welding rod dryer **Materials** · Electrode, flux, wire, gas **Requirements for employees** Teamwork spirit, honesty, pursuit of excellence, meticulous and earnest, good time management, and keeping promises
3.0 Conduct Manual Shielded Metal Arc Welding (SMAW) of flat butt joint	3.1 Conduct flat shielded metal arc welding of corner joint or T joint 3.2 Conduct flat butt welding of low carbon or low alloy steel plates using shielded metal arc welding.	**General skills and knowledge** · Cooperating with others using communication skills and report to the superiors · Health and safety prevention knowledge · Emergency treatment of corresponding accidents · Cleaning of the tools, equipment and workplace · Correct storage of tools and equipment · Reading and understanding drawings · Reserving the reverse bending deformation of weldments correctly · Methods and skills of Manual Shielded Metal Arc Welding (SMAW) of flat butt joint **Tools and equipment** · Welding power supply for shielded metal arc welding · Welding power cables · Welding tong · Ground clamp · Welding rod drying box · Welding rod insulation barrel · Welding console (frame) · Angle grinder · Chipping hammer · Steel ruler · Wire brush

DUTIES	TASKS	ENABLERS
		· Labor protection articles (welding masks (protective glasses), welder gloves, work clothes, insulated shoes, etc.) **Materials** · Electrode, weldment, electric power **Requirements for employees** Teamwork spirit, honesty, pursuit of excellence, meticulous and earnest, good time management, and keeping promises
4.0 Conduct Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield	4.1 Conduct Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield of corner joint or T joint 4.2 Conduct Gas Metal Arc Welding (GMAW) of flat butt joint with consumable electrode and gas shield of low carbon steel or low alloy steel plate.	**General skills and knowledge** · Cooperating with others using communication skills and report to the superiors · Health and safety prevention knowledge · Emergency treatment of corresponding accidents · Cleaning of the tools, equipment and workplace · Correct storage of tools and equipment · Reading and understanding drawings · Reserving the reverse bending deformation of weldments correctly · Cleaning of the surface of welding head **Tools and equipment** · Welding power source for Gas Metal Arc Welding (GMAW) · Wire feeder · Welding gun · Control system · Gas and water supply system · Welding console (frame) · Angle grinder · Chipping hammer · Steel ruler · Wire brush · Labor protection articles (welding masks (protective glasses), welder gloves, work clothes, insulated shoes, etc. **Materials** · Welding wire, weldment, shielding

DUTIES	TASKS	ENABLERS
		gas, electricity, water **Requirements for employees** Teamwork spirit, honesty, pursuit of excellence, meticulous and earnest, good time management, and keeping promises
5.0 Conduct gas welding	5.1 Conduct gas welding of corner joints of low carbon steel or low alloy steel plates. 5.2 Conduct gas welding of T- joints of low carbon steel or low alloy steel plates in flat position.	**General skills and knowledge** · Cooperating with others using communication skills and report to the superiors · Health and safety prevention knowledge · Emergency treatment of corresponding accidents · Cleaning of the tools, equipment and workplace · Correct storage of tools and equipment · Reading and understanding drawings · Reserving the reverse bending deformation of weldments correctly · Carrying out self-inspection on the appearance quality of joints **Tools and equipment** · Oxygen cylinder · Acetylene gas bottle · Pressure reducer · Gas hose · Torch · Ignition gun · Flash-back preventer · Welding console (frame) · Angle grinder · Chipping hammer · Steel ruler · Wire brush · Labor protection articles (welding masks (protective glasses), welder gloves, work clothes, insulated shoes, etc.) **Materials** · Welding wire, weldment, oxygen, acetylene, electricity **Requirements for employees** Teamwork spirit, honesty, pursuit of excellence, meticulous and earnest,

DUTIES	TASKS	ENABLERS
		good time management, and keeping promises