

QUALIFICATION SPECIFICATION						
SECTION A						
QUALIFICATION DEVELOPER		Ministry of Employment, Labour Productivity and Skills Development				
TITLE		Certificate V in Welding and Fabrication			NCQF LEVEL	5
FIELD	Manufacturing, Engineering and Technology			SUBFIELD	Welding and Fabrication	
New qualification	√	Review of existing qualification				
SUB-FRAMEWORK	General Education		TVET	√	Higher Education	
QUALIFICATION TYPE	Certificate	√	Diploma		Bachelor	
	Bachelor Honours		Master		Doctorate/ PhD	
CREDIT VALUE					120 Credits	
RATIONALE AND PURPOSE OF THE QUALIFICATION						
Rationale The Botswana Vision 2036 states that development of the human capital and the informal sector and the micro and small enterprises (MSES) are essential in achieving the VISION 2036 pillars, Sustainable Economic Development and Human and Social Development. Although Botswana has been fortunate to experience unprecedented economic growth since independence, this has not generated enough jobs to reduce unemployment. The most severely hit group amongst the unemployed is the youth, who account for about 51.7 % of the total unemployed, with the 15-19 age group most affected (Statistics Botswana 2018). The Botswana Education and Training Sector Strategic Plan (ETSSP 2015-2020) marks a significant milestone in our collective efforts as a nation to bring about a more diversified, knowledge-based economy. Through a planned and careful development of human capital, the ETSSP seeks to refocus our education and training towards fulfillment of social and economic aspirations identified in our Revised National Policy on Education (RNPE) of (1994), the National Development Plan 11, Vision 2036 and as well as the Millennium Development Goals (MDG). In particular, the ETSSP is intended to strengthen the link between qualifications and labour market requirements, thereby ensuring that education and training outputs are more closely aligned to socio economic development needs of the country. In line with this strategic goal, the Human Resource Development Council (HRDC 2016) report on top occupations in demand has identified Welding and Fabrication as one of the priority skills for the Manufacturing and Engineering Sector.						

From the abstract retrieved from: Welding Technology in the Construction Industry in Botswana by C Cheterev and J D G Foster, it states that a survey of companies connected to welding in support of the construction industry in Botswana was conducted by these authors. The results show that companies in the industry are generally small, and that the welding technology used is predominantly that of manual metal arc welding. The application of metal active gas welding (mag) is very limited in comparison with the level of use that is achieved in the industrialized countries of the world. The comparison was used to work out the fundamental directions for further development of welding technology and infrastructure in Botswana. Recommendations were made to assist in the application of modern welding technology in Botswana, which would bring benefits to the construction industry in terms of both cost and quality. A way should be found to ensure that craft trainees and practicing welders in all industries gain experience of advanced methods of production that employ modern welding technologies. Efforts should also be made to encourage partnerships between the private sector and government in education and training, especially regarding curriculum development. This would ensure that education meets the needs of the construction and engineering sector.

PURPOSE

The purpose of this qualification is to produce artisans with skills, knowledge and competence to:

- Use mechanized equipment to cut metals
- Lay out, erect and install steel structures
- Layout and fabricate work pieces and components using the calculation method
- Weld aluminium and its alloys using TIG welding process
- Join metals using resistance welding (RW) process
- Perform destructive and non-destructive testing on welded specimens
- Interpret complex structural steel drawings and fabricate as per design requirements.

People holding this qualification should be able to perform routine work with no or less supervision and display the ability to lead, and communicate with, people to ensure the relevant work is performed in an acceptable manner.

Minimum entry requirement for this qualification is a:

NCQF level 4, Certificate IV (General Education or TVET) or equivalent.

Recognition of Prior Learning (RPL):

There will be access through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) in accordance with the RPL and CAT National Policies.

QUALIFICATION SPECIFICATION			SECTION B
GRADUATE PROFILE (LEARNING OUTCOMES)	ASSESSMENT CRITERIA		
Demonstrate knowledge, skill, and competence to engage in vocationally relevant tasks, be it in an organization or vocational context.	• Apply negotiation and communication skills prior to and during work-based learning. • Perform assigned vocation-related tasks to the required standards. • Apply effective fundamental and core skills throughout the duration of the work-based learning program. • Adhere to health and safety requirements. • Apply problem solving skills as and when problems are encountered during work process. • Contribute effectively to teamwork initiatives within the work environment. • Evaluate the work-based learning experience to determine its benefits and/or limitations.		
Perform hand-held plasma cutting on mild steel in accordance with code of safe practice	• Describe the plasma arc cutting process and its applications • Identify the different components of Plasma Arc cutting equipment and PPE required for its use • List the characteristics and hazards associated with plasma cutting • Safely set up the equipment, adjust air pressure and current to correct settings • Quality assure cuts		
Demonstrate knowledge and ability to weld stainless steel and aluminium and its alloys using Tungsten Inert Gas (TIG) welding process	• Hazards associated with shielded metal arc welding processes are identified prior to welding in accordance with a code of safe practice • Identify by labelling different parts of Tungsten Inert Gas (TIG) welding equipment		

	• Identify by listing safety precautions to be observed when welding stainless steel and aluminium and its alloys using Tungsten Inert Gas (TIG) welding process • Assemble correctly Tungsten Inert Gas (TIG) welding equipment • Select and correctly set Tungsten Inert Gas (TIG) welding process parameters • Weld stainless steel and aluminium and its alloys using Tungsten Inert Gas (TIG) welding process to • Inspect welded joints for defects in compliance with job specification • Comply with safety regulations and safe working practices • Demonstrate knowledge and ability to store and care for the equipment
Demonstrate knowledge and ability to weld mild steel using Metal Active Gas (MAG/ CO ₂) welding process	• Hazards associated with shielded metal arc welding processes are identified prior to welding in accordance with a code of safe practice • Identify by labelling different parts Metal Active Gas (MAG/ CO₂) welding process • Identify by listing safety precautions to be observed when welding mild steel using Metal Active Gas (MAG/ CO₂) welding process • Assemble correctly Metal Active Gas (MAG/ CO₂) welding equipment • Assemble correctly Metal Active Gas (MAG/ CO₂) welding equipment • Use Metal Active Gas (MAG/ CO₂) welding equipment to weld mild steel • Inspect welded joints for defects in compliance with job specification • Comply with safety regulations and safe working practices
Inspect welded joints using different methods of Testing.	• Identify by labelling different parts of a fillet weld and groove weld.

	• Identify by listing different weld faults/defects, causes and remedies. • Destructive and non-destructive testing processes are explained and performed on welded specimens as per job requirement. • Prepare welded specimen for destructive and non-destructive testing • Destructive equipment is identified according to the job specification • Prepare the specimen for destructive testing • Perform destructive testing on welded specimens • Quality assure welded specimens
Layout, fabricate and weld a steel structure using manual metal arc welding process	• Plan, prepare and organize metal fabrication process • Interpret and verify engineering drawings to identify correct configurations • Lay out pattern and transfer features of drawings to work piece • The metal structure is laid out and fabricated in accordance with specified requirement • Fabricated metal structures are checked for quality for compliance to specifications in accordance with specified job requirements
Develop, fabricate and weld components using radial line, parallel line, triangulation and spiral development	• Engineering drawing concepts are explained and interpreted as per job requirements • Prepare to draw and interpret drawings. • Develop patterns using radial line, parallel line, triangulation and spiral development • Transfer patterns on to the tasks as per job specification • Carry-out tasks as per job specification, adhering to health, safety and quality standard. • Perform quality checks on the job done and make improvements as needed.

	• Clean tools and equipment and store them in an appropriate place after use. • Clean/tidy up the work area in accordance with organizational requirements.
Perform metal joining using resistance spot welding process	• Identify unsafe conditions for welding with the resistance spot welding process • Identify labelling different parts of resistance spot welding process • Assemble resistance spot welding process equipment • Perform tasks as per job specification, adhering to health, safety and quality standard. • Perform quality checks on the job done and make improvements as needed. • Clean tools and equipment and store them in an appropriate place after use. • Clean/tidy up the work area in accordance with organizational requirements.
Repair cast iron components using Manual Metal Arc welding process	• Plan and prepare the job as per requirement. • Select the type & size of electrode, power source, polarity, welding current as per requirement • Deposit the weld adapting appropriate welding Technique and safety aspects. • Clean the welded joint thoroughly. • Carry out visual inspection to ascertain quality of weld joint • Perform tasks as per job specification, adhering to health, safety and quality standard. • Clean tools and equipment and store them in an appropriate place after use. • Clean/tidy up the work area in accordance with organizational requirements.

Perform welding of pipe joints in different positions (5 F and 6 G)	• Examine the job specification to determine the tools, equipment and consumables to be used • Select correctly tools, equipment and consumables to be used • Assemble correctly manual metal arc welding equipment • Set correctly manual metal arc welding process parameters • Perform tasks as per job specification, adhering to health, safety and quality standard. • Perform quality checks on the job done and make improvements as needed. • Clean tools and equipment and store them in an appropriate place after use. • Clean/tidy up the work area in accordance with organizational requirements.
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QUALIFICATION STRUCTURE			
			SECTION C
FUNDAMENTAL COMPONENT	Title	Level	Credits
Subjects/Units/Modules/Courses	Entrepreneurship	5	11
CORE COMPONENT	Thermal Joining Processes	5	17
Subjects/Units/Modules/Courses	Weld inspection and quality control	5	10
	Pattern development	5	10
	Thermal Cutting Process	5	10
	Structural Steelwork 2	5	12
	Work placement	5	48
ELECTIVE COMPONENT	Pipe welding 5 F and 6 G positions	5	2
Subjects/Units/Modules /Courses	Repair cast iron components	5	2
Rules of combinations, Credit distribution (where applicable):			
A candidate to achieve a maximum of 120 credits inclusive of 11 credits of fundamental, 107 credits of core components and 2 credits of elective component. To be awarded this qualification a candidate is required to achieve the stipulated total credits inclusive of the fundamental, core and elective components. A candidate is required to complete the required period of work-based learning /work-placement or projects and associated portfolio of evidence to be eligible for the award of the qualification.			
ASSESSMENT AND MODERATION ARRANGEMENTS			
ASSESSMENT ARRANGEMENTS			
All assessments, formative and summative, leading/contributing to the award of credits or a qualification should be based on learning outcomes and/or sub-outcomes.			
Formative assessment			
Formative assessment or continuous assessment contributing towards the award of credits should be based on course outcomes. The contribution of formative assessment to the final grade shall be 60% .			
Summative assessment			

Learners shall undergo assessment including written and practical and simulated projects. The final examination for each course contributes **40%** of the final mark for that course.

MODERATION ARRANGEMENTS

Internal and external moderators to be engaged will be BQA accredited subject specialists in relevant fields with relevant industry experience and academic qualifications. Both internal and external moderation shall be done in accordance with applicable policies and regulations.

RECOGNITION OF PRIOR LEARNING (RPL) if applicable

Candidates may submit evidence of prior learning and current competence and/or undergo appropriate forms of RPL assessment for the award of credits towards the qualification in accordance with applicable RPL policies and relevant national-level policy and legislative framework. Implementation of RPL shall also be consistent with requirements, if any, prescribed for the field or sub-field of study by relevant national, regional or international professional bodies.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Learning Pathways:

Horizontal Articulation- Graduates of this qualification can progress in the following:

- Certificate V in Welding
- Certificate V in Mechanical Engineering

Vertical Articulation

Graduates of this qualification can progress in the following:

- Diploma in Coded Welding
- Diploma in Welding Inspection
- Diploma in Mechanical Engineering

Employment Pathways

People graduated in this qualification may work as:

- Artisan welder
- Technician
- Pipe fitter

- Boilermaker
- Set up own informal business.

QUALIFICATION AWARD AND CERTIFICATION

Minimum standards of achievement for the award of the qualification

A candidate is required to achieve the stipulated minimum 120 credits inclusive of 11 credits for fundamental, 107 credits for core components and 2 credits for elective to be awarded the qualification.

Certification

Candidates meeting prescribed requirements will be awarded a certificate for award of the **Certificate V in Welding and Fabrication** in accordance with standards prescribed for the award of the qualification and applicable policies.

REGIONAL AND INTERNATIONAL COMPARABILITY

Comparability Matrix of Qualifications

Subfield: Fabrication and Welding

Introductory Statement

Benchmarking has been done against a sample of similar types and levels qualifications offered within the region and beyond to appreciate international trends and practices in relation to exit level descriptors and scope of content covered and ascertain regional and international comparability and articulation of the proposed qualification. The outcome of this process is highlighted below:

Summary of Similarities and Differences Observed

National Certificate: Welding Application and Practice -**SGB WELDING(NQF level 4)**worth 158 credits The qualification is intended to develop knowledge skills and competences in:

1. Demonstrate an ability to weld pipes using a variety of welding processes and operations.
2. Demonstrate an understanding of quality specifications and an ability to interpret these and evaluate fabricated components to determine compliance with specifications.
3. Maintain and support procedures to solve a variety of problems, both familiar and unfamiliar, within a welding context and operate within familiar and new situations, taking responsibility and making decisions.
4. Coordinate work team, promote the maintenance of a safe and efficient workplace and developing the skills and performance of workgroup members.

5. Communicate with peers and members of supervisory / management levels by producing simple written reports using information gathered and summarized from a range of sources.
6. Demonstrate the ability to communicate and present information clearly and reliably, and to analyse information in order to identify problems and determine trends.
7. Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning.

- Assessment strategies for the qualification include questioning, observation, reports and portfolio.

Rules for the award: Candidates are required to achieve a minimum of 158 credits inclusive of: fundamental, Core, and Electives. Holders of this qualification may pursue other qualifications in corporate areas for multi skilling purposes. For upgrading graduates may pursue qualifications at diploma level. Employment pathways for graduates include boiler making, plating and auto body building.

Compentenz - National Certificate in Engineering - Fabrication (NZQF level 5) worth 100 credits The qualification is intended to develop knowledge skills and competences in:

1. Engineering Fabrication
2. Forming and shaping of fabrication materials
3. Assembly and mechanical joining of fabricated parts
4. Mechanical Services
5. Precision Engineering
6. Material Removal

Assessment strategies for the qualification include research, questioning, observation, reports and portfolio.

Rules for the award: Candidates are required to achieve a minimum of 100 credits inclusive of fundamental, Core, and Electives.

Holders of these qualifications may pursue other qualifications in corporate areas for multi skilling purposes. For upgrading graduates may pursue qualifications at diploma level. Employment pathways for graduates include apprentice welding fabricator and apprentice mechanical engineer.

A direct comparison with these international qualifications indicates that the education and training focus of all the qualifications is basically the same. However, it was noted that the method of assessment is more or less the same: generally, assessments are normally through on-the-job observation and questioning which actually

confirms learners can demonstrate competence in the workplace. Candidates are assessed to underpin knowledge, understanding and work-based performance.

Comparability and articulation of the proposed qualification with the ones examined

The qualification designed for Botswana compares very well with the foreign qualifications studied in that: it covers / emphasizes all similar competencies and attributes and that it follows a structure typical of similar types and levels of qualifications.

REVIEW PERIOD

This qualification shall be reviewed every five (5) years