GOVERNMENT NOTICES

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

No. 431 **30 April 2009**

SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)

In accordance with Regulation 24(c) of the Regulations of 28 March 1998, the Standards Generating Body (SGB) for

Manufacturing and Assembly Process

registered by Organising Field 06, Manufacturing,Engineering and Technology , publishes the following Qualifications and Unit Standards and for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purposes of the Qualifications and Unit Standards. The full Qualifications and Unit Standards can be accessed via the SAQA web-site at **www.saqa.org.za**. Copies may also be obtained from the Directorate for Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comments on the Qualifications and Unit Standards should reach SAQA at the address ***below and no later than 01 June 2009.*** All correspondence should be marked **Standards Setting – SGB for Manufacturing and Assembly Process** addressed to

The Director: Standards Setting and Development
SAQA
Attention: Mr. E. Brown
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SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
National Certificate: Foundry Operations

SAQA QUAL ID	*QUALIFICATION TITLE*		
66512	National Certificate: Foundry Operations		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
National Certificate	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	121	Level 2	Regular-Unit Stds Based

This qualification does not replace any other qualification and is not replaced by another qualification.

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

This qualification is designed to empower learners to operate efficiently in Foundry Operations, manufacturing either quality pattern equipment (wooden patternmaking), or sand composite moulds and cores by hand (floor moulding) or machine (machine moulding and coremaking) for consumption within a metal casting process, or producing the liquid metal (foundry melting) consumed by such metal casting processes.

This qualification gives recognition for the skills, knowledge and values acquired by learners involved with:

- The inspection, repairs to and manufacture of wooden pattern equipment required for the sand moulding process.
- The manufacture of sand composite moulds.
- The preparation, use and operation of Foundry Melting equipment.

The main skills learnt in this qualification are the ability to:

- Prepare, use and operate equipment to support the Foundry Melting process equipment. This capability requires a foundational understanding of quality requirements and of the foundry melting process.
- Manufacture and maintain simple wooden pattern equipment and recognise and respond to equipment defects. This capability requires an understanding of pattern equipment materials, associated engineering hand and power tools, concepts of measurement, quality requirements and the ability to draw and interpret simple engineering drawings.
- Manufacture simple moulds and assemble cores. This capability requires an understanding of the associated pattern equipment, engineering hand and measuring tools, quality requirements and the ability to read and interpret simple technical drawings.

Practical skills play a large role in this qualification.

On completion, the learner will receive recognition for the ability to:

• Manufacture a product (pattern equipment or sand moulds and cores or molten metal) that is used by downstream processes.
• Check product against customer requirements, engineering drawings or quality standards.
• Report on the quality of the manufactured product.
• Take corrective action where required.
• Solve known associated/routine problems.
• Function in workplaces that utilise such Foundry Operations.

Qualified learners will also understand:

• The basics of how a business functions.
• Their role in the business, i.e. in production and related activities.
• How they are affected by legislation, regulations, agreements and policies related to their particular working environment.
• How they should function within the legislative, safety, health, environmental, quality and risk management systems that govern their workplace.
• How to apply the various policies and procedures related to these systems.

Qualifying in the exit level outcomes will enable learners to effectively perform a range of workplace activities. What learners achieve in this qualification will also serve as a basis for further learning within Foundry Patternmaking, Foundry Moulding or Foundry Melting processes. Learners will also have foundational competence in mathematics, science, reading, writing and speaking relevant to Foundry Operations.

Rationale:

The Foundry industry is a complex and specialised sector supplying a vast range of quality metal products to downstream customers. The emergence of South Africa as a cost-effective supplier to international markets has created a demand for people with the skills to manufacture the final products as well as function within the support processes to the manufacturing process. These processes include Foundry Patternmaking, Foundry Moulding and Foundry Melting.

This is the first in a series of qualifications in Foundry Operations starting at NQF Level 2 and progressing to NQF Level 4. This series of qualifications will enable learners to:

• Develop their existing skill level and progress vertically in a selected career path within the Foundry industry.
• Receive recognition for experience gained in the workplace through an RPL process.
• Obtain skills and knowledge portable within similar metal product manufacturing industries.
• Gain access to higher levels of learning and learning provision.
• Access opportunities to progress in their personal life and career, and add value to the operations in which they function.
• Contribute to the growth of the South African economy and the development of society.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
This qualification assumes learners have a National Certificate (General Education and Training Certificate) in Manufacturing, Engineering and Related Activities at NQF Level 1 or equivalent.

If the learner does not already have such a qualification, learning in preparation for this qualification would also have to include NQF Level 1 learning in:

• Communication.

- Mathematical Literacy.
- Basic concepts of science and technology.

Recognition of prior learning:

This qualification may be obtained through a process of RPL. The learner should be thoroughly briefed prior to the assessment and support provided and guidance should be provided to assist in the process of developing a portfolio. While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes.

Care should be taken that the process used provides the learner with an opportunity to demonstrate competence and is not too demanding as to prevent learners from taking up the RPL option towards gaining a qualification.

Access to the Qualification:

This qualification is designed for learners who:

- Are new-entry workers to Foundry Operations.
- Have attended courses and applied the knowledge gained in the workplace.
- Are already workers and have acquired the skills and knowledge without attending formal courses.
- Are part of a learnership programme, which integrates structured learning, and work experience.

Access for learners with physical disabilities is dependent:

- On the type and severity of disability.
- On the nature of the Foundry Operations environment and the inherent requirements of equipment operation.

QUALIFICATION RULES
In order to be awarded this qualification totalling 121 credits, learners have to be declared competent in:

- All listed unit standards in the Fundamental category of the qualification totaling 36 credits.
- All listed unit standards in the Core category of the qualification totaling 25 credits.
- A selection of specialisation unit standards in the Elective category of the qualification totaling 60 credits.

Depending on their area of specialisation (Foundry Patternmaking, Foundry Moulding OR Foundry Melting), learners may choose from the categories:

Wooden Patternmaking:

- ID 264054: Manufacture simple wooden pattern equipment, NQF Level 2, 16 credits.
- ID 12219: Select, use and care for engineering power tools, NQF Level 2, 6 credits.
- ID 12238: Draw and interpret simple engineering drawings, NQF Level 2, 10 credits.
- ID 13159: Care for, select and use hand and measuring tools, NQF Level 1, 4 credits.
- ID 13165: Describe the properties of materials found in the workplace and describe their impact on the environment, NQF Level 1, 6 credits.
- ID 13238: Mark off basic engineering shapes, NQF Level 2, 2 credits.
- Plus a choice of unit standards from the Elective category of learning to the value of at least 10 credits.

OR

Floor Moulding:

• ID 264035: Select, use and care for moulding materials and equipment, NQF Level 1, 8 credits.
• ID 264057: Produce a mould, NQF Level 2, 16 credits.
• ID 9885: Read and interpret engineering drawings, NQF Level 3, 12 credits.
• Plus a choice of unit standards from the Elective category of learning to the value of at least 18 credits.

OR

Machine Moulding:

• ID 264035: Select, use and care for moulding materials and equipment, NQF Level 1, 8 credits.
• ID 264037: Produce moulds using a moulding machine, NQF Level 1, 20 credits.
• ID 9885: Read and interpret engineering drawings, NQF Level 3, 12 credits.
• Plus a choice of unit standards from the Elective category of learning to the value of at least 14 credits.

OR

Machine Coremaking:

• ID 264015: Produce cores using a coremaking machine, NQF Level 1, 16 credits.
• ID 264035: Select, use and care for moulding materials and equipment, NQF Level 1, 8 credits.
• ID 9885: Read and interpret engineering drawings, NQF Level 3, 12 credits.
• Plus a choice of unit standards from the Elective category of learning to the value of at least 18 credits.

OR

Foundry Melting:

• ID 264077: Demonstrate a basic understanding of the methods of chemical analysis for metals, NQF Level 2, 2 credits.
• ID 264095: Demonstrate an understanding of introductory principles of electricity as applied in a metals production context, NQF Level 2, 2 credits.
• ID 264115: Demonstrate knowledge of introductory principles of metallurgy, NQF Level 2, 6 credits.
• ID 264134: Demonstrate a basic understanding of quality, NQF Level 2, 4 credits.
• ID 114881: Prepare, use and operate equipment to support a manufacturing process, NQF Level 2, 32 credits).
• Plus a choice of unit standards from the Elective category of learning to the value of at least 8 credits

EXIT LEVEL OUTCOMES

1. Operate within the foundry manufacturing environment.

2. Communicate with all levels of work in the foundry production environment.

A choice of the following exit level outcomes depending on the chosen specialisation area:

3. Read, interpret and produce basic technical drawings.

OR

4. Understand the manufacturing process.

OR

5. Maintain and manufacture simple wooden pattern equipment.

OR

6. Prepare for and produce simple moulds or cores.

OR

7. Ready input material, equipment and/or process in line with product and scheduling requirements.

ASSOCIATED ASSESSMENT CRITERIA
Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Output and quality requirements are met according to production requirements.
1.2 Safe working practices are applied according to safety procedures.
1.3 An understanding of materials used in the workplace is demonstrated according to material properties.
1.4 Solve problems and emergencies are dealt with in an efficient and effective manner by following procedures.
1.5 Relationships with peers and supervisory/management levels are established and functioning using constructive communication procedures.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Regular and ongoing communication is conducted according to communication practices.
2.2 Daily work schedules and production issues are discussed on a regular basis with other team members.
2.3 Information relevant to own work context is recorded and reported according to procedure.
2.4 Demonstrate an understanding of options for further learning in this or a related field of learning according to possible specialisation areas.

A choice of the following exit level outcomes depending on the chosen specialisation area.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Pattern equipment that require manufacturing is identified and their requirements are interpreted according to technical drawings.
3.2 Technical drawing(s) are produced and meets job requirements.
3.3 Response to questioning indicates understanding of issues related to technical drawing concepts and material lists.

OR

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 Material and pattern equipment damage and production of scrap or faulty moulds is minimised.
4.2 Non-conformances and actions taken are accurately and clearly (orally or in writing) reported.
4.3 A clean and safe work area is maintained according to housekeeping procedures.
4.4 Response to questioning indicates understanding of issues related to the manufacturing process.
4.5 Recognise and respond to changes in the manufacturing process according to process indicators.

OR

Associated Assessment Criteria for Exit Level Outcome 5:

5.1 Appropriate checks are performed and the pattern equipment is prepared to specification(s).
5.2 Appropriate hand and power tools are correctly used according to procedure.
5.4 Operational and customer requirements are met in maintaining and manufacturing pattern equipment.
5.5 Non-conformances and actions taken are reported according to procedure.
5.6 A clean and safe work area is maintained according to housekeeping procedures.
5.7 Response to questioning indicates understanding of issues related to pattern equipment inspection, preparation and manufacturing according to procedure.

OR

Associated Assessment Criteria for Exit Level Outcome 6:

6.1 Technical sketches and drawings are read and interpreted according to procedure.
6.2 Materials and/or moulds are prepared and processed according to procedure.
6.3 Adjustments or changes are made to equipment and process according to procedure.
6.4 Mould quality is monitored in terms of quality parameters.
6.6 Problems, changes and/or malfunctions are recognised and reported according to procedure.
6.7 Response to questioning indicates understanding of issues related to preparing, producing and processing materials and moulds according to procedure.

Associated Assessment Criteria for Exit Level Outcome 7:

7.1 Materials are prepared and processed according to standard operating procedure.
7.2 Production equipment and/or process are prepared, started up and shut down according to procedure.
7.3 Adjustments or changes are made to equipment and process according to procedures.
7.4 Materials are received, verified and stored according to procedure.
7.5 Problems, changes and/or malfunctions are recognised and reported.
7.6 Response to questioning indicates understanding of issues related to readying materials, equipment and/or process according to procedure.

Integrated Assessment:

Integrated assessment at the level of the qualification provides an opportunity for learners to show they are able to integrate concepts, actions and ideas achieved across a range of unit standards and contexts.

Integrated assessment must evaluate the quality of observable performance as well as the thinking behind the performance, and must be based on a summative assessment guide. The

guide will spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in the primary activity as well as other interactions).
- Asking questions and initiating short discussions to test understanding.
- looking at records and reports in the portfolio and reviewing previous assessments.

In some cases inference will be necessary to determine competence depending on the nature and context within which performance takes place.

Since this is a foundational qualification, it is necessary to ensure that the fundamental part of the qualification is also targeted to ensure that while the competence may have been achieved in a particular context, learners are able to apply it in a range of other contexts and for further learning. The assessment should also ensure that all the critical cross-field outcomes have been achieved.

The learner may choose in which language s/he wants to be assessed. This should be established as part of a process of preparing the learner for assessment and familiarising the learner with the approach being taken.

While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes. The assessment process should cover both the explicit tasks required for the qualification as well as the understanding of the concepts and principles that underpin the activities associated with Foundry Operations.

INTERNATIONAL COMPARABILITY

An extensive international search was conducted for evidence of comparable education and training systems. Countries included in the search were Australia, New Zealand, Britain, Scotland, Canada, North and South America, Sweden, Finland, Germany and South African SADC countries.

Despite the fact that Foundry Operations are evident and well developed world-wide, relatively little sources of outcomes-based, standards-based and/or learning material could be found during the research. Indications are that operatives are trained on the job by skilled co-workers, supported by equipment and input material suppliers.

Additional to this, subject matter experts party to the standards generation process contacted their international counterparts to establish what learning processes they have available. There is evidence of training material, although not aligned to any formal qualification framework.

The only detailed information found, related to the New Zealand Qualifications Authority, where reference was found within the National Certificate Metal Casting (Technology) (Level 4), reference 0129. This qualification embraces both Engineering as well as Foundry (Patternmaking and Moulding) disciplines.

The comparison was made difficult because neither the fundamental learning elements nor some of the generic core elements are specified. A further complication is brought about by the fact that the learning required crosses several levels. Further to this, the New Zealand qualification does not specify the level of complexity that has to be achieved. The applied competence in the South African qualification focuses on achieving a specific level of competence required by a person working in a real-world Foundry Operations context in which a degree of specialisation, experience and problem-solving ability is required.

Further comparison elements are highlighted below:

Comparison Element; New Zealand Metal Casting qualifications; This Foundry Operations qualification suite:

- Scope; Nominal competence in a wide range of mechanical engineering skills; Mastery of specific foundry moulding skills in context.
- Approach; Task based; Skills development-based.
- Level(s); Level 1, 2, 3 and 4; Level 2, 3 and 4.
- Context; Partly contextualised; Contextual.
- Assessment; Institution or work-based; Work-based and portfolio-based.
- Essential embedded knowledge; Not clear; Specified.
- Credits; 20, 124, 88 and 75 respectively; 120, 126 and 140 respectively.
- Fundamental learning; Not formally specified; Specified.
- Business relations; Not formally specified; Specified.
- Working with and developing others; Not formally specified; Specified.
- Life skills; Not formally specified; Specified.

There are considerable similarities in the competencies required but the approach of the South African qualification looks at whole-person development in not only technological, but also in team and business related skills and makes explicit assumptions related to level of schooling and life skills.

It is evident that the technical content of this qualification for Foundry Operations places emphasis on safety, quality and best practice but is of better quality and greater value to learners when compared with that found during the research.

ARTICULATION OPTIONS

The qualification has been designed and structured so that qualifying learners can move both horizontally from one area of specialisation (Foundry Patternmaking, Foundry Moulding, Foundry Melting) to another, and vertically, further specialising in a particular skills area.

This qualification articulates horizontally with the following qualifications:

- ID 36154: National Certificate in Polymer Composite Fabrication, NQF Level 2.
- ID 58718: National Certificate in Metals Processing, NQF Level 2.
- ID 21008: National Certificate in Iron and Steel Manufacturing, NQF Level 2.
- ID 49018: National Certificate in Metals Production, NQF level 2.
- ID 22991: National Certificate in Refractories Installation, NQF Level 2.

This qualification articulates vertically with the following qualifications:

- ID 66449: National Certificate in Foundry Operations, NQF Level 3.
- ID 22670: National Certificate in Construction Carpentry, NQF level 3.
- ID 23280: National Certificate in Mechanical Engineering:Tooling Manufacture, NQF Level 3.
- ID 21009: National Certificate in Iron and Steel Manufacturing, NQF Level 3.
- ID 36155: National Certificate in Polymer Composite Fabrication, NQF Level 3.
- ID 58719: National Certificate in Metals Processing, NQF Level 3.
- ID 49019: National Certificate in Metals Production, NQF level 3.

The qualification should also, in terms of the fundamental, non-manufacturing unit standards and other portable skills, articulate with any other qualification at NQF Level 2 and 3 in the field of engineering and manufacturing processes.

The qualification has been designed so that the learner can meaningfully articulate into the higher education and training band once s/he has obtained a NQF Level 4 qualification in Foundry Operations.

Employers, learners and/or institutions should be able to evaluate the outcomes of these qualifications against the needs of a production context and structure top-up learning appropriately. Equally, holders of other qualifications may be evaluated against this qualification for the purpose of RPL.

MODERATION OPTIONS

Moderators for this qualification should be qualified and accredited with an appropriate ETQA. To assure the quality of the assessment process, the moderation should cover one or more of the following:

- Assessor credentials.
- The assessment instrument(s).
- The assessment process (including preparation and post-assessment feedback).

CRITERIA FOR THE REGISTRATION OF ASSESSORS

The following criteria should be applied by the relevant ETQA:

At least the NQF level 3 Foundry Operations qualification with relevant workplace experience of at least 12 months in the field of Foundry Operations or equivalent. The subject matter experience of the assessor can be established by recognition of prior learning.

Appropriate experience and understanding of assessment theory, processes and practices.

Good interpersonal skills and the ability to balance the conflicting requirements of:

- Maintaining national standards.
- The interests of the learner.
- The interest of the organisation.
- The need for transformation and redressing the legacies of the past.
- The cultural background and language of the learner.

Registration as an assessor with the relevant ETQA.

Any other criteria required by the relevant ETQA.

NOTES

N/A

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119463	Access and use information from texts	Level 2	5
Fundamental	9009	Apply basic knowledge of statistics and probability to influence the use of data and procedures in order to investigate life related problems	Level 2	3
Fundamental	7480	Demonstrate understanding of rational and irrational numbers and number systems	Level 2	3
Fundamental	119454	Maintain and adapt oral/signed communication	Level 2	5
Fundamental	12444	Measure, estimate and calculate physical quantities and explore, describe and represent geometrical relationships in 2-dimensions in different life or workplace contexts	Level 2	3
Fundamental	119460	Use language and communication in occupational learning programmes	Level 2	5
Fundamental	7469	Use mathematics to investigate and monitor the financial aspects of personal and community life	Level 2	2
Fundamental	9007	Work with a range of patterns and functions and solve problems	Level 2	5
Fundamental	119456	Write/present for a defined context	Level 2	5

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Core	120402	Demonstrate an understanding of introductory principles of chemistry and physics	Level 2	5
Core	259597	Explain emergency preparedness and response procedures	Level 2	3
Core	12466	Explain the individual`s role within business	Level 2	4
Core	12481	Sling loads	Level 2	4
Core	259604	Verify compliance to safety, health and environmental requirements in the workplace	Level 2	4
Core	9322	Work in a team	Level 2	3
Core	117171	Manage time effectively to enhance productivity and enable a balanced lifestyle	Level 3	2
Elective	13159	Care for, select and use hand and measuring tools	Level 1	4
Elective	13169	Describe and discuss issues relating to HIV-AIDS, TB and sexually transmitted illnesses and their impact on the workplace	Level 1	4
Elective	13165	Describe the properties of materials found in the workplace and describe their impact on the environment	Level 1	6
Elective	264075	Inspect and prepare pattern equipment	Level 1	16
Elective	116932	Operate a personal computer system	Level 1	3
Elective	264044	Pour molten metal into a mould to produce a casting	Level 1	20
Elective	264078	Prepare sand for foundry mould production	Level 1	16
Elective	264015	Produce cores using a coremaking machine	Level 1	16
Elective	264037	Produce moulds using a moulding machine	Level 1	20
Elective	264035	Select, use and care for moulding materials and equipment	Level 1	8
Elective	116938	Use a Graphical User Interface (GUI)-based word processor to create and edit documents	Level 1	4
Elective	243067	Cut materials using the oxy-fuel gas cutting process (manual cutting)	Level 2	6
Elective	9663	Cut pre-formed refractories	Level 2	4
Elective	264134	Demonstrate a basic understanding of quality	Level 2	4
Elective	264077	Demonstrate a basic understanding of the methods of chemical analysis for metals	Level 2	2
Elective	264095	Demonstrate an understanding of introductory principles of electricity as applied in a metals production context	Level 2	2
Elective	264115	Demonstrate knowledge of introductory principles of metallurgy	Level 2	6
Elective	12465	Develop a learning plan and a portfolio for assessment	Level 2	6
Elective	12238	Draw and interpret simple engineering drawings	Level 2	10
Elective	264034	Foundry: Analyse production sands	Level 2	16
Elective	264043	Foundry: Assemble cores	Level 2	16
Elective	264057	Foundry: Produce a mould	Level 2	16
Elective	9909	Identify and process waste	Level 2	4
Elective	244365	Lift and move material and equipment by means of a forklift	Level 2	3
Elective	9268	Manage basic personal finance	Level 2	6
Elective	264054	Manufacture simple wooden pattern equipment	Level 2	16
Elective	13238	Mark off basic engineering shapes	Level 2	2
Elective	13965	Mix refractory monolithics	Level 2	4
Elective	242976	Operate overhead/gantry cranes	Level 2	5
Elective	13966	Pack refractory bricks to complete refractory linings	Level 2	10
Elective	12484	Perform basic fire fighting	Level 2	4
Elective	12483	Perform basic first aid	Level 2	4
Elective	114881	Prepare, use and operate equipment to support a manufacturing process	Level 2	32
Elective	264079	Produce gravity die castings	Level 2	3
Elective	12219	Select, use and care for engineering power tools	Level 2	6
Elective	9885	Read and interpret engineering drawings	Level 3	12

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
National Certificate: Foundry Operations

SAQA QUAL ID	***QUALIFICATION TITLE***		
66449	National Certificate: Foundry Operations		
ORIGINATOR		***PROVIDER***	
SGB Manufacturing and Assembly Processes			
QUALIFICATION TYPE	***FIELD***	***SUBFIELD***	
National Certificate	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	***MINIMUM CREDITS***	***NQF LEVEL***	***QUAL CLASS***
Undefined	126	Level 3	Regular-Unit Stds Based

This qualification does not replace any other qualification and is not replaced by another qualification.

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

This qualification is designed to enhance the skills of learners operating within Foundry Operations, manufacturing either quality pattern equipment (wooden patternmaking and metal tooling), or sand composite moulds and cores by hand (floor moulding) or machine (machine moulding and coremaking) for consumption within a metal casting process, or producing the liquid metal (foundry melting) consumed by such metal casting processes.

This qualification gives recognition for the skills, knowledge and values acquired by learners involved with:

- The inspection, repairs to and manufacture of three-dimensional wooden and metal pattern equipment required for the sand moulding process.
- The manufacture of sand composite moulds and cores.
- The preparation, use and operation of Foundry Melting equipment.

The main skills learnt in this qualification are the ability to:

- Manufacture and maintain three-dimensional regular shaped wooden and metal pattern equipment and recognise and respond to equipment defects. This capability requires an understanding of pattern equipment materials, associated engineering hand and power tools, quality requirements and the ability to draw and interpret detailed engineering drawings.
- Manufacture moulds and cores. This capability requires an elevated understanding of the associated pattern equipment, engineering hand and measuring tools, quality requirements and the ability to draw and interpret simple engineering drawings.
- Prepare, use and operate Foundry Melting equipment. This capability requires a foundational understanding of metallurgy associated with the foundry melting process.

Practical skills play a large role in this qualification:

On completion, the learner will receive recognition for the ability to:

• Manufacture a product (pattern equipment or sand moulds and cores) or produce liquid metal that is consumed in downstream processes.
• Check product against customer requirements, engineering drawings or quality standards.
• Report on the quality of the manufactured product.
• Take corrective action where required.
• Solve associated problems.
• Function in workplaces that utilise such Foundry Operations.

Qualified learners will also understand:

• Their role in the business, i.e. in production and related activities and how their actions affects the business.
• How they are affected by legislation, regulations, agreements and policies related to their particular working environment.
• How they should function and participate within the legislative, safety, health, environmental, quality and risk management systems that govern their workplace.
• How to apply the various organisational policies and procedures.

Qualifying in the exit level outcomes will enable learners to effectively perform a range of workplace activities. What learners achieve in this qualification will also serve as a basis for further learning within Foundry Patternmaking, Foundry Moulding or Foundry Melting processes. Learners will also have foundational competence in mathematics, science, reading, writing and speaking relevant to Foundry Operations.

Rationale:

The Foundry industry is a complex and specialised sector supplying a vast range of quality metal products to downstream customers. The emergence of South Africa as a cost-effective supplier to international markets has created a demand for people with the skills to manufacture the final products as well as function within the support processes to the manufacturing process. These processes include Foundry Patternmaking, Foundry Moulding and Foundry Melting.

This is the second in a series of qualifications in Foundry Operations starting at NQF Level 2 and progressing to NQF Level 4. This series of qualifications will enable learners to:

• Develop their existing skill level and progress vertically in a selected career path within the Foundry industry.
• Receive recognition for experience gained in the workplace through an RPL process.
• Obtain skills and knowledge portable within similar metal product manufacturing industries.
• Gain access to higher levels of learning and learning provision.
• Access opportunities to progress in their personal life and career, and add value to the operations in which they function.
• Contribute to the growth of the South African economy and the development of society.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
It is assumed that learners have already completed the National Certificate: Foundry Operations, at NQF Level 2.

If the learner does not already have such a qualification, learning in preparation for this qualification would also have to included:

• Communication and Mathematical Literacy at NQF Level 2.

• Basic concepts of science and technology related to material, machinery and equipment in use in foundry operation processes at NQF Level 2.
• Basic concepts regarding organising factors in labour, business and the economy.
• Purpose of procedures related to the workplace, governing:
○ Relationships.
○ Roles.
○ Responsibilities.

Recognition of Prior Learning:

This qualification may be obtained through a process of RPL. The learner should be thoroughly briefed prior to the assessment and support provided and guidance should be provided to assist in the process of developing a portfolio. While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes.

Care should be taken that the process used provides the learner with an opportunity to demonstrate competence and is not too demanding as to prevent learners from taking up the RPL option towards gaining a qualification.

Access to the Qualification:

Access is open bearing in mind learning assumed to be in place.

Access for learners with physical disabilities is dependent:

• On the type and severity of disability.
• On the nature of the Foundry Operations environment and the inherent requirements of equipment operation.

QUALIFICATION RULES
This is a 126 credits certificate:

• All listed unit standards in the Fundamental category of the qualification totalling 36 credits.
• All listed unit standards in the Core category of the qualification totalling 17 credits.
• A selection of specialisation unit standards in the Elective category of the qualification totalling 73 credits.

Depending on their area of specialisation (Foundry Patternmaking, Foundry Moulding or Foundry Melting), learners may choose from the categories:

Specialization Area 1: Wooden Patternmaking:

• Unit standard ID 6936: Manufacture 3-dimensional regular shaped wooden pattern equipment; 40 credits; Level 3.
• Unit standard ID 9914: Handle and care for materials; 12 credits; Level 3.
• Unit standard ID 13297: Grind tools and drill bits; 4 credits; Level 3.
• Unit standard ID 13298: Produce detailed engineering drawings; 6 credits; Level 3.
• Plus a choice of unit standards from the Elective category of learning to the value of at least 11 credits.

Specialization Area 2: Metal Tooling:

• Unit standard ID 6936: Manufacture 3-dimensional regular shaped tooling; 40 credits; Level 3.
• Unit standard ID 9914: Handle and care for materials; 12 credits; Level 3.

• Unit standard ID 13297: Grind tools and drill bits; 4 credits; Level 3.
• Unit standard ID 13298: Produce detailed engineering drawings; 6 credits; Level 3.
• Plus a choice of unit standards from the Elective category of learning to the value of at least 11 credits.

Specialization Area 3: Floor Moulding:

• Unit standard ID 6938: Produce cores by hand; 16 credits; Level 3.
• Unit standard ID 264016: Produce a mould using a loose pattern; 16 credits; Level 3.
• Unit standard ID 9914: Handle and care for materials; 12 credits; Level 3.
• Unit standard ID 12238: Draw and interpret simple engineering drawings; 10 credits; Level 2.
• Plus a choice of unit standards from the Elective category of learning to the value of at least 19 credits.

Specialization Area 4: Machine Moulding:

• Unit standard ID 244338: Operate a production process; 15 credits; Level 2.
• Unit standard ID 9914: Handle and care for materials; 12 credits; Level 3.
• Unit standard ID 12238: Draw and interpret simple engineering drawings; 10 credits; Level 2.
• Plus a choice of unit standards from the Elective category of learning to the value of at least; 36 credits.

Specialization Area 5: Foundry Melting:

• Unit standard ID 264038: Demonstrate understanding of chemical reactions in, and the solidification of, liquid metals; 6 credits; Level 3.
• Unit standard ID 244338: Operate a production process; 15 credits; Level 2.
• Unit standard ID 12768: Demonstrate knowledge of fundamental chemical and physical reactions; 8 credits; Level 3.
• Unit standard ID 13974: Demonstrate an understanding of the refractory materials, products and processes; 5 credits; Level 6.
• Plus a choice of unit standards from the Elective category of learning to the value of at least 39 credits.

EXIT LEVEL OUTCOMES
1. Solve familiar problems related to foundry operations.

2. Communicate with team members, internal customers and members of supervisory/management levels.

3. Interpret and produce detailed technical drawings.

4. Prepare and set up the Foundry Operations process.

5. Manufacture a range of complex pattern equipment.

6. Produce a range of complex moulds and cores.

7. Monitor and control the Foundry Melting process.

ASSOCIATED ASSESSMENT CRITERIA
Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Output and quality requirements are explained and applied in foundry operations.
1.2 Solve problems in an efficient and effective manner according to procedures.

1.3 Unfamiliar problems are accurately reported to appropriate personnel according to procedure.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Relevant information is gathered from a range of sources and accurately summarised and reported in an appropriate and timely manner to relevant parties.
2.2 Foundry Operation issues are discussed and resolved in work area on a regular basis with other team members, internal customers and supervisors/management.
2.3 Relationships with peers and supervisory/management levels are established and maintained in accordance with organizational requirements.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Required calculations are made and detailed drawings are produced to scale.
3.2 Freehand sketches and pattern layouts are made from detailed engineering drawings.
3.3 Components and assemblies to be manufactured are identified and their requirements are interpreted from detailed technical drawings.

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 Appropriate materials or consumables, tools and instruments are used to make adjustments or changes to process equipment set up and tooling.
4.2 Equipment specifications and manufacturing requirements are complied with set standards.
4.3 Process equipment availability and readiness for manufacturing processes is maintained during operations.
4.4 A clean and safe work area is maintained according to procedures.

Associated Assessment Criteria for Exit Level Outcome 5:

5.1 Acceptable materials, consumables, tools and equipment are used to achieve the expressed customer and quality requirements.
5.2 Pattern equipment is manufactured according to equipment specifications and manufacturing requirements.
5.3 Foundry Operations process and product is monitored according to product and customer requirements are met.
5.4 Process is brought back into specification and indicators are responded to when deviations occur according to standard operating procedures.
5.5 A clean and safe work area is maintained according to housekeeping procedures.

Associated Assessment Criteria for Exit Level Outcome 6:

6.1 Technical drawings are read, interpreted and drawn in accordance with the code of practice.
6.2 Acceptable materials, consumables, tools and equipment are used to achieve the expressed customer and quality requirements.
6.3 Moulds and cores produced according to equipment specifications and manufacturing requirements.
6.4 Foundry Operations process and product is monitored in accordance with requirements.
6.5 Product and customer requirements are met in accordance with organizational standards.
6.6 Process is brought back into specification and indicators responded to when deviations occur.

Associated Assessment Criteria for Exit Level Outcome 7:

7.1 Acceptable materials, consumables, tools and equipment are used to achieve the expressed customer and quality requirements.

7.2 Equipment specifications and manufacturing requirements are complied with at all times.
7.3 Foundry Operations process and product is monitored according to standard operating procedures.
7.4 Process is brought back into specification and indicators responded to when deviations occur according to procedures.
7.5 A clean and safe work area is maintained at all times according to procedures.

Integrated Assessment:

Integrated assessment at the level of the qualification provides an opportunity for learners to show they are able to integrate concepts, actions and ideas achieved across a range of unit standards and contexts.

Integrated assessment must evaluate the quality of observable performance as well as the thinking behind the performance, and must be based on a summative assessment guide. The guide will spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in the primary activity as well as other interactions).
- Asking questions and initiating short discussions to test understanding.
- Looking at records and reports in the portfolio and reviewing previous assessments.

In some cases, inference will be necessary to determine competence depending on the nature and context within which performance takes place.

Since this is a foundational qualification, it is necessary to ensure that the fundamental part of the qualification is also targeted to ensure that while the competence may have been achieved in a particular context, learners are able to apply it in a range of other contexts and for further learning. The assessment should also ensure that all the critical cross-field outcomes have been achieved.

The learner may choose in which language she/he wants to be assessed. This should be established as part of a process of preparing the learner for assessment and familiarising the learner with the approach being taken.

While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes. The assessment process should cover both the explicit tasks required for the qualification as well as the understanding of the concepts and principles that underpin the activities associated with Foundry Operations.

INTERNATIONAL COMPARABILITY
An extensive international search was conducted for evidence of comparable education and training systems. Countries included in the search were Australia, New Zealand, Britain, Scotland, Canada, North and South America, Sweden, Finland, Germany and SADC countries.

Despite the fact that Foundry Operations are evident and well developed world-wide, relatively little sources of outcomes-based, standards-based and/or learning material could be found during the research. Indications are that operatives are trained on the job by skilled co-workers, supported by equipment and input material suppliers.

Additional to this, subject matter experts party to the standards generation process contacted their international counterparts to establish what learning processes they have available. There is evidence of training material, although not aligned to any formal qualification framework.

The only detailed information found, related to the New Zealand Qualifications Authority, where reference was found within the National Certificate Metal Casting (Technology) (Level 4),

reference #0129. This qualification embraces both Engineering as well as Foundry (Patternmaking and Moulding) disciplines.

Further to this, the New Zealand qualification does not specify the level of complexity that has to be achieved. The applied competence in the South African qualification focuses on achieving a specific level of competence required by a person working in a real-world Foundry Operations context in which a degree of specialisation, experience and problem-solving ability is required.

Further comparison elements are highlighted below:

Comparison Element, New Zealand Metal Casting qualifications & This Foundry Operations qualification suite:

- Scope: Nominal competence in a wide range of mechanical engineering skills, Mastery of specific foundry moulding skills in context.
- Approach: Task based, Skills development-based.
- Level(s): Level 1, 2, 3 and 4, Level 2, 3 and 4.
- Context: Partly contextualised, Contextual.
- Assessment: Institution or work-based, Work-based and portfolio-based.
- Essential embedded knowledge: Not clear, Specified.
- Credits: 20, 124, 88 and 75 respectively, 120, 126 and 140 respectively.
- Fundamental learning: Not formally specified, Specified.
- Business relations: Not formally specified, Specified.
- Working with and developing others: Not formally specified, Specified.
- Life skills: Not formally specified, Specified.

There are considerable similarities in the competencies required but the approach of the South African qualification looks at whole-person development in not only technological, but also in team and business-related skills and makes explicit assumptions related to level of schooling and life skills.

It is evident that the technical content of this qualification for Foundry Operations places emphasis on safety, quality and best practice but is of better quality and greater value to learners when compared with that found during the research.

ARTICULATION OPTIONS

This qualification allows for vertical articulation with:

- ID 66489: FETC Foundry Operations (In process of registration), Level 4.

And horizontal articulation with:

- ID 22670: National Certificate: Construction Carpentry, Level 3.
- ID 23280: National Certificate: Mechanical Engineering, Tooling Manufacture, Level 3.
- ID 36155: National Certificate: Polymer Composite Fabrication, Level 3.
- ID 58719: National Certificate: Metals Processing, Level 3.
- ID 21009: National Certificate: Iron and Steel Manufacturing, Level 3.
- ID 64190: National Certificate: Metals Production, Level 3.

MODERATION OPTIONS

- Anyone assessing a learner or moderating the assessment of a learner against this Qualification must be registered as an assessor with the relevant ETQA.

- Any institution offering learning that will enable the achievement of this Qualification must be accredited as a provider with the relevant ETQA.

• Assessment and moderation of assessment will be overseen by the relevant ETQA according to the ETQA`s policies and guidelines.

• A learner wishing to be assessed for this Qualification can only be assessed through an accredited assessment provider/centre.

CRITERIA FOR THE REGISTRATION OF ASSESSORS
The following criteria should be applied by the relevant ETQA:

• At least the NQF Level 4 Foundry Operations qualification with relevant workplace experience of at least 12 months in the field of Foundry Operations or equivalent. The subject matter experience of the assessor can be established by recognition of prior learning.
• Registration as an assessor with the relevant ETQA.
• Any other criteria required by the relevant ETQA.

NOTES
N/A

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	9010	Demonstrate an understanding of the use of different number bases and measurement units and an awareness of error in the context of relevant calculations	Level 3	2
Fundamental	9013	Describe, apply, analyse and calculate shape and motion in 2-and 3-dimensional space in different contexts	Level 3	4
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	9012	Investigate life and work related problems using data and probabilities	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	7456	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Core	13234	Apply quality procedures	Level 3	8
Core	13223	Apply safety, health and environmental protection procedures	Level 3	6
Core	14048	Apply Self Management Concepts	Level 4	3
Elective	258939	Carry out basic electric arc welding in an electrical environment	Level 2	8
Elective	12238	Draw and interpret simple engineering drawings	Level 2	10
Elective	264014	Foundry: Set up a production machine	Level 2	16
Elective	264135	Manufacture a resin pattern	Level 2	16
Elective	244338	Operate a production process	Level 2	15
Elective	258679	Operate and monitor a lathe	Level 2	12
Elective	258678	Operate and monitor a milling machine	Level 2	12
Elective	243014	Operate and monitor computerised numerically controlled (CNC) machining equipment	Level 2	16
Elective	242976	Operate overhead/gantry cranes	Level 2	5
Elective	117924	Use a Graphical User Interface (GUI)-based word processor to format documents	Level 2	5
Elective	243063	Weld carbon steel work-pieces using the shielded metal arc welding process in the down-hand position.	Level 2	15
Elective	264038	Demonstrate an understanding of chemical reactions in, and the solidification of, liquid metals	Level 3	6
Elective	13974	Demonstrate an understanding of the refractory materials, products and processes	Level 3	5
Elective	13915	Demonstrate knowledge and understanding of HIV/AIDS in a workplace, and its effects on a business sub-sector, own organisation and a specific workplace	Level 3	4

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	12768	Demonstrate knowledge of fundamental chemical and physical reactions	Level 3	8
Elective	12429	Develop a personal financial plan	Level 3	2
Elective	12457	Develop learning strategies and techniques	Level 3	3
Elective	12456	Explain and use organisational procedures	Level 3	6
Elective	13297	Grind tools and drill bits	Level 3	4
Elective	9914	Handle and care for materials	Level 3	12
Elective	242812	Induct a member into a team	Level 3	4
Elective	13975	Install and maintain castable/mouldable refractory materials	Level 3	5
Elective	13976	Install and maintain refractory brickwork/blockwork	Level 3	12
Elective	13977	Install gunite materials for refractory linings	Level 3	10
Elective	242820	Maintain records for a team	Level 3	4
Elective	264154	Manufacture three dimensional regular shaped metal tooling	Level 3	40
Elective	264076	Manufacture three dimensional regular shaped wooden pattern equipment	Level 3	40
Elective	12319	Perform change overs in a production or packaging environment	Level 3	7
Elective	12455	Perform the role of a safety, health and environmental protection representative	Level 3	4
Elective	264016	Produce a mould using a loose pattern	Level 3	16
Elective	258715	Produce components by spark eroding machining operations	Level 3	8
Elective	264096	Produce cores by hand	Level 3	16
Elective	13298	Produce detailed engineering drawings	Level 3	6
Elective	264059	Produce pressure die castings	Level 3	12
Elective	116930	Use a Graphical User Interface (GUI)-based presentation application to enhance presentation appearance	Level 3	5
Elective	116940	Use a Graphical User Interface (GUI)-based spreadsheet application to solve a given problem	Level 3	6
Elective	243068	Weld carbon steel workpieces using the gas tungsten arc welding process in the downhand position	Level 3	15
Elective	242816	Conduct a structured meeting	Level 4	5

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
Further Education and Training (FET) Certificate: Foundry Operations

SAQA QUAL ID	***QUALIFICATION TITLE***		
66489	Further Education and Training (FET) Certificate: Foundry Operations		
ORIGINATOR		***PROVIDER***	
SGB Manufacturing and Assembly Processes			
QUALIFICATION TYPE	***FIELD***	***SUBFIELD***	
Further Ed and Training Cert	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	***MINIMUM CREDITS***	***NQF LEVEL***	***QUAL CLASS***
Undefined	128	Level 4	Regular-Unit Stds Based

This qualification does not replace any other qualification and is not replaced by another qualification.

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

This qualification is designed to enhance the skills of learners operating within Foundry Operations, manufacturing either quality pattern equipment (wooden patternmaking and metal tooling), or sand composite moulds and cores by hand (floor moulding) or machine (machine moulding and coremaking) for consumption within a metal casting process, or producing the liquid metal (foundry melting) consumed by such metal casting processes.

This qualification gives recognition for the skills, knowledge and values acquired by learners involved with:

- The inspection, repairs to and manufacture of complex wooden and metal pattern equipment required for the sand moulding process.
- The manufacture of complex sand composite moulds and cores.
- The control of Foundry Melting processes.

The main skills learnt in this qualification are the ability to:

- Produce and read detailed technical sketches and drawings, produce complex pattern equipment, organise and supervise workers and resolve identified non-conformances relating to the patternmaking process. This capability requires an understanding of advanced patternmaking and/or tooling theory and detailed technical drawings as well as a familiarity with the equipment and processes within the environment in which the learner is working.

- Make and read detailed technical sketches and drawings, produce complex cores and moulds, organise and supervise workers and resolve identified non-conformances relating to the moulding process. This capability requires an understanding of advanced moulding theory and detailed technical drawings as well as a familiarity with the equipment and processes within the environment in which the learner is working.

• Co-ordinate, control and maintain the efficient production of a range of liquid metals. This capability requires an in-depth understanding of the production process, product quality requirements, as well as an understanding of communication, people management and people development theory.

Practical skills play a large role in this qualification.

On completion, the learner will receive recognition for the ability to:

• Determine material requirements.
• Control the efficient delivery of product by Foundry Operation processes.
• Produce a range of complex quality products.
• Optimise and maintain production efficiency.
• Solve familiar and unfamiliar problems in Foundry Operation processes.
• Check the quality of products against quality standards.
• Function in workplaces that use such processes.

Qualified learners will also understand:

• Their accountability to ensure compliance with the legislative, safety, health, environmental, quality and risk management systems that govern their workplace.
• How to implement and ensure adherence to the various organisational policies and procedures.
• How they are affected by legislation, regulations, agreements and policies related to their particular working environment.

Qualifying in the exit level outcomes will enable learners to effectively perform a range of workplace activities. What learners achieve in this qualification will also serve as a basis for further learning in the Higher Education and Training band. Learners will also have foundational competence in controlling and co-ordinating the work and output of individuals and/or work teams, relevant to Foundry Operations.

Rationale:

The Foundry industry is a complex and specialised sector supplying a vast range of quality metal products to downstream customers. The emergence of South Africa as a cost-effective supplier to international markets has created a demand for people with the skills to manufacture the final products as well as function within the support processes to the manufacturing process. These processes include Foundry Patternmaking, Foundry Moulding and Foundry Melting.

This is the third in a series of qualifications in Foundry Operations starting at NQF Level 2 and progressing to NQF Level 4. This series of qualifications will enable learners to:

• Develop their existing skill level and progress vertically in a selected career path within the Foundry industry.
• Receive recognition for experience gained in the workplace through an RPL process.
• Obtain skills and knowledge portable within similar metal product manufacturing industries.
• Gain access to higher levels of learning and learning provision.
• Access opportunities to progress in their personal life and career, and add value to the operations in which they function.
• Contribute to the growth of the South African economy and the development of society.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE

This qualification assumes learners have a National Certificate in Foundry Operations at NQF Level 3 or equivalent. If the learner does not already have such a qualification, learning in preparation for this qualification would also have to include learning in:

- Communication at NQF Level 3.
- Mathematical Literacy.
- Basic concepts of science and technology related to material, machinery and equipment in use in foundry operation processes at NQF Level 3.

Recognition of Prior Learning:

This qualification may be obtained through a process of RPL. The learner should be thoroughly briefed prior to the assessment and support provided and guidance should be provided to assist in the process of developing a portfolio. While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes.

Care should be taken that the process used provides the learner with an opportunity to demonstrate competence and is not too demanding as to prevent learners from taking up the RPL option towards gaining a qualification.

Access to the Qualification:

This qualification is designed for learners who:

- Are new-entry workers to Foundry Operations.
- Have attended courses and applied the knowledge gained in the workplace.
- Are already workers and have acquired the skills and knowledge without attending formal courses.
- Are part of a learnership programme, which integrates structured learning, and work experience.

Access for learners with physical disabilities is dependent:

- On the type and severity of disability.
- On the nature of the Foundry Operations environment and the inherent requirements of equipment operation.

QUALIFICATION RULES

In order to be awarded this qualification totalling 140 credits, learners have to be declared competent in:

Fundamental component:

The Fundamental Component consists of Unit Standards in:

- Mathematical Literacy at Level 4 to the value of 16 credits.
- Communication at Level 4 in a First South African Language to the value of 20 credits.
- Communication in a Second South African Language at Level 3 to the value of 20 credits.

It is compulsory therefore for learners to do Communication in two different South African languages, one at Level 4 and the other at Level 3.

All listed unit standards in the Core category of the qualification totalling 26 Credits.

A selection of specialisation unit standards in the Elective category of the qualification totalling 46 Credits.

Depending on their area of specialisation (Foundry Patternmaking, Foundry Moulding OR Foundry Melting), learners may choose from the categories.

Wooden Patternmaking:

- Unit standard ID 264056: Manufacture complex wooden pattern equipment, NQF Level 4, 40 Credits.
- Unit standard ID 13301: Produce complex engineering drawings, NQF Level 4, 6 Credits.

OR

Metal Tooling:

- Unit standard ID 264060: Manufacture complex metal tooling, NQF Level 4, 40 Credits.
- Unit standard ID 13301: Produce complex engineering drawings, NQF Level 4, 6 Credits.

OR

Floor Moulding:

- Unit standard ID 264114: Produce a mould by core assembly, NQF Level 4, 30 Credits.
- Plus a choice of unit standards from the Elective category of learning to the value of at least 15 Credits.

OR

Machine Moulding:

- Unit standard ID 9922: Adjust and maintain production process, NQF Level 3, 30 Credits.
- Plus a choice of unit standards from the Elective category of learning to the value of at least 15 Credits.

OR

Foundry Melting:

- Unit standard ID 264376: Demonstrate an understanding of basic physical metallurgy, NQF Level 4, 8 Credits.
- Unit standard ID 9895: Coordinate predictive and preventive maintenance, NQF Level 5, 12 Credits.
- Unit standard ID 13194: Perform statistical process control, NQF Level 4, 12 Credits.
- Plus a choice of unit standards from the Elective category of learning to the value of at least 13 Credits.

EXIT LEVEL OUTCOMES

1. Solve a variety of manufacturing problems.

2. Organise and control resources, individuals and work teams to meet operational requirements.

3. Enhance manufacturing team performance.

4. Communicate and present information.

5. Read, interpret and produce complex technical drawings.

6. Coordinate and control the Foundry Melting process.

7. Manufacture a range of complex Foundry Operation products.

ASSOCIATED ASSESSMENT CRITERIA
Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Solutions to manufacturing problems are based on a clear analysis of information gathered through diagnostic procedures.
1.2 Procedures are amended to respond to unfamiliar problems.
1.3 Equipment repair and preventive maintenance need is communicated to maintenance specialists according to procedure.
1.4 Actions related to problem solving are recorded for future reference according to procedure.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Workplace performance is aligned to meet organisational goals, objectives and targets.
2.2 Resources are organised to effectively meet workplace objectives.
2.3 Diversity is harnessed and strengths of a diverse work team is built on according to principles of diversity management.
2.4 Production activities are performed according to production requirements by work teams.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Dynamics within a specific group is understood according to group dynamics.
3.2 Procedures related to legislation are implemented according to legislation.
3.3 Individuals and team members are motivated using a current motivational model.
3.4 Learning outcomes are assessed in terms of assessment procedures.
3.5 Plan of action is developed and team performance is enhanced.

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 Meetings with team members, peers, management and maintenance specialists are conducted clearly and reliably.
4.2 Conditions, evidence, incidences and trends are accurately and timely reported and discussed.
4.3 Records are made available for scrutiny and future reference.

Associated Assessment Criteria for Exit Level Outcome 5:

5.1 Components and assemblies to be manufactured are identified and requirements from technical drawing are interpreted.
5.2 Technical drawing specifications are met by manufactured components and assemblies.

Associated Assessment Criteria for Exit Level Outcome 6:

6.1 Foundry Melting processes are monitored and adjusted according to manufacturing and customer requirements.
6.2 Product test results are analysed and interpreted and corrective action.
6.3 Trends are determined and discussed with relevant roleplayers.
6.4 A clean and safe work area is maintained according to procedures.

6.5 Production cost is monitored and controlled.
6.6 Quality, safety, health, environmental and risk management specifications are met according to specifications.

Associated Assessment Criteria for Exit Level Outcome 7:

7.1 Technical drawings are read, interpreted and drawn.
7.2 Foundry Operations process and product is monitored.
7.3 Production process is brought back into specification and indicators are responded to when deviations occur.
7.4 Drawing, output and quality requirements are met.
7.5 A clean and safe work area is maintained.
7.6 Quality, safety, health, environmental and risk management specifications are met.

Integrated Assessment:

Integrated assessment at the level of the qualification provides an opportunity for learners to show they are able to integrate concepts, actions and ideas achieved across a range of unit standards and contexts.

Integrated assessment must evaluate the quality of observable performance as well as the thinking behind the performance, and must be based on a summative assessment guide. The guide will spell out how the assessor will assess different aspects of the performance and will include:

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- Asking questions and initiating short discussions to test understanding.
- Looking at records and reports in the portfolio and reviewing previous assessments.

In some cases, inference will be necessary to determine competence depending on the nature and context within which performance takes place.

Since this is a foundational qualification, it is necessary to ensure that the fundamental part of the qualification is also targeted to ensure that while the competence may have been achieved in a particular context, learners are able to apply it in a range of other contexts and for further learning. The assessment should also ensure that all the critical cross-field outcomes have been achieved.

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INTERNATIONAL COMPARABILITY
An extensive international search was conducted for evidence of comparable education and training systems. Countries included in the search were Australia, New Zealand, Britain, Scotland, Canada, North and South America, Sweden, Finland, Germany and South African SADC countries.

Despite the fact that Foundry Operations are evident and well developed world-wide, relatively little sources of outcomes-based, standards-based and/or learning material could be found

during the research. Indications are that operatives are trained on the job by skilled co-workers, supported by equipment and input material suppliers.

Additional to this, subject matter experts party to the standards generation process contacted their international counterparts to establish what learning processes they have available. There is evidence of training material, although not aligned to any formal qualification framework.

The only detailed information found, related to the New Zealand Qualifications Authority, where reference was found within the National Certificate Metal Casting (Technology) (Level 4), reference ID 0129. This qualification embraces both Engineering as well as Foundry (Patternmaking and Moulding) disciplines.

The comparison was made difficult because neither the fundamental learning elements nor some of the generic core elements are specified. A further complication is brought about by the fact that the learning required crosses several levels. Further to this, the New Zealand qualification does not specify the level of complexity that has to be achieved. The applied competence in the South African qualification focuses on achieving a specific level of competence required by a person working in a real-world Foundry Operations context in which a degree of specialisation, experience and problem-solving ability is required.

Further comparison elements are highlighted below.

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- Business relations; Not formally specified; Specified.
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- Life skills; Not formally specified; Specified.

There are considerable similarities in the competencies required but the approach of the South African qualification looks at whole-person development in not only technological, but also in team- and business-related skills and makes explicit assumptions related to level of schooling and life skills.

It is evident that the technical content of this qualification for Foundry Operations places emphasis on safety, quality and best practice but is of better quality and greater value to learners when compared with that found during the research.

ARTICULATION OPTIONS

The qualification has been designed and structured so that qualifying learners can move both horizontally from one area of specialisation (Foundry Patternmaking, Foundry Moulding, Foundry Melting) to another, and vertically, further specialising in a particular skills area.

This qualification articulates horizontal with the following qualifications:

- ID 66513: Further Education and Training Certificate in Foundry Patternmaking, NQF Level 4.
- ID 21010: National Certificate in Iron and Steel Manufacturing, NQF Level 4.

• ID 49403: National Certificate in Steel Tube and Pipe Manufacturing (Seamless Hot-Finished OR Welded OR Cold-Formed), NQF Level 4.
• ID 21016: National Certificate in Metal and Engineering Manufacturing, NQF Level 4.
• ID 36153: National Certificate: Polymer Composite Fabrication, NQF Level 4.
• ID 23281: National Certificate: Mechanical Engineering: Tooling Manufacture, NQF Level 4.

This qualification articulates vertical with the following qualifications:

• ID 22433: National Certificate: Manufacturing and Assembly, NQF level 5.
• ID 22028: National Certificate: Tool and Jigmaker, NQF Level 5.
• ID 22435: National Diploma: Engineering and Related Design, NQF Level 5.

The qualification should also, in terms of the fundamental, non-manufacturing unit standards and other portable skills, articulate with any other qualification at level 4 and 5 in the field of engineering and manufacturing processes.

The qualification has been designed so that the learner can meaningfully articulate into the higher education and training band once she has obtained a NQF Level 4 qualification in Foundry Operations.

Employers, learners and/or institutions should be able to evaluate the outcomes of these qualifications against the needs of a production context and structure top-up learning appropriately. Equally, holders of other qualifications may be evaluated against this qualification for the purpose of RPL.

MODERATION OPTIONS
Moderators for this qualification should be qualified and accredited with an appropriate ETQA. To assure the quality of the assessment process, the moderation should cover one or more of the following:

• Assessor credentials.
• The assessment instrument(s).
• The assessment process (including preparation and post-assessment feedback).

CRITERIA FOR THE REGISTRATION OF ASSESSORS
The following criteria should be applied by the relevant ETQA:

• At least a NQF level 5 manufacturing process qualification with relevant workplace experience of at least 12 months in the field of Foundry Operations or equivalent. The subject matter experience of the assessor can be established by recognition of prior learning.
• Appropriate experience and understanding of assessment theory, processes and practices.
• Good interpersonal skills and the ability to balance the conflicting requirements of:
o Maintaining national standards.
o The interests of the learner.
o The interest of the organisation.
o The need for transformation and redressing the legacies of the past.
o The cultural background and language of the learner.
• Registration as an assessor with the relevant ETQA.
• Any other criteria require by the relevant ETQA.

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	11942	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	11957	Interpret and use information from texts	Level 3	5

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Fundamental	9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	Level 4	6
Fundamental	119462	Engage in sustained oral/signed communication and evaluate spoken/signed texts	Level 4	5
Fundamental	119469	Read/view, analyse and respond to a variety of texts	Level 4	5
Fundamental	9016	Represent analyse and calculate shape and motion in 2- and 3-dimensional space in different contexts	Level 4	4
Fundamental	119471	Use language and communication in occupational learning programmes	Level 4	5
Fundamental	7468	Use mathematics to investigate and monitor the financial aspects of personal, business, national and international issues	Level 4	6
Fundamental	119459	Write/present/sign for a wide range of contexts	Level 4	5
Core	242655	Demonstrate knowledge and application of ethical conduct in a business environment	Level 4	4
Core	120344	Demonstrate knowledge and understanding of relevant current occupational health and safety legislation	Level 4	4
Core	114877	Formulate and implement an action plan to improve productivity within an organisational unit	Level 4	8
Core	13224	Monitor the application of safety, health and environmental protection procedures	Level 4	4
Core	120375	Participate in the estimation and preparation of cost budget for a project or sub project and monitor and control actual cost against budget	Level 4	6
Elective	9922	Adjust and maintain production process	Level 3	30
Elective	244611	Apply problem-solving techniques to make a decision or solve a problem in a real life context	Level 3	2
Elective	242820	Maintain records for a team	Level 3	4
Elective	13298	Produce detailed engineering drawings	Level 3	6
Elective	119078	Use a GUI-based word processor to enhance a document through the use of tables and columns	Level 3	5
Elective	116930	Use a Graphical User Interface (GUI)-based presentation application to enhance presentation appearance	Level 3	5
Elective	116940	Use a Graphical User Interface (GUI)-based spreadsheet application to solve a given problem	Level 3	6
Elective	9890	Anticipate and troubleshoot machine functioning	Level 4	16
Elective	9905	Change and set tooling	Level 4	16
Elective	114884	Co-ordinate the improvement of productivity within a functional unit	Level 4	8
Elective	13261	Conduct laboratory tests on manufactured products and raw materials	Level 4	10
Elective	264376	Demonstrate an understanding of basic physical metallurgy and its applications	Level 4	8
Elective	13952	Demonstrate basic understanding of the Primary labour legislation that impacts on a business unit	Level 4	8
Elective	13331	Diagnose and repair faults on tooling during the production run	Level 4	24
Elective	12544	Facilitate the preparation and presentation of evidence for assessment	Level 4	4
Elective	10980	Induct a new employee	Level 4	6
Elective	117156	Interpret basic financial statements	Level 4	4
Elective	13235	Maintain the quality assurance system	Level 4	5
Elective	264060	Manufacture complex metal tooling	Level 4	40
Elective	264056	Manufacture complex wooden pattern equipment	Level 4	40
Elective	14586	Monitor and control quality control practices in a manufacturing/engineering environment	Level 4	8
Elective	13194	Perform statistical process control	Level 4	12
Elective	115112	Plan and set up testing programme to investigate quality issues and recommend changes	Level 4	20
Elective	264114	Produce a mould by core assembly	Level 4	30
Elective	264094	Produce a strickle mould	Level 4	30
Elective	13301	Produce complex engineering drawings	Level 4	6

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	9889	Set up production machines	Level 4	30
Elective	10981	Supervise work unit to achieve work unit objectives (individuals and teams)	Level 4	12
Elective	115753	Conduct outcomes-based assessment	Level 5	15
Elective	12665	Control production and resource scheduling and planning in a manufacturing environment	Level 5	8
Elective	9895	Coordinate predictive and preventive maintenance	Level 5	12
Elective	13203	Counsel workgroup members in respect of HIV/AIDS	Level 5	3
Elective	114274	Demonstrate and apply an understanding of the Basic Conditions of Employment Act (Act 75 of 1997)	Level 5	8
Elective	114278	Demonstrate and apply an understanding of the Labour Relations Act (Act 66 of 1995)	Level 5	12
Elective	264055	Design pattern and/tooling for industry	Level 5	15
Elective	264074	Develop a metal casting process	Level 5	30
Elective	12458	Develop the skills of a work team	Level 5	10
Elective	15233	Harness diversity and build on strengths of a diverse working environment	Level 5	3
Elective	12674	Perform auditing activities	Level 5	12

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
National Certificate: Foundry Patternmaking

SAQA QUAL ID	*QUALIFICATION TITLE*		
66490	National Certificate: Foundry Patternmaking		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
National Certificate	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	140	Level 2	Regular-Unit Stds Based

This qualification does not replace any other qualification and is not replaced by another qualification.

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

This qualification is designed to empower learners to operate efficiently in a Foundry Patternmaking environment, manufacturing quality wooden and metal pattern equipment for a highly competitive Foundry Moulding process.

This qualification gives recognition for the skills, knowledge and values acquired by learners involved with the inspection, repairs to and manufacture of pattern equipment required for the metal casting production process.

The chief skill learnt in this qualification is the ability to manufacture and maintain simple wooden pattern equipment and recognise and respond to equipment defects. This capability requires an understanding of pattern equipment materials, associated engineering hand and power tools, concepts of measurement, quality requirements and the ability to draw and interpret simple engineering drawings. Practical skills play a large role in this qualification.

On completion, the learner will receive recognition for the ability to:

- Manufacture simple wooden pattern equipment.
- Check wooden pattern equipment against engineering drawings and quality standards.
- Report on the condition of wooden pattern equipment.
- Repair defects where required.
- Solve known associated/routine problems.
- Function in workplaces that repair and/or manufacture such wooden foundry patternmaking equipment.

Qualified learners will also understand:

- The basics of how a business functions.
- Their role in the business, i.e. in production and related activities.
- How they are affected by legislation, regulations, agreements and policies related to their particular working environment.

• How they should function within the legislative, safety, health, environmental, quality and risk management systems that govern their workplace.
• How to apply the various policies and procedures related to these systems.

Qualifying in the exit level outcomes will enable learners to effectively perform a range of workplace activities. What learners achieve in this qualification will also serve as a basis for further learning within Foundry Patternmaking processes. Learners will also have foundational competence in mathematics, science, reading, writing and speaking relevant to the Foundry Patternmaking industry.

Rationale:

The Foundry Patternmaking industry is a complex and specialised industry supplying a vast range of wooden and metal pattern equipment to batch as well as continuous foundry moulding processes for use within their metal casting production processes. The Foundry Patternmaking industry has to continuously respond to global competition and ongoing development of new products and customer requirements.

Persons working in the Foundry Patternmaking environment require specialised technical skills and knowledge, as well as highly developed practical skills in order to meet the stringent requirements of diverse industries.

This is the first in a series of qualifications in Foundry Patternmaking starting at NQF Level 2 and progressing to NQF Level 4. This series of qualifications will enable learners to:

• Develop their existing skills level and progress vertically in a selected career path in Foundry Patternmaking.
• Receive recognition for learning achieved.
• Obtain skills and knowledge portable within similar wooden and metal product manufacturing industries.
• Gain access to higher levels of learning and learning provision.
• Access opportunities to progress in their personal life and career, and add value to the operations in which they function.
• Contribute to the growth of the South African economy and the development of society.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
This qualification assumes learners have a National Certificate (GETC) in Manufacturing, Engineering and Related Activities: NQF Level 1 or equivalent. If the learner does not already have such a qualification, learning in preparation for this qualification would also have to include NQF Level 1 learning in:

• Communication.
• Mathematical Literacy.
• Basic concepts of science and technology.

Recognition of Prior Learning:

This qualification may be obtained through a process of RPL. The learner should be thoroughly briefed prior to the assessment and support provided and guidance should be provided to assist in the process of developing a portfolio. While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the Exit-Level Outcomes.

Care should be taken that the process used provides the learner with an opportunity to demonstrate competence and is not too demanding as to prevent learners from taking up the RPL option towards gaining a qualification.

Access to the Qualification:

This qualification is designed for learners who:

- Are new-entry workers to a Foundry Patternmaking process.
- Have attended courses and applied the knowledge gained in the workplace.
- Are already workers and have acquired the skills and knowledge without attending formal courses.
- Are part of a learnership programme, which integrates structured learning, and work experience.

Access for learners with physical disabilities is dependent:

- On the type and severity of disability.
- On the nature of the Foundry Patternmaking process and the requirements of equipment operation.

QUALIFICATION RULES
In order to be awarded this qualification, learners have to be declared competent in:

- All listed unit standards in the Fundamental category of the qualification totalling 36 credits.

- All listed unit standards in the Core category of the qualification totalling 86 credits.

- A choice of unit standards from the Elective category of the qualification totalling a minimum of 18 credits.

EXIT LEVEL OUTCOMES
1. Demonstrate an ability to read, interpret and produce basic technical drawings.

2. Manufacture and maintain simple wooden pattern equipment.

3. Operate within foundry patternmaking processes.

ASSOCIATED ASSESSMENT CRITERIA
Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Identify pattern equipment that needs to be manufactured and interpret their requirements from the technical drawing.
1.2 Technical drawing(s) produced meets job requirements.
1.3 Respond to questions and discuss issues related to technical drawing concepts and material lists according to drawing theory.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Perform appropriate checks and prepare the pattern equipment to specification(s) according to procedure.
2.2 Use appropriate hand and power tools according to procedure.
2.3 Pattern equipment meets operational and customer requirements.
2.4 Report non-conformances and actions taken according to procedure.
2.5 Maintain a clean and safe work area according to housekeeping procedures.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Apply appropriate procedures to solve problems and deal with emergencies in an efficient and effective manner.
3.2 Report problems accurately to appropriate personnel.
3.3 Respond to questions and discuss issues related to familiar problems in Foundry Patternmaking processes.
3.4 Communicate with peers and members of supervisory/management levels by demonstrating the ability to summarise information and express opinions on given information in spoken or written form.

Integrated Assessment:

Integrated assessment at the level of the qualification provides an opportunity for learners to show they are able to integrate concepts, actions and ideas achieved across a range of unit standards and contexts.

Integrated assessment must evaluate the quality of observable performance as well as the thinking behind the performance, and must be based on a summative assessment guide. The guide will spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in the primary activity as well as other interactions).
- Asking questions and initiating short discussions to test understanding.
- Looking at records and reports in the portfolio and reviewing previous assessments.

In some cases inference will be necessary to determine competence depending on the nature and context within which performance takes place.

Since this is a foundational qualification, it is necessary to ensure that the fundamental part of the qualification is also targeted to ensure that while the competence may have been achieved in a particular context, learners are able to apply it in a range of other contexts and for further learning. The assessment should also ensure that all the critical cross-field outcomes have been achieved.

The learner may choose in which language s/he wants to be assessed. This should be established as part of a process of preparing the learner for assessment and familiarising the learner with the approach being taken.

While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes. The assessment process should cover both the explicit tasks required for the qualification as well as the understanding of the concepts and principles that underpin the activities associated with the Foundry Patternmaking process.

INTERNATIONAL COMPARABILITY

Members of the working group could not embark on study tours to different parts of the world for the purpose of evaluating what is available due to the lack of resources.

Extensive use was made of the links to other international qualification authorities provided on SAQA's website. Further to this, Internet searches using a range of search engines were conducted for any reference to standards, unit standards, competency standards, qualifications and skills programmes. Relatively little sources of outcomes-based, standards-based and/or learning material could be found during Internet searches. The only information available was from the New Zealand Qualifications Authority, where reference was found within the National

Certificate Metal Casting (Technology) (Level 4), reference 0129. This qualification embraces both Engineering as well as Foundry (Patternmaking and Moulding) disciplines.

The comparison was made difficult because neither the fundamental learning elements nor some of the generic core elements are specified. A further complication is brought about by the fact that the learning required crosses several levels. Further to this, the New Zealand qualification does not specify the level of complexity that has to be achieved. The applied competence in the South African qualification focuses on achieving a specific level of competence required by a person working in a real-world Foundry Patternmaking context in which a degree of specialisation, experience and problem-solving ability is required.

Further comparison elements are highlighted below.

Comparison Element; New Zealand; South Africa:

- Scope; Nominal competence in a wide range of mechanical engineering skills; Mastery of specific foundry moulding skills in context.
- Approach; Task based; Skills development-based.
- Level(s); Level 1, 2, 3 and 4; Level 2, 3 and 4.
- Context; Partly contextualised; Contextual.
- Assessment; Institution or work-based; Work-based and portfolio-based.
- Essential embedded knowledge; Not clear; Specified.
- Credits; 20, 124, 88 and 75 respectively; 140, 132 and 140 respectively.
- Fundamental learning; Not formally specified; Specified.
- Business relations; Not formally specified; Specified.
- Working with and developing others; Not formally specified; Specified.
- Life skills; Not formally specified; Specified.

There are considerable similarities in the competencies required but the approach of the South African qualification looks at whole person development in not only technological, but also in team and business related skills and makes explicit assumptions related to level of schooling and life skills.

Additional to this, subject matter experts in this field contacted their international counterparts to establish what learning processes they have available. There is evidence of training material, although not aligned to any formal qualification framework. This material is however, available at a cost. Comparison between this qualification and any other international model was therefore not possible. Due to their uniqueness, Foundry Patternmaking operations situated in other African countries could utilise and benefit from these qualifications.

This qualification was however compared with existing South African unit standards-based qualifications:

- National Certificate: Foundry Moulding, NQF Level 2 (In process of registration).
- ID 23273: National Certificate in Mechanical Engineering, Fitting: NQF Level 2.
- National Certificate: Metals Processing, NQF Level 2 (In process of registration).

It was evident that the technical content of this qualification for Foundry Patternmaking corresponds with the level and content of the qualifications highlighted above, and is of similar quality and value to learners and the provision of learning according to NQF principles.

ARTICULATION OPTIONS

The qualification has been designed and structured so that qualifying learners can move both horizontally from one area of specialisation to another, and vertically, further specialising in a particular skills area.

This qualification articulates horizontally with the following qualification:

- ID 36154: National Certificate: Polymer Composite Fabrication, NQF Level 2.

This qualification articulates vertically with the following qualification:

- National Certificate: Foundry Patternmaking: NQF Level 3.
- ID 22670: National Certificate: Construction Carpentry, NQF Level 3.
- ID 23280: National Certificate: Mechanical Engineering: Tooling Manufacture, NQF Level 3.
- ID 36155: National Certificate: Polymer Composite Fabrication, NQF Level 3.

The qualification should also, in terms of the fundamental, non-manufacturing unit standards and other portable skills, articulate with any other qualification at NQF Level 2 in the field of engineering.

The qualification has been designed so that the learner can meaningfully articulate into the higher education and training band once s/he has obtained a NQF Level 4 qualification in Foundry Patternmaking.

Employers, learners and/or institutions should be able to evaluate the outcomes of these qualifications against the needs of a production context and structure top-up learning appropriately. Equally, holders of other qualifications may be evaluated against this qualification for the purpose of RPL.

MODERATION OPTIONS
Moderators for this qualification should be qualified and accredited with an appropriate ETQA. To assure the quality of the assessment process, the moderation should cover one or more of the following:

- Assessor credentials.
- The assessment instrument(s).
- The assessment process (including preparation and post-assessment feedback).

CRITERIA FOR THE REGISTRATION OF ASSESSORS
- The following criteria should be applied by the relevant ETQA:

- At least the NQF Level 3 Foundry Patternmaking qualification with relevant workplace experience of at least 12 months in the field of Foundry Patternmaking or equivalent. The subject matter experience of the assessor can be established by recognition of prior learning.

- Appropriate experience and understanding of assessment theory, processes and practices.

- Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards.
  - The interests of the learner.
  - The interest of the organisation.
  - The need for transformation and redressing the legacies of the past.
  - The cultural background and language of the learner.

- Registration as an assessor with the relevant ETQA.

- Any other criteria required by the relevant ETQA.

NOTES
N/A

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119463	Access and use information from texts	Level 2	5
Fundamental	9009	Apply basic knowledge of statistics and probability to influence the use of data and procedures in order to investigate life related problems	Level 2	3
Fundamental	7480	Demonstrate understanding of rational and irrational numbers and number systems	Level 2	3
Fundamental	119454	Maintain and adapt oral/signed communication	Level 2	5
Fundamental	12444	Measure, estimate and calculate physical quantities and explore, describe and represent geometrical relationships in 2-dimensions in different life or workplace contexts	Level 2	3
Fundamental	119460	Use language and communication in occupational learning programmes	Level 2	5
Fundamental	7469	Use mathematics to investigate and monitor the financial aspects of personal and community life	Level 2	2
Fundamental	9007	Work with a range of patterns and functions and solve problems	Level 2	5
Fundamental	119456	Write/present for a defined context	Level 2	5
Core	13159	Care for, select and use hand and measuring tools	Level 1	4
Core	13165	Describe the properties of materials found in the workplace and describe their impact on the environment	Level 1	6
Core	14445	Frame and implement an individual action plan to improve productivity within an organisational unit	Level 1	3
Core	12238	Draw and interpret simple engineering drawings	Level 2	10
Core	259597	Explain emergency preparedness and response procedures	Level 2	3
Core	12466	Explain the individual's role within business	Level 2	4
Core	264057	Foundry: Produce a mould	Level 2	16
Core	110011	Handle and use chemicals safely in a manufacturing environment	Level 2	5
Core	264054	Manufacture simple wooden pattern equipment	Level 2	16
Core	13238	Mark off basic engineering shapes	Level 2	2
Core	12219	Select, use and care for engineering power tools	Level 2	6
Core	12481	Sling loads	Level 2	4
Core	259604	Verify compliance to safety, health and environmental requirements in the workplace	Level 2	4
Core	9322	Work in a team	Level 2	3
Elective	252250	Apply fire fighting techniques	Level 1	3
Elective	13169	Describe and discuss issues relating to HIV-AIDS, TB and sexually transmitted illnesses and their impact on the workplace	Level 1	4
Elective	264075	Inspect and prepare pattern equipment	Level 1	16
Elective	116932	Operate a personal computer system	Level 1	3
Elective	116938	Use a Graphical User Interface (GUI)-based word processor to create and edit documents	Level 1	4
Elective	12465	Develop a learning plan and a portfolio for assessment	Level 2	6
Elective	9268	Manage basic personal finance	Level 2	6
Elective	120496	Provide risk-based primary emergency care/first aid in the workplace	Level 2	5
Elective	8039	Operating cranes	Level 3	10
Elective	8038	Operating lift trucks	Level 3	6

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
National Certificate: Foundry Patternmaking

SAQA QUAL ID	*QUALIFICATION TITLE*		
66469	National Certificate: Foundry Patternmaking		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
National Certificate	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	132	Level 3	Regular-Unit Stds Based

This qualification does not replace any other qualification and is not replaced by another qualification.

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

This qualification is designed to empower learners to operate efficiently in a Foundry Patternmaking environment, manufacturing quality wooden and metal pattern equipment for a highly competitive Foundry Moulding process.

This qualification gives recognition for the skills, knowledge and values acquired by learners involved with the production of and supervision of workers producing complex pattern equipment, to customer specification.

The chief skills learnt in this qualification is the ability to produce and read detailed technical sketches and drawings, produce complex pattern equipment, organise and supervise workers and resolve identified non-conformances relating to the patternmaking process. This capability requires an understanding of advanced patternmaking and/or tooling theory and detailed technical drawings as well as a familiarity with the equipment and processes within the environment in which the learner is working. Practical skills play a large role in this qualification.

On completion, the learner will receive recognition for the ability to:

- Produce and interpret technical drawings.
- Determine material requirements.
- Manufacture a range of complex quality pattern equipment.
- Inspect, monitor, supervise and adjust the operation of a Foundry pattern equipment manufacturing process and report progress.
- Solve known associated/routine problems.
- Check the manufactured product against quality standards.
- Function in workplaces that use such processes.

Qualified learners will also understand:

• Their role in the business, i.e. in production and related activities and how their actions affects the business.
• How they are affected by legislation, regulations, agreements and policies related to their particular working environment.
• How they should function and participate within the legislative, safety, health, environmental, quality and risk management systems that govern their workplace.
• How to apply the various organisational policies and procedures.

Qualifying in the exit level outcomes will enable learners to effectively perform a range of workplace activities. What learners achieve in this qualification will also serve as a basis for further learning where they will engage with more complex foundry disciplines. Learners will also further develop their foundational competence in mathematics, science, reading, writing and speaking relevant to the Foundry Patternmaking process.

Rationale:

The Foundry Patternmaking industry is a complex and specialised industry supplying a vast range of wooden and metal pattern equipment to batch as well as continuous foundry moulding processes for use within their metal casting production processes. The Foundry Patternmaking industry has to continuously respond to global competition and ongoing development of new products and customer requirements.

Persons working in the Foundry Patternmaking environment require specialised technical skills and knowledge, as well as highly developed practical skills in order to meet the stringent requirements of diverse industries.

This is the last in a series of qualifications in Foundry Patternmaking starting at NQF Level 2 and progressing to NQF Level 4. This series of qualifications will enable learners to:

• Develop their existing skills level and progress vertically in a selected career path in the Foundry industry.
• Receive recognition for learning achieved.
• Obtain skills and knowledge portable within similar mould manufacturing processes.
• Gain access to higher levels of learning and learning provision.
• Access opportunities to progress in their personal life and career, and add value to the operations in which they function.
• Contribute to the growth of the South African economy and the development of society.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
This qualification assumes learners have obtained a National Certificate in Foundry Patternmaking at NQF Level 2 or equivalent.

If the learner does not already have such a qualification, learning in preparation for this qualification would also have to include learning in:

• Communication.
• Mathematical Literacy at NQF Level 2.
• Basic concepts of science and technology related to material, machinery and equipment in use in Foundry Patternmaking processes at NQF Level 2.

Recognition of Prior Learning:

This qualification may be obtained through a process of RPL. The learner should be thoroughly briefed prior to the assessment and support provided and guidance should be provided to assist in the process of developing a portfolio. While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes. Care should be taken that the process used provides the learner with an opportunity to demonstrate competence and is not too demanding as to prevent learners from taking up the RPL option towards gaining a qualification.

Access to the Qualification:

This qualification is designed for learners who:

- Are new-entry workers to a Foundry Patternmaking process.
- Completed the National Certificate in Foundry Patternmaking at NQF Level 2 or equivalent.
- Have attended courses and applied the knowledge gained in the workplace.
- Are already workers and have acquired the skills and knowledge without attending formal courses.
- Are part of a learnership programme, which integrates structured learning, and work experience.

Access for learners with physical disabilities is dependant:

- On the type and severity of disability.
- On the nature of the Foundry Patternmaking process and the requirements of equipment operation.

QUALIFICATION RULES
In order to be awarded this qualification, learners have to be declared competent in:

- All listed unit standards in the Fundamental category of the qualification totalling 36 credits.
- All listed unit standards in the Core category of the qualification totalling 45 credits.

Depending on their area of specialisation, learners may choose from the categories:

Wooden Patternmaking:

- Unit standard ID 6935, Level 3, 40 credits.
- Plus a choice of unit standards from the Elective category of learning to the value of at least 11 credits.

OR

Metal Tooling:

- Unit standard ID 6936, Level 3, 40 credits.
- Plus a choice of unit standards from the Elective category of learning to the value of at least 11 credits.

EXIT LEVEL OUTCOMES
1. Manufacture a range of complex pattern equipment.

2. Solve problems within Foundry Patternmaking processes.

3. Communicate within Foundry Patternmaking processes.

4. Read, interpret and produce detailed technical drawings.

ASSOCIATED ASSESSMENT CRITERIA
Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Identify components and assemblies to be manufactured and interpret their requirements from technical drawing.
1.2 Manufactured components and assemblies meet detailed technical drawing specifications.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Use acceptable materials, consumables, tools and equipment to achieve the expressed customer and quality requirements.
2.2 Monitor the Foundry Patternmaking process and product according to procedure.
2.3 Bring the production process back into specification by responding to indicators when deviations occur.
2.4 Maintain a clean and safe work area according to procedure.
2.5 Comply with equipment specifications and manufacturing requirements.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Solve problems in an efficient and effective according to procedures.
3.2 Report unfamiliar problems accurately to appropriate personnel.
3.3 Respond to questions and discuss issues related to familiar problems in the preparation for and production of quality pattern equipment.

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 Gather relevant information from a range of sources and accurately summarise and report in an appropriate and timely manner to relevant parties.
4.2 Discuss and resolve pattern equipment manufacturing issues in work area on a regular basis with other team members, internal customers and supervisors/management.
4.3 Maintain relationships with peers and supervisory/management levels.

Integrated Assessment:

Integrated assessment at the level of the qualification provides an opportunity for learners to show they are able to integrate concepts, actions and ideas achieved across a range of unit standards and contexts. Integrated assessment must evaluate the quality of observable performance as well as the thinking behind the performance, and must be based on a summative assessment guide. The guide will spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in the primary activity as well as other interactions).
- Asking questions and initiating short discussions to test understanding.
- Looking at records and reports in the portfolio and reviewing previous assessments.

In some cases inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It is necessary to ensure that the fundamental part of the qualification is also targeted to ensure that while the competence may have been achieved in a particular context, learners are able to apply it in a range of other contexts and for further learning. The assessment should also ensure that all the critical cross-field outcomes have been achieved.

The learner may choose in which language she/he wants to be assessed. This should be established as part of a process of preparing the learner for assessment and familiarising the learner with the approach being taken.

While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes. The assessment process should cover both the explicit tasks required for the qualification as well as the understanding of the concepts and principles that underpin the activities associated with the Foundry Patternmaking process.

INTERNATIONAL COMPARABILITY

Members of the working group could not embark on study tours to different parts of the world for the purpose of evaluating what is available due to the lack of resources.

Extensive use was made of the links to other international qualification authorities provided on SAQA's website. Further to this, Internet searches using a range of search engines were conducted for any reference to standards, unit standards, competency standards, qualifications and skills programmes. Relatively little sources of outcomes-based, standards-based and/or learning material could be found during Internet searches. The only information available was from the New Zealand Qualifications Authority, where reference was found within the National Certificate Metal Casting (Technology) (NQF Level 4), reference 0129. This qualification embraces both Engineering as well as Foundry (Patternmaking and Moulding) disciplines.

The comparison was made difficult because neither the fundamental learning elements nor some of the generic core elements are specified. A further complication is brought about by the fact that the learning required crosses several levels. Further to this, the New Zealand qualification does not specify the level of complexity that has to be achieved. The applied competence in the South African qualification focuses on achieving a specific level of competence required by a person working in a real-world Foundry Patternmaking context in which a degree of specialisation, experience and problem-solving ability is required.

Further comparison elements are highlighted below:

Comparison Element; New Zealand; South Africa:

- Scope; Nominal competence in a wide range of mechanical engineering skills; Mastery of specific foundry moulding skills in context.
- Approach; Task based-Skills development; based.
- NQF Level(s); NQF Level 1, 2, 3 and 4; NQF Level 2, 3 and 4.
- Context; Partly contextualised; Contextual.
- Assessment; Institution or work-based; Work-based and portfolio-based.
- Essential embedded knowledge; Not clear; Specified.
- Credits; 20, 124, 88 and 75 respectively; 140, 132 and 140 respectively.
- Fundamental learning; Not formally specified; Specified.
- Business relations; Not formally specified; Specified.
- Working with and developing others; Not formally specified; Specified.
- Life skills; Not formally specified; Specified.

There are considerable similarities in the competencies required but the approach of the South African qualification looks at whole-person development in not only technological, but also in team- and business-related skills and makes explicit assumptions related to level of schooling and life skills.

Additional to this, subject matter experts in this field contacted their international counterparts to establish what learning processes they have available. There is evidence of training material, although not aligned to any formal qualification framework. This material is however, available at

a cost. Comparison between this qualification and any other international model was therefore not possible. Due to their uniqueness, Foundry Patternmaking operations situated in other African countries could utilise and benefit from these qualifications.

This qualification was however compared with existing South African unit standards-based qualifications:

- National Certificate in Foundry Moulding: NQF Level 3 (In process of registration).
- ID 23274: National Certificate in Mechanical Engineering: Fitting: NQF Level 3, 133 Credits.
- ID 23278: National Certificate in Mechanical Engineering: Machining: NQF Level 3, 126 Credits.
- ID 58719: National Certificate in Metals Processing: NQF Level 3, 12o Credits.

It was evident that the technical content of this qualification for Foundry Patternmaking corresponds with the level and content of the qualifications highlighted above, and is of similar quality and value to learners and the provision of learning according to NQF Level principles.

ARTICULATION OPTIONS

The qualification has been designed and structured so that qualifying learners can move both horizontally from one area of specialisation to another, and vertically, further specialising in a particular skills area.

This qualification horizontally articulates with the following qualifications:

- ID 23280: National Certificate in Mechanical Engineering: Tooling Manufacture: NQF Level 3, 169 Credits.
- ID 22670: National Certificate in Construction Carpentry: NQF level 3, 177 Credits.
- ID 36155: National Certificate in Polymer Composite Fabrication: NQF Level 3, 130 Credits.

This qualification horizontally articulates with the following qualification:

- ID 66513: Further Education and Training Certificate in Foundry Patternmaking: NQF Level 4, 144 Credits.

The qualification should also, in terms of the fundamental, non-manufacturing unit standards and other portable skills, articulate with any other qualification at level 3 in the field of engineering.

This qualification has been designed so that the learner can meaningfully articulate into the higher education and training band once she/he has obtained a NQF Level 4 qualification in Foundry Patternmaking.

Employers, learners and/or institutions should be able to evaluate the outcomes of these qualifications against the needs of a production context and structure top-up learning appropriately. Equally, holders of other qualifications may be evaluated against this qualification for the purpose of RPL.

MODERATION OPTIONS

Moderators for the qualification should be qualified and accredited with an appropriate ETQA. To assure the quality of the assessment process, the moderation should cover one or more of the following:

- Assessor credentials.
- The assessment instrument(s).
- The assessment process (including preparation and post-assessment feedback).

CRITERIA FOR THE REGISTRATION OF ASSESSORS

The following criteria should be applied by the relevant ETQA:

- At least the NQF level 4 Foundry Patternmaking qualification with relevant workplace experience of at least 24 months in the field of Foundry Patternmaking or equivalent. The subject matter experience of the assessor can be established by recognition of prior learning.
- Appropriate experience and understanding of assessment theory, processes and practices.
- Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards.
  - The interests of the learner.
  - The interests of the company.
  - The need for transformation and redressing the legacies of the past.
  - The cultural background and language of the learner.
  - Registration as an assessor with the relevant ETQA.
  - Any other criteria required by the relevant ETQA.

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	9010	Demonstrate an understanding of the use of different number bases and measurement units and an awareness of error in the context of relevant calculations	Level 3	2
Fundamental	9013	Describe, apply, analyse and calculate shape and motion in 2-and 3-dimensional space in different contexts	Level 3	4
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	9012	Investigate life and work related problems using data and probabilities	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	7456	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Core	13234	Apply quality procedures	Level 3	8
Core	13223	Apply safety, health and environmental protection procedures	Level 3	6
Core	12456	Explain and use organisational procedures	Level 3	6
Core	13297	Grind tools and drill bits	Level 3	4
Core	9914	Handle and care for materials	Level 3	12
Core	13298	Produce detailed engineering drawings	Level 3	6
Core	14048	Apply Self Management Concepts	Level 4	3
Elective	258939	Carry out basic electric arc welding in an electrical environment	Level 2	8
Elective	264135	Manufacture a resin pattern	Level 2	16
Elective	258679	Operate and monitor a lathe	Level 2	12
Elective	258678	Operate and monitor a milling machine	Level 2	12
Elective	243014	Operate and monitor computerised numerically controlled (CNC) machining equipment	Level 2	16
Elective	117924	Use a Graphical User Interface (GUI)-based word processor to format documents	Level 2	5
Elective	243066	Weld carbon steel workpieces using the gas metal arc welding process in the down-hand position	Level 2	8
Elective	242812	Induct a member into a team	Level 3	4
Elective	264154	Manufacture three dimensional regular shaped metal tooling	Level 3	40
Elective	264076	Manufacture three dimensional regular shaped wooden pattern equipment	Level 3	40
Elective	12455	Perform the role of a safety, health and environmental protection representative	Level 3	4
Elective	258715	Produce components by spark eroding machining operations	Level 3	8

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	243068	Weld carbon steel workpieces using the gas tungsten arc welding process in the downhand position	Level 3	15

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
Further Education and Training Certificate: Foundry Patternmaking

SAQA QUAL ID	*QUALIFICATION TITLE*		
66513	Further Education and Training Certificate: Foundry Patternmaking		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
Further Ed and Training Cert	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	144	Level 4	Regular-Unit Stds Based

This qualification does not replace any other qualification and is not replaced by another qualification.

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

This qualification is designed to empower learners to operate efficiently in a Foundry Patternmaking environment, manufacturing quality wooden and metal pattern equipment for a highly competitive Foundry Moulding process.

This qualification gives recognition for the skills, knowledge and values acquired by learners involved with the production of and supervision of workers producing complex pattern equipment, to customer specification.

The chief skills learnt in this qualification is the ability to produce and read detailed technical sketches and drawings, produce complex pattern equipment, organise and supervise workers and resolve identified non-conformances relating to the patternmaking process. This capability requires an understanding of advanced patternmaking and/or tooling theory and detailed technical drawings as well as a familiarity with the equipment and processes within the environment in which the learner is working. Practical skills play a large role in this qualification.

On completion, the learner will receive recognition for the ability to:

- Produce and interpret technical drawings.
- Determine material requirements.
- Manufacture a range of complex quality pattern equipment.
- Inspect, monitor, supervise and adjust the operation of a foundry pattern equipment manufacturing process and report progress.
- Solve known associated/routine problems.
- Check the manufactured product against quality standards.
- Function in workplaces that use such processes.

Qualified learners will also understand:

• Their role in the business, i.e. in production and related activities and how their actions affects the business.
• How they are affected by legislation, regulations, agreements and policies related to their particular working environment.
• How they should function and participate within the legislative, safety, health, environmental, quality and risk management systems that govern their workplace.
• How to apply the various organisational policies and procedures.

Qualifying in the exit level outcomes will enable learners to effectively perform a range of workplace activities. What learners achieve in this qualification will also serve as a basis for further learning where they will engage with more complex foundry disciplines. Learners will also further develop their foundational competence in mathematics, science, reading, writing and speaking relevant to the Foundry Patternmaking process.

Rationale:

The Foundry Patternmaking industry is a complex and specialised industry supplying a vast range of wooden and metal pattern equipment to batch as well as continuous foundry moulding processes for use within their metal casting production processes. The Foundry Patternmaking industry has to continuously respond to global competition and ongoing development of new products and customer requirements.

Persons working in the Foundry Patternmaking environment require specialised technical skills and knowledge, as well as highly developed practical skills in order to meet the stringent requirements of diverse industries.

This is the last in a series of qualifications in Foundry Patternmaking starting at NQF Level 2 and progressing to NQF Level 4. This series of qualifications will enable learners to:

• Develop their existing skills level and progress vertically in a selected career path in the Foundry industry.
• Receive recognition for learning achieved.
• Obtain skills and knowledge portable within similar mould manufacturing processes.
• Gain access to higher levels of learning and learning provision.
• Access opportunities to progress in their personal life and career, and add value to the operations in which they function.
• Contribute to the growth of the South African economy and the development of society.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
This qualification assumes learners have obtained a National Certificate in Foundry Patternmaking at NQF Level 3 or equivalent:

If the learner does not already have such a qualification, learning in preparation for this qualification would also have to include learning in:

• Communication at NQF Level 3.
• Mathematical Literacy.
• Basic concepts of science and technology related to material, machinery and equipment in use in Foundry Patternmaking processes at NQF Level 3.

Recognition of Prior Learning:

This qualification may be obtained through a process of RPL. The learner should be thoroughly briefed prior to the assessment and support provided and guidance should be provided to assist in the process of developing a portfolio. While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes. Care should be taken that the process used provides the learner with an opportunity to demonstrate competence and is not too demanding as to prevent learners from taking up the RPL option towards gaining a qualification.

Access to the Qualification:

This qualification is designed for learners who:

- Are new-entry workers to a Foundry Patternmaking process.
- Completed the National Certificate in Foundry Patternmaking at NQF Level 3 or equivalent.
- Have attended courses and applied the knowledge gained in the workplace.
- Are already workers and have acquired the skills and knowledge without attending formal courses.
- Are part of a learnership programme, which integrates structured learning, and work experience.

Access for learners with physical disabilities is dependant:

- On the type and severity of disability.
- On the nature of the Foundry Patternmaking process and the requirements of equipment operation.

QUALIFICATION RULES
In order to be awarded this qualification, learners have to be declared competent in:

Fundamental component:

The Fundamental Component consists of Unit Standards in:

- Mathematical Literacy at Level 4 to the value of 16 credits.
- Communication at Level 4 in a First South African Language to the value of 20 credits.
- Communication in a Second South African Language at Level 3 to the value of 20 credits.

It is compulsory therefore for learners to do Communication in two different South African languages, one at Level 4 and the other at Level 3.

All listed unit standards in the Core category of the qualification, 33 credits.

Depending on their area of specialisation, learners may choose from the categories:

- Wooden Patternmaking.
- ID 264056: Manufacture complex wooden pattern equipment, 40 credits.
- Plus a choice of unit standards from the Elective category of learning to the value of at least 15 credits.

OR

- Metal Tooling.
- ID 264060: Manufacture complex metal tooling 40 credits.
- Plus a choice of unit standards from the Elective category of learning to the value of at least 15 credits.

EXIT LEVEL OUTCOMES

1.Read, interpret and produce complex technical drawings.

2. Manufacture a range of complex pattern equipment.

3. Demonstrate a familiarity with manufacturing process and procedures.

4. Solve a variety of manufacturing problems.

5. Organise and control individuals and work teams in area of responsibility to meet operational requirements.

6. Demonstrate the ability to enhance manufacturing team performance.

7. Communicate and present information clearly and reliably.

ASSOCIATED ASSESSMENT CRITERIA

Associated Assessment Criteria for Exit Level Outcomes 1:

1.1 Identify components and assemblies to be manufactured and interpret requirements from technical drawing.
1.2 Manufactured components and assemblies meet technical drawing specifications.

Associated Assessment Criteria for Exit Level Outcomes 2:

2.1 Monitor the Foundry Patternmaking process and product.
2.2 Bring the production process back into specification by responding to indicators when deviations occur.
2.3 Meet drawing, output and quality requirements.
2.4 Maintain a clean and safe work area.
2.5 Apply and adhere to applicable policies and procedures.
2.6 Respond to questions and discuss issues related to pattern equipment manufacturing processes relevant to the outcomes.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Establish root cause of problems and categorise defect types.
3.2 Communicate equipment repair and preventive maintenance need to maintenance specialists.
3.3 Respond to questions and discuss issues related to maintenance issues on machinery.
3.4 Diagnose and troubleshoot machinery malfunctioning according to procedures.

Associated Assessment Criteria for Exit Level Outcomes 4:

4.1 Base solutions to manufacturing problems on a clear analysis of information gathered through diagnostic procedures.
4.2 Modify procedures to respond to unfamiliar problems where appropriate.
4.3 Record actions related to problem solving for future reference.
4.4 Respond to questions and discuss issues related to familiar and unfamiliar problems arising in the manufacturing process.

Associated Assessment Criteria for Exit Level Outcomes 5:

5.1 Align workplace performance to meet organisational goals, objectives and targets.

5.2 Organise resources to effectively meet workplace objectives.
5.3 Harness diversity and build on strengths of a diverse work team.
5.4 Work team performs production activities according to production requirements.
5.5 Respond to questions and discuss issues related to planning, organising and controlling individuals and work teams.

Associated Assessment Criteria for Exit Level Outcomes 6:

6.1 Understand the dynamics within a specific group.
6.2 Implement procedures related to legislation.
6.3 Motivate individuals and team members.
6.4 Assess learning outcomes.
6.5 Develop a plan of action and enhance team performance.

Associated Assessment Criteria for Exit Level Outcomes 7:

7.1 Participate effectively in meetings with team members, peers, management and maintenance specialists.
7.2 Report and discuss conditions, evidence, incidences and trends accurately and in a timely manner.
7.3 Make records available for scrutiny and future reference.

Integrated Assessment:

Integrated assessment at the level of the qualification provides an opportunity for learners to show they are able to integrate concepts, actions and ideas achieved across a range of unit standards and contexts. Integrated assessment must evaluate the quality of observable performance as well as the thinking behind the performance, and must be based on a summative assessment guide. The guide will spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in the primary activity as well as other interactions).
- Asking questions and initiating short discussions to test understanding.
- Looking at records and reports in the portfolio and reviewing previous assessments.

In some cases inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It is necessary to ensure that the fundamental part of the qualification is also targeted to ensure that while the competence may have been achieved in a particular context, learners are able to apply it in a range of other contexts and for further learning. The assessment should also ensure that all the critical cross-field outcomes have been achieved.

The learner may choose in which language s/he wants to be assessed. This should be established as part of a process of preparing the learner for assessment and familiarising the learner with the approach being taken.

While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes. The assessment process should cover both the explicit tasks required for the qualification as well as the understanding of the concepts and principles that underpin the activities associated with the Foundry Patternmaking process.

INTERNATIONAL COMPARABILITY

Members of the working group could not embark on study tours to different parts of the world for the purpose of evaluating what is available due to the lack of resources.

Extensive use was made of the links to other international qualification authorities provided on SAQA's website. Further to this, Internet searches using a range of search engines were conducted for any reference to standards, unit standards, competency standards, qualifications and skills programmes. Relatively little sources of outcomes-based, standards-based and/or learning material could be found during Internet searches. The only information available was from the New Zealand Qualifications Authority, where reference was found within the National Certificate Metal Casting (Technology) (Level 4), reference 0129. This qualification embraces both Engineering as well as Foundry (Patternmaking and Moulding) disciplines.

The comparison was made difficult because neither the fundamental learning elements nor some of the generic core elements are specified. A further complication is brought about by the fact that the learning required crosses several levels. Further to this, the New Zealand qualification does not specify the level of complexity that has to be achieved. The applied competence in the South African qualification focuses on achieving a specific level of competence required by a person working in a real-world Foundry Patternmaking context in which a degree of specialisation, experience and problem-solving ability is required.

Further comparison elements are highlighted below:

Comparison Element; New Zealand; South Africa:

- Scope; Nominal competence in a wide range of mechanical engineering skills; Mastery of specific foundry moulding skills in context.

- Approach; Task based; Skills development-based.
- Level(s); Level 1, 2, 3 and 4; Level 2, 3 and 4.
- Context; Partly contextualised; Contextual.
- Assessment; Institution or work-based; Work-based and portfolio-based.
- Essential embedded knowledge; Not clear; Specified.
- Credits; 20, 124, 88 and 75 respectively; 140, 132 and 140 respectively.
- Fundamental learning; Not formally specified; Specified.
- Business relations; Not formally specified; Specified.
- Working with and developing others; Not formally specified; Specified.
- Life skills; Not formally specified; Specified.

There are considerable similarities in the competencies required but the approach of the South African qualification looks at whole-person development in not only technological, but also in team- and business-related skills and makes explicit assumptions related to level of schooling and life skills.

Additional to this, subject matter experts in this field contacted their international counterparts to establish what learning processes they have available. There is evidence of training material, although not aligned to any formal qualification framework. This material is however, available at a cost. Comparison between this qualification and any other international model was therefore not possible. Due to their uniqueness, Foundry Patternmaking operations situated in other African countries could utilise and benefit from these qualifications.

This qualification was however compared with existing South African unit standards-based qualifications:

- National Certificate in Foundry Moulding at NQF Level 4.
- ID 59709: Further Education and Training Certificate in Mechanical Engineering: Fitting at NQF Level 4.
- National Certificate in Metals Processing at NQF Level 3.

It was evident that the technical content of this qualification for Foundry Patternmaking corresponds with the level and content of the qualifications highlighted above, and is of similar quality and value to learners and the provision of learning according to NQF principles.

ARTICULATION OPTIONS
The qualification has been designed and structured so that qualifying learners can move both horizontally from one area of specialisation to another, and vertically, further specialising in a particular skills area.

This qualification articulates horizontally with the following qualifications:

- ID 2328: Futher Education and Training Certificate: Mechanical Engineering in Tooling Manufacture at NQF Level 4.
- ID 36153: Futher Education and Training Certificate: Polymer Composite Fabrication at NQF Level 4.

This qualification articulates vertically with the following qualifications:

- ID 22433: National Certificate: Manufacturing and Assembly at NQF Level 5.
- ID 22435: National Diploma: Engineering and Related Design at NQF Level 5.

The qualification should also, in terms of the fundamental, non-manufacturing unit standards and other portable skills, articulate with any other qualification at NQF Level 4 in the field of engineering.

This qualification has been designed so that the learner can meaningfully articulate into the higher education and training band once s/he has obtained at NQF Level 4 qualification in Foundry Patternmaking.

Employers, learners and/or institutions should be able to evaluate the outcomes of these qualifications against the needs of a production context and structure top-up learning appropriately. Equally, holders of other qualifications may be evaluated against this qualification for the purpose of RPL.

MODERATION OPTIONS
Moderators for the qualification should be qualified and accredited with an appropriate ETQA. To assure the quality of the assessment process, the moderation should cover one or more of the following:

- Assessor credentials.
- The assessment instrument(s).
- The assessment process (including preparation and post-assessment feedback).

CRITERIA FOR THE REGISTRATION OF ASSESSORS
The following criteria should be applied by the relevant ETQA:

- At least the NQF Level 4 Foundry Patternmaking qualification with relevant workplace experience of at least 12 months within a Foundry Patternmaking supervisory capacity. The subject matter experience of the assessor can be established by recognition of prior learning.

- Appropriate experience and understanding of assessment theory, processes and practices.

- Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards.
  - The interests of the learner.
  - The interests of the company.

- The need for transformation and redressing the legacies of the past.
- The cultural background and language of the learner.

- Registration as an assessor with the relevant ETQA.

- Any other criteria required by the relevant ETQA.

NOTES
N/A

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Fundamental	9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	Level 4	6
Fundamental	119462	Engage in sustained oral/signed communication and evaluate spoken/signed texts	Level 4	5
Fundamental	119469	Read/view, analyse and respond to a variety of texts	Level 4	5
Fundamental	9016	Represent analyse and calculate shape and motion in 2- and 3-dimensional space in different contexts	Level 4	4
Fundamental	119471	Use language and communication in occupational learning programmes	Level 4	5
Fundamental	7468	Use mathematics to investigate and monitor the financial aspects of personal, business, national and international issues	Level 4	6
Fundamental	119459	Write/present/sign for a wide range of contexts	Level 4	5
Core	242668	Demonstrate knowledge and application of the Occupational Health and Safety Act, 85 of 1993 (OHSA) (as amended) and the responsibilities of management in terms of the Act	Level 4	4
Core	13235	Maintain the quality assurance system	Level 4	5
Core	114880	Measure and improve single factor productivity at a work station	Level 4	8
Core	242819	Motivate and Build a Team	Level 4	10
Core	13301	Produce complex engineering drawings	Level 4	6
Elective	244611	Apply problem-solving techniques to make a decision or solve a problem in a real life context	Level 3	2
Elective	117715	Apply the Key Performance Indicators (KPI) of ERP transactions to end-user tasks	Level 4	4
Elective	258677	Conduct complex turning operations	Level 4	16
Elective	13952	Demonstrate basic understanding of the Primary labour legislation that impacts on a business unit	Level 4	8
Elective	242655	Demonstrate knowledge and application of ethical conduct in a business environment	Level 4	4
Elective	12544	Facilitate the preparation and presentation of evidence for assessment	Level 4	4
Elective	258676	Grind tools and cutters used in engineering machining operations	Level 4	8
Elective	10980	Induct a new employee	Level 4	6
Elective	117156	Interpret basic financial statements	Level 4	4
Elective	264060	Manufacture complex metal tooling	Level 4	40
Elective	264056	Manufacture complex wooden pattern equipment	Level 4	40
Elective	13224	Monitor the application of safety, health and environmental protection procedures	Level 4	4
Elective	120375	Participate in the estimation and preparation of cost budget for a project or sub project and monitor and control actual cost against budget	Level 4	6

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	10981	Supervise work unit to achieve work unit objectives (individuals and teams)	Level 4	12
Elective	13315	Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine	Level 4	24
Elective	115753	Conduct outcomes-based assessment	Level 5	15
Elective	9904	Coordinate work group to produce product	Level 5	8
Elective	13203	Counsel workgroup members in respect of HIV/AIDS	Level 5	3
Elective	264055	Design pattern and/tooling for industry	Level 5	15
Elective	12458	Develop the skills of a work team	Level 5	10
Elective	264042	Foundry: Manufacture CAD/CAM Designed Metal Tooling	Level 5	40
Elective	13333	Write computer numerical controlled (CNC) programmes for CNC machining centres using proprietary software	Level 5	30

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Foundry: Set up a production machine

SAQA US ID	*UNIT STANDARD TITLE*		
264014	Foundry: Set up a production machine		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	16

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6928	Foundry: Set up a production machine	Level 2	16	Will occur as soon as 264014 is registered

SPECIFIC OUTCOME 1
Plan work activity.

SPECIFIC OUTCOME 2
Prepare tooling.

SPECIFIC OUTCOME 3
Set tooling.

SPECIFIC OUTCOME 4
Produce sample and make adjustments.

SPECIFIC OUTCOME 5
Monitor machine operation and tooling during the production process.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66449	National Certificate: Foundry Operations	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Produce cores using a coremaking machine

SAQA US ID	*UNIT STANDARD TITLE*		
264015	Produce cores using a coremaking machine		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 1	16

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6899	Foundry: Operate a Coremaking Machine	Level 1	16	Will occur as soon as 264015 is registered

SPECIFIC OUTCOME 1
Plan to produce cores using a coremaking machine.

SPECIFIC OUTCOME 2
Set up coremaking machine for production.

SPECIFIC OUTCOME 3
Monitor and adjust core production process.

SPECIFIC OUTCOME 4
Perform finishing activities on cores.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Produce a mould using a loose pattern

SAQA US ID	*UNIT STANDARD TITLE*		
264016	Produce a mould using a loose pattern		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Fabrication and Extraction	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	16

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6956	Foundry: Produce a mould using a loose pattern	Level 3	16	Will occur as soon as 264016 is registered

SPECIFIC OUTCOME 1
Plan to produce moulds using a loose pattern.

SPECIFIC OUTCOME 2
Prepare pattern, moulding materials, equipment and consumables.

SPECIFIC OUTCOME 3
Produce mould using a loose pattern.

SPECIFIC OUTCOME 4
Strip and finish mould.

SPECIFIC OUTCOME 5
Close and secure mould.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66449	National Certificate: Foundry Operations	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Foundry: Analyse production sands

SAQA US ID	*UNIT STANDARD TITLE*		
264034	Foundry: Analyse production sands		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	16

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6925	Foundry: Analyse Production Sands	Level 2	16	Will occur as soon as 264034 is registered

SPECIFIC OUTCOME 1
Plan to analyse sand.

SPECIFIC OUTCOME 2
Prepare sand samples.

SPECIFIC OUTCOME 3
Determine sand properties.

SPECIFIC OUTCOME 4
Record and communicate sand test results.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Select, use and care for moulding materials and equipment

SAQA US ID	*UNIT STANDARD TITLE*		
264035	Select, use and care for moulding materials and equipment		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 1	8

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to identify, select and use moulding material.

SPECIFIC OUTCOME 2
Identify, select and use moulding materials and components.

SPECIFIC OUTCOME 3
Care for and store moulding equipment and materials.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Produce moulds using a moulding machine

SAQA US ID	*UNIT STANDARD TITLE*		
264037	Produce moulds using a moulding machine		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 1	20

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to produce moulds using a moulding machine.

SPECIFIC OUTCOME 2
Load and check pattern equipment.

SPECIFIC OUTCOME 3
Monitor and adjust mould production process.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Demonstrate an understanding of chemical reactions in, and the solidification of, liquid metals

SAQA US ID	*UNIT STANDARD TITLE*		
264038	Demonstrate an understanding of chemical reactions in, and the solidification of, liquid metals		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Fabrication and Extraction	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	6

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Demonstrate understanding of the various melting processes and manufacturing routes for metal products.

SPECIFIC OUTCOME 2
Demonstrate understanding of the behaviour of pure liquid metals.

SPECIFIC OUTCOME 3
Demonstrate understanding of the interaction of oxygen with various elements and compounds in a liquid metal bath.

SPECIFIC OUTCOME 4
Demonstrate understanding of the solidification of pure metals.

SPECIFIC OUTCOME 5
Demonstrate understanding of the solidification of binary alloys.

SPECIFIC OUTCOME 6
Demonstrate understanding of the upper part of the binary phase diagram applicable to the type of metal(s) produced.

SPECIFIC OUTCOME 7
Prepare and interpret metallographic samples.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66449	National Certificate: Foundry Operations	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Foundry: Manufacture CAD/CAM Designed Metal Tooling

SAQA US ID	*UNIT STANDARD TITLE*		
264042	Foundry: Manufacture CAD/CAM Designed Metal Tooling		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 5	40

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan work activity.

SPECIFIC OUTCOME 2
Model Tooling.

SPECIFIC OUTCOME 3
Programme tool path for CNC machine.

SPECIFIC OUTCOME 4
Set up CNC machine to manufacture metal workpieces.

SPECIFIC OUTCOME 5
Unload CNC machine.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66513	Further Education and Training Certificate: Foundry Patternmaking	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Foundry: Assemble cores

SAQA US ID	*UNIT STANDARD TITLE*		
264043	Foundry: Assemble cores		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	16

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6926	Foundry: Assemble Cores	Level 2	16	Will occur as soon as 264043 is registered

SPECIFIC OUTCOME 1
Plan to assemble cores.

SPECIFIC OUTCOME 2
Prepare cores for assembly.

SPECIFIC OUTCOME 3
Assemble cores.

SPECIFIC OUTCOME 4
Prepare core assembly for production.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Pour molten metal into a mould to produce a casting

SAQA US ID	*UNIT STANDARD TITLE*		
264044	Pour molten metal into a mould to produce a casting		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 1	20

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to pour molten metal.

SPECIFIC OUTCOME 2
Transport ladle of molten metal.

SPECIFIC OUTCOME 3
Align ladle with mould.

SPECIFIC OUTCOME 4
Pour molten metal into mould.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Manufacture simple wooden pattern equipment

SAQA US ID	*UNIT STANDARD TITLE*		
264054	Manufacture simple wooden pattern equipment		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	16

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to manufacture simple wooden pattern equipment.

SPECIFIC OUTCOME 2
Prepare simple wooden pattern equipment layout.

SPECIFIC OUTCOME 3
Prepare simple wooden pattern materials.

SPECIFIC OUTCOME 4
Manufacture simple wooden pattern equipment.

SPECIFIC OUTCOME 5
Finish simple wooden pattern equipment.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2
Core	66490	National Certificate: Foundry Patternmaking	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Design pattern and/tooling for industry

SAQA US ID	*UNIT STANDARD TITLE*		
264055	Design pattern and/tooling for industry		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 5	15

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Prepare design requirements for patterns and/or tooling.

SPECIFIC OUTCOME 2
Design pattern and/or tooling.

SPECIFIC OUTCOME 3
Complete documentation for pattern and/or tooling design.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66489	Further Education and Training (FET) Certificate: Foundry Operations	Level 4
Elective	66513	Further Education and Training Certificate: Foundry Patternmaking	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Manufacture complex wooden pattern equipment

SAQA US ID	*UNIT STANDARD TITLE*		
264056	Manufacture complex wooden pattern equipment		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Fabrication and Extraction	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	40

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6964	Foundry: Manufacture complex wooden pattern equipment	Level 4	40	Will occur as soon as 264056 is registered

SPECIFIC OUTCOME 1
Plan to manufacture complex wooden equipment.

SPECIFIC OUTCOME 2
Prepare complex wooden pattern equipment layouts.

SPECIFIC OUTCOME 3
Prepare complex wooden pattern equipment materials.

SPECIFIC OUTCOME 4
Construct complex wooden pattern equipment.

SPECIFIC OUTCOME 5
Finish complex wooden pattern equipment.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66489	Further Education and Training (FET) Certificate: Foundry Operations	Level 4
Elective	66513	Further Education and Training Certificate: Foundry Patternmaking	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Foundry: Produce a mould

SAQA US ID	*UNIT STANDARD TITLE*		
264057	Foundry: Produce a mould		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	16

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6929	Foundry: Produce a Mould	Level 2	16	Will occur as soon as 264057 is registered

SPECIFIC OUTCOME 1
Plan to produce mould.

SPECIFIC OUTCOME 2
Prepare pattern equipment and moulding consumables.

SPECIFIC OUTCOME 3
Produce mould.

SPECIFIC OUTCOME 4
Strip and finish mould.

SPECIFIC OUTCOME 5
Close and secure mould.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2
Core	66490	National Certificate: Foundry Patternmaking	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Produce pressure die castings

SAQA US ID	*UNIT STANDARD TITLE*		
264059	Produce pressure die castings		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	12

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to produce pressure die castings.

SPECIFIC OUTCOME 2
Prepare and set up pressure die casting equipment.

SPECIFIC OUTCOME 3
Produce pressure die castings.

SPECIFIC OUTCOME 4
Shut down pressure die casting machine.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66449	National Certificate: Foundry Operations	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Manufacture complex metal tooling

SAQA US ID	*UNIT STANDARD TITLE*		
264060	Manufacture complex metal tooling		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Fabrication and Extraction	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	40

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6966	Foundry: Manufacture complex metal tooling	Level 4	40	Will occur as soon as 264060 is registered

SPECIFIC OUTCOME 1
Plan to manufacture complex tooling.

SPECIFIC OUTCOME 2
Prepare complex tooling layout.

SPECIFIC OUTCOME 3
Prepare metal workpieces and equipment.

SPECIFIC OUTCOME 4
Manufacture complex tooling and fixtures.

SPECIFIC OUTCOME 5
Finish complex metal tooling.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66489	Further Education and Training (FET) Certificate: Foundry Operations	Level 4
Elective	66513	Further Education and Training Certificate: Foundry Patternmaking	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Develop a metal casting process

SAQA US ID	*UNIT STANDARD TITLE*		
264074	Develop a metal casting process		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 5	30

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Determine the requirements for metal casting.

SPECIFIC OUTCOME 2
Design the metal casting process.

SPECIFIC OUTCOME 3
Evaluate the metal casting process.

SPECIFIC OUTCOME 4
Establish the casting process and work plans.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66489	Further Education and Training (FET) Certificate: Foundry Operations	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Inspect and prepare pattern equipment

SAQA US ID	*UNIT STANDARD TITLE*		
264075	Inspect and prepare pattern equipment		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 1	16

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6882	Foundry: Inspect and prepare patterns	Level 1	16	Will occur as soon as 264075 is registered

SPECIFIC OUTCOME 1
Plan to inspect and prepare pattern equipment.

SPECIFIC OUTCOME 2
Inspect pattern equipment for production.

SPECIFIC OUTCOME 3
Prepare pattern equipment for production.

SPECIFIC OUTCOME 4
Store prepared pattern equipment.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2
Elective	66490	National Certificate: Foundry Patternmaking	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Manufacture three dimensional regular shaped wooden pattern equipment

SAQA US ID	*UNIT STANDARD TITLE*		
264076	Manufacture three dimensional regular shaped wooden pattern equipment		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	40

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6935	Foundry: Manufacture three dimensional regular shaped wooden pattern equipment	Level 3	40	Will occur as soon as 264076 is registered

SPECIFIC OUTCOME 1
Plan to produce three dimensional regular shaped wooden pattern equipment.

SPECIFIC OUTCOME 2
Prepare three dimensional regular shaped wooden pattern equipment layout.

SPECIFIC OUTCOME 3
Prepare three dimensional regular shaped wooden pattern materials.

SPECIFIC OUTCOME 4
Construct three dimensional regular shaped wooden pattern equipment.

SPECIFIC OUTCOME 5
Finish three dimensional regular shaped wooden pattern equipment.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66449	National Certificate: Foundry Operations	Level 3
Elective	66469	National Certificate: Foundry Patternmaking	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Demonstrate a basic understanding of the methods of chemical analysis for metals

SAQA US ID	*UNIT STANDARD TITLE*		
264077	Demonstrate a basic understanding of the methods of chemical analysis for metals		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	2

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Demonstrate an understanding of the importance of determining the chemical composition of metals at various stages of manufacture.

SPECIFIC OUTCOME 2
Demonstrate basic awareness of the techniques available to analyse metals.

SPECIFIC OUTCOME 3
Demonstrate understanding of the working, operation and limitations of the optical spark emission spectrometer.

SPECIFIC OUTCOME 4
Demonstrate understanding of the working, operation and limitations of gas carrier based analysers.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Prepare sand for foundry mould production

SAQA US ID	*UNIT STANDARD TITLE*		
264078	Prepare sand for foundry mould production		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 1	16

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
6898	Foundry: Prepare Sand	Level 1	16	Will occur as soon as 264078 is registered

SPECIFIC OUTCOME 1
Plan to prepare foundry sand.

SPECIFIC OUTCOME 2
Mix and distribute foundry sand.

SPECIFIC OUTCOME 3
Perform initial test(s) on mixed foundry sand.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Produce gravity die castings

SAQA US ID	*UNIT STANDARD TITLE*		
264079	Produce gravity die castings		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	3

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to produce gravity die castings.

SPECIFIC OUTCOME 2
Prepare and set up gravity die casting equipment.

SPECIFIC OUTCOME 3
Produce gravity die castings.

SPECIFIC OUTCOME 4
Clean die body and turn-around process.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Produce a strickle mould

SAQA US ID	*UNIT STANDARD TITLE*		
264094	Produce a strickle mould		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	30

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to produce strickle mould.

SPECIFIC OUTCOME 2
Prepare work area for strickle mould production.

SPECIFIC OUTCOME 3
Produce cope and drag mould.

SPECIFIC OUTCOME 4
Finish strickle mould.

SPECIFIC OUTCOME 5
Close strickle mould.

SPECIFIC OUTCOME 6
Clamp and secure strickle mould.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66489	Further Education and Training (FET) Certificate: Foundry Operations	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Demonstrate an understanding of introductory principles of electricity as applied in a metals production context

SAQA US ID	*UNIT STANDARD TITLE*		
264095	Demonstrate an understanding of introductory principles of electricity as applied in a metals production context		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	2

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Demonstrate understanding of the nature of electricity, the carriers of electric current, how current flows through solids, liquids and gases, and the types of current.

SPECIFIC OUTCOME 2
Demonstrate knowledge and understanding of electric potential and electric resistance, their effects on electric current, and of the types of electrical conductor.

SPECIFIC OUTCOME 3
Demonstrate knowledge of electric power and electric energy.

SPECIFIC OUTCOME 4
Demonstrate understanding of basic electrical circuits and how electricity is received at home and at work.

SPECIFIC OUTCOME 5
Demonstrate knowledge of the dangers of electricity to the human body and associated basic safety rules.

SPECIFIC OUTCOME 6
Demonstrate understanding of the interactive nature between a current carrying conductor, a magnetic field, and of the induction of current in a second conductor.

SPECIFIC OUTCOME 7
Demonstrate knowledge of the electrical working of furnaces.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Produce cores by hand

SAQA US ID	*UNIT STANDARD TITLE*		
264096	Produce cores by hand		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	16

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to produce core by hand.

SPECIFIC OUTCOME 2
Prepare corebox.

SPECIFIC OUTCOME 3
Produce core by hand.

SPECIFIC OUTCOME 4
Strip and finish core.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66449	National Certificate: Foundry Operations	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Produce a mould by core assembly

SAQA US ID	*UNIT STANDARD TITLE*		
264114	Produce a mould by core assembly		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	30

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to produce a mould by core assembly.

SPECIFIC OUTCOME 2
Prepare work area.

SPECIFIC OUTCOME 3
Assemble cores.

SPECIFIC OUTCOME 4
Finish mould by core assembly.

SPECIFIC OUTCOME 5
Clamp and secure mould by core assembly.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66489	Further Education and Training (FET) Certificate: Foundry Operations	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Demonstrate knowledge of introductory principles of metallurgy

SAQA US ID	*UNIT STANDARD TITLE*		
264115	Demonstrate knowledge of introductory principles of metallurgy		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	6

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Demonstrate an understanding of the role of metals in industry.

SPECIFIC OUTCOME 2
Demonstrate basic knowledge of the building blocks of metals.

SPECIFIC OUTCOME 3
Demonstrate knowledge and understanding of the structure of metals on an atomic and a microscopic scale.

SPECIFIC OUTCOME 4
Demonstrate understanding of the physical properties and behaviour of metals.

SPECIFIC OUTCOME 5
Demonstrate a basic understanding of the mechanical properties of metals.

SPECIFIC OUTCOME 6
Demonstrate understanding of the effects of adding another element to a metal.

SPECIFIC OUTCOME 7
Demonstrate understanding of commonly used engineering metals.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Demonstrate a basic understanding of quality

SAQA US ID	*UNIT STANDARD TITLE*		
264134	Demonstrate a basic understanding of quality		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	4

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Demonstrate understanding of the term "Quality".

SPECIFIC OUTCOME 2
Demonstrate understanding of the term "Quality Objectives".

SPECIFIC OUTCOME 3
Demonstrate understanding of the measurement of quality.

SPECIFIC OUTCOME 4
Demonstrate understanding of Quality Control.

SPECIFIC OUTCOME 5
Demonstrate understanding of Quality Assurance, the Quality Management System and their practical implications.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66512	National Certificate: Foundry Operations	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Manufacture a resin pattern

SAQA US ID	*UNIT STANDARD TITLE*		
264135	Manufacture a resin pattern		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	16

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to manufacture resin pattern

SPECIFIC OUTCOME 2
Prepare materials.

SPECIFIC OUTCOME 3
Manufacture negative mould.

SPECIFIC OUTCOME 4
Manufacture resin pattern.

SPECIFIC OUTCOME 5
Finish resin pattern.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66449	National Certificate: Foundry Operations	Level 3
Elective	66469	National Certificate: Foundry Patternmaking	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Manufacture three dimensional regular shaped metal tooling

SAQA US ID	*UNIT STANDARD TITLE*		
264154	Manufacture three dimensional regular shaped metal tooling		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	40

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Plan to manufacture three dimensional regular shaped metal tooling.

SPECIFIC OUTCOME 2
Prepare metal work piece.

SPECIFIC OUTCOME 3
Finish metal work piece.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66449	National Certificate: Foundry Operations	Level 3
Elective	66469	National Certificate: Foundry Patternmaking	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Demonstrate an understanding of basic physical metallurgy and its applications

SAQA US ID	*UNIT STANDARD TITLE*		
264376	Demonstrate an understanding of basic physical metallurgy and its applications		
ORIGINATOR		*PROVIDER*	
SGB Manufacturing and Assembly Processes			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	8

This unit standard does not replace any other unit standard and is not replaced by another unit standard.

SPECIFIC OUTCOME 1
Demonstrate understanding of the need for different properties in different metal products.

SPECIFIC OUTCOME 2
Demonstrate understanding of the concept basic mechanical properties of metals and how it is measured.

SPECIFIC OUTCOME 3
Demonstrate understanding of atomic movement in the lattice of solid metals and its effect on mechanical properties.

SPECIFIC OUTCOME 4
Demonstrate understanding of phase transformations in solid metals.

SPECIFIC OUTCOME 5
Demonstrate understanding of the binary phase diagram applicable to the type of metal(s) a works/foundry/factory produces and its implications for the phase transformations that take place at various temperatures and at various solute concentrations.

SPECIFIC OUTCOME 6
Demonstrate understanding of the heat treatments of metals and their influences on mechanical properties.

SPECIFIC OUTCOME 7
Demonstrate understanding of the deformation of metals and its influence on mechanical properties.

SPECIFIC OUTCOME 8
Demonstrate basic understanding of Metallography.

SPECIFIC OUTCOME 9

Demonstrate understanding of the mechanisms by which different properties are achieved in different metal products.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66489	Further Education and Training (FET) Certificate: Foundry Operations	Level 4