

Occupational Qualification Document					
Occupational Code	Qualification Title	NQF Level			
652204	National Occupational Qualification: Engineering Patternmaker	4			
	Name	Email	Phone	Logo	
Development Quality Partner	Manufacturing Engineering and Related Services Education Authority	SHlubi@merseta.or.za	011 219 3268		
Assessment Quality Partner	National Artisan Moderation Body (NAMB)	G van Standen	011 206 1015	[insert image here]	

DQP Representative Signature

Date

QUALIFICATION DETAILS

Qualification Title: National Occupational Qualification: Engineering Patternmaker

Occupational Code: 652204

Curriculum Code: 672107001

Quality Assuring Body: Quality Council for Trades and Occupations (QCTO)

Sub Framework: Occupational Qualifications Sub-Framework

Field: Field 06 - Manufacturing, Engineering and Technology

Subfield: Undefined

NQF Level: 4

Credits: 541

Originator/Development Quality Partner (DQP): Manufacturing Engineering and Related Services Education Authority

Originating Provider/Assessment Quality Partner (AQP): National Artisan Moderation Body (NAMB)

Qualification Type: Occupational Qualification

Registered qualifications and or learning programmes to be replaced:

- None

RATIONALE

A shortage of Engineering Patternmaking skills and capacity within the industry was identified as one of the major gaps within the Foundry Industry and listed on the critical skills list of the MERSETA. The range of typical learners that will enter this qualification are people who would like to gain access to employment opportunities in Engineering Patternmaking.

This qualification resides as one of several in the mechanical engineering and manufacturing environments and makes allowance for any feeder occupation within this context to gain access to the Engineering Patternmaker qualification. The Engineering Patternmaker qualification also makes provision for people to progress within this discipline to other aspects such as working with metal patterns, wooden patterns and resin patterns.

The main benefits of this qualification for the learner are that the learner has an opportunity to be recognised as a qualified artisan with well-structured, relevant and current competencies and have access to skilled employment opportunities within the mechanical engineering and manufacturing environments. Society will be served by qualified Engineering Patternmakers that not only undertake work with improved skills but are also contributing to the competitiveness of South Africa's manufacturing sector. The overall benefits for the economy would include efficient and effective Engineering Patternmaking competencies available to be utilised for economic growth purposes.

PURPOSE

The purpose of this qualification is to prepare a learner to operate as an engineering patternmaker.

Engineering Patternmakers construct full size engineering patterns from specific construction material such as timber, polymer (resin) or metal to produce metal castings, vacuum form tooling and tooling as a positive or negative shape for specific products used in various manufacturing industries.

A qualified learner will be able to:

- Inspecting, planning and preparing pattern equipment and materials for the operations of a patternmaking manufacturing process
- Manufacturing patternmaking patterns equipment
- Problem-solving, adjusting and maintaining patternmaking production process

RULES OF COMBINATION

This qualification is made up of the following compulsory Knowledge and Practical Skill Modules:

Knowledge Modules:

- 652204000-KM-01, Applied Mathematics, Sciences and Drawings, NQF Level 4, Credits 5
- 652204000-KM-02, Metallurgy and Melting Processes, NQF Level 4, Credits 22
- 652204000-KM-03, Health, Safety, Quality and Legislation, NQF Level 3, Credits 10
- 652204000-KM-04, Environment and Energy Efficiency, NQF Level 4, Credits 5
- 652204000-KM-05, Tools, Equipment, Materials and Workplace Practice, NQF Level 4, Credits 12
- 652204000-KM-06, Sand Technology and Sand Casting, NQF Level 4, Credits 4
- 652204000-KM-07, Casting and Die Casting, NQF Level 4, Credits 15
- 652204000-KM-08, Pattern Assembly, NQF Level 4, Credits 6
- 652204000-KM-09, Design and Cutter Technology, NQF Level 4, Credits 11
- 652204000-KM-10, Information Technology for Patternmakers, NQF Level 2, Credits 5
- 652204000-KM-11, Introduction to Engineering Technology and Drawings, NQF Level 2, Credits 15
- 652204000-KM-12, Workplace fundamentals, NQF Level 3, Credits 10

Total number of credits for Knowledge Modules: 120

Practical Skill Modules:

- 652204000-PM-01, Inspect and prepare patterns, NQF Level 3, Credits 8
- 652204000-PM-02, Plan and prepare patternmaking equipment and materials, NQF Level 3, Credits 8
- 652204000-PM-03, Interpret and draw engineering drawings, NQF Level 3, Credits 15
- 652204000-PM-04, Prepare to set up patternmaking production machines, NQF Level 3, Credits 8
- 652204000-PM-05, Manufacture simply wooden pattern, NQF Level 3, Credits 30
- 652204000-PM-06, Manufacture advanced and complex wooden pattern, NQF Level 4, Credits 60

- 652204000-PM-07, Manufacture resin pattern using tools and equipment, NQF Level 4, Credits 30
- 652204000-PM-08, Manufacture metal pattern using tools and equipment, NQF Level 4, Credits 64
- 652204000-PM-09, Communicate safety, health, environmental, risk and quality issues regarding the operation of machinery, NQF Level 2, Credits 8
- 652204000-PM-10, Conduct problem solving and maintenance activities during patternmaking production process, NQF Level 4, Credits 8

Total number of credits for Practical Skill Modules: 239

This qualification also requires the following Work Experience Modules:

- 652204000-WM-01, Planning and preparing processes for patternmaking equipment, consumables and production machines suitable for producing metal patterns for use in a production environment, NQF Level 3, Credits 21
- 652204000-WM-02, Planning and preparing processes for patternmaking equipment, consumables and production machines suitable for producing wooden patterns and resin patterns for use in a production environment, NQF Level 3, Credits 21
- 652204000-WM-03, Patternmaking manufacturing processes for producing metal patterns for use in a production environment, NQF Level 4, Credits 25
- 652204000-WM-04, Patternmaking manufacturing processes for producing wooden patterns and resin patterns in a production environment, NQF Level 4, Credits 25
- 652204000-WM-05, Patternmaking production problem-solving, adjustment and maintenance processes for producing metal patterns for use in a production environment, NQF Level 4, Credits 30
- 652204000-WM-06, Patternmaking production problem-solving, adjustment and maintenance processes for producing wooden patterns and resin patterns for use in a production environment, NQF Level 4, Credits 30
- 652204000-WM-07, Processes for repair and manufacturing of simple wooden pattern, NQF Level 3, Credits 30

Total number of credits for Work Experience Modules: 182

ENTRY REQUIREMENTS

- NQF Level 3 qualification plus N2 with Engineering Maths and Science and Engineering Drawing

EXIT LEVEL OUTCOMES AND ASSOCIATED ASSESSMENT CRITERIA

- **Exit Level Outcome 1**

Inspecting, planning and preparing pattern equipment and materials (25%)

Associated Assessment Criteria

- Ensure correct materials and consumables are used in the preparation of the pattern equipment.
- The correct tools use of tools, measuring equipment and or machines as to specification.
- Methods of determining materials, consumables and equipment are in accordance with a specific job, tasks or activity.
- Materials and schedule equipment are ordered to reflect relevance and accuracy of materials relevant for specification.

- **Exit Level Outcome 2**

Manufacturing patternmaking patterns equipment (25%)

Associated Assessment Criteria

- Materials and schedule equipment are ordered in accordance with relevant procedures
- The marking off of isometric scales are compliant to standard practices.
- Assembly drawings are used to represent items that consist of more than one component
- Assembled drawing is labelled correctly to demonstrate the parts of the complete drawing
- Correct programming, setting up and operating of advanced (CNC and EDM) machinery are demonstrated to meet manufacturing requirement and in accordance with safety and environmental procedures
- Machines are inspected for safety in accordance with the standard operating procedures for each machine
- Manufacturing machines are shut down safely, work area is cleaned and waste is removed and disposed in accordance with standard operating procedures
- Pattern equipment parts and /or equipment are labelled to prepare for finishing activities according to specifications

- **Exit Level Outcome 3**

Problem-solving, adjusting and maintaining patternmaking production process (50%)

Associated Assessment Criteria

- Problems related to tools and equipment are identified and recorded to reflect as part of the maintenance history.
- The causes of the identified problem are evaluated and determined to effect the optimal solution and possible solutions to rectify the problem are determined, implemented and sustained using different techniques for problem solving.
- The need for replacement of consumables are identified to reflect the importance of maintenance during the production processes
- Set up activities are conducted to optimise production processes and a test run of the set up activities is commissioned to optimise production processes
- Waste is disposed of in a safe and responsible manner in line with prevailing best practice
- The pattern parts and /or equipment are coated and painted according to specification by considering the reactions of different coatings on pattern materials
- Communication activities are planned in accordance with type of information, type of audience, media available, formats, timeframes, standard operating procedures and QMS application and system

INTERNATIONAL COMPARABILITY

An International comparability study was undertaken to evaluate a selected number of Engineering Patternmaker qualifications from various countries in terms of their scope, levels and curriculum content.

The purpose of this exercise is to benchmark the Engineering Patternmaker qualification against best practice internationally. The benchmark is against three namely: Germany, United States of America (USA) and India.

An analysis of the occupations in the various countries has revealed that there is a significant amount of similarities.

Germany

Germany has a vibrant foundry industry of over 900 individual plants, on which their heavy engineering plant manufacturing sector as well as the highly developed rail, sea and road transportation sector is based. Germany is a leader in wind energy turbine development, and leads the world in the demanding technology required for these applications. Their training and research establishments are world-renowned.

USA

The United States of America has been one of the leaders in casting technology of both non-ferrous and ferrous metals and their alloys. There are approximately two thousand foundries in the USA and the research institutions are globally recognised for both the quality and quantity of the research projects published.

India

India became the second largest casting manufacturer in the world from 2010. Its foundry industry developed over many years and recently grew at significant levels. It produces for all the engineering sectors including automotive; agricultural implements and tractors, infrastructure projects and manufactured products. The Indian Institute of Foundry men, is represented at the BRICS Foundry Forum, of which South Africa is also a member. Similar to other two countries, India's approach was found to be comparable.

The analysis of the occupations provided evidence that there is a high level of commonalities between them. All occupations are regarded as trade/occupational qualifications and prescribe a set of national standards. The jobs related to the occupations require very similar knowledge and variety of similar skills sets which include: production skills; process design and development skills; skills in health and safety; skills in maintenance, installation and repair; skills in quality assurance as well as knowledge of supply chain logistics.

Conclusion

The South African occupational qualification is comparable to benchmarked countries in terms of the content coverage and the delivery approaches.

INTEGRATED ASSESSMENT

Integrated formative assessment:

The skills development provider will use the curriculum to guide them on the stipulated internal assessment criteria and weighting. They will also apply the scope of practical skills and applied knowledge as stipulated by the internal assessment criteria. This formative assessment leads to entrance into the integrated external summative assessment.

Integrated summative assessment:

An external integrated summative assessment, conducted through the relevant QCTO Assessment Quality Partner is required for the issuing of this qualification. The external integrated summative assessment will focus on the exit level outcomes and associated assessment criteria.

RECOGNITION OF PRIOR LEARNING

RPL for access to the external integrated summative assessment: Accredited providers and approved workplaces must apply the internal assessment criteria specified in the related curriculum document to establish and confirm prior learning. Accredited providers and workplaces must confirm prior learning by issuing a statement of result or certifying a work experience record.

RPL for access to the qualification: Accredited providers and approved workplaces may recognise prior learning against the relevant access requirements.

ARTICULATION

Horizontal

This qualification articulates horizontally with the following qualification:

- Occupational Certificate: EDM Wire Operator NQF Level 4, Occupational Certificate: EDM **Plunge** NQF Level 4 Operator Occupational Qualifications: Moulder: NQF Level 4

Vertical

This qualification articulates horizontally with the following qualification:

- Occupational Certificate: Tooling Machinist NQF Level 5, Occupational Qualifications: Toolmaker NQF Level 5, National Certificate: N4 Engineering Studies, NQF Level 5

NOTES

Qualifying for external assessment:

None

Foundational learning competence is a pre-requisite for the awarding of this qualification.

Additional legal or physical entry requirements:

None

Criteria for the accreditation of providers

Accreditation of providers will be done against the criteria as reflected in the relevant curriculum on the QCTO website.

The curriculum title and code is 652204000: National Occupational Qualification: Engineering Patternmaker

This qualification encompasses the following trades as recorded on the NLRD:

This qualification encompasses the following trades as recorded on the NLRD:

- This is not a trade qualification.

Assessment Quality Partner (AQP)
National Artisan Moderation Body (NAMB)

Entry Requirements

NQF Level 3 with Mathematics and Science
 Or

N2 Engineering Studies with Mathematics and Engineering Science

MODULES

COMPONENT	ID	MODULE TITLE	NQF LEVEL	CREDITS
Knowledge	652204000-KM-01	Applied Mathematics and Sciences	4	5
Knowledge	652204000-KM-02	Metallurgy and Melting Processes	4	22
Knowledge	652204000-KM-03	Health, Safety, Quality and Legislation	3	10
Knowledge	652204000-KM-04	Environment and Energy Efficiency	4	5
Knowledge	652204000-KM-05	Tools, Equipment, Materials and Workplace Practice	4	12
Knowledge	652204000-KM-06	Sand Technology and Sand Casting	4	4
Knowledge	652204000-KM-07	Casting and Die Casting	4	15
Knowledge	652204000-KM-08	Pattern Assembly	4	6
Knowledge	652204000-KM-09	Design and Cutter Technology	4	11
Knowledge	652204000-KM-10	Information Technology for Patternmakers	2	5
Knowledge	652204000-KM-11	Introduction to Engineering Technology and Drawings	2	15
Knowledge	652204000-KM-12	Workplace fundamentals	3	10



Practical	652204000-PM-01	Inspect and prepare patterns	3	8
Practical	652204000-PM-02	Plan and prepare patternmaking equipment and materials	3	8
Practical	652204000-PM-03	Interpret and draw engineering drawings	3	15
Practical	652204000-PM-04	Prepare to set up patternmaking production machines	3	8
Practical	652204000-PM-05	Manufacture simple wooden pattern	3	30
Practical	652204000-PM-06	Manufacture advanced and complex wooden pattern	4	60
Practical	652204000-PM-07	Manufacture resin pattern using tools and equipment	4	30
Practical	652204000-PM-08	Manufacture metal pattern using tools and equipment	4	64
Practical	652204000-PM-09	Communicate safety, health, environmental, risk and quality issues regarding the operation of machinery	2	8
Practical	652204000-PM-10	Conduct problem solving and maintenance activities during patternmaking production process	4	8
Workplace	652204000-WM-01	Planning and preparing processes for patternmaking equipment, consumables and	3	21

		production machines suitable for producing metal patterns for use in a production environment		
Workplace	652204000-WM-02	Planning and preparing processes for patternmaking equipment, consumables and production machines suitable for producing wooden patterns and resin patterns for use in a production environment	3	21
Workplace	652204000-WM-03	Patternmaking manufacturing processes for producing metal patterns for use in a production environment	4	25
Workplace	652204000-WM-04	Patternmaking manufacturing processes for producing wooden patterns and resin patterns in a production environment	4	25
Workplace	652204000-WM-05	Patternmaking production problem-solving, adjustment and maintenance processes for producing metal patterns for use in a production environment,	4	30
Workplace	652204000-WM-06	Patternmaking production problem-	4	30

		solving, adjustment and maintenance processes for producing wooden patterns and resin patterns for use in a production environment		
Workplace	652204000-WM-07	Processes for repair and manufacturing of simple wooden pattern	3	30

DERIVED QUALIFICATIONS REGISTERED AS PART QUALIFICATIONS

SAQA ID	Curriculum Code	Title	NQF Level	Credits
	672107001	Pattern Patch and Repairer	3	153

Occupational Qualification Document					
Occupational Code	Qualification Title	NQF Level			
652204	National Occupational Qualification: Engineering Pattern Repairer	3			
	Name	Email	Phone	Logo	
Development Quality Partner	Manufacturing Engineering and Related Services Education Authority	shlubi@merseta.or.za	011 219 3268		
Assessment Quality Partner	National Artisan Moderation Body (NAMB)		011 206 1015	[insert image here]	

Qualification Title: **National Occupational Qualification: Engineering Pattern Repairer**

Occupational Code: 652204 652204-000-01-00

Curriculum Code: 652204-000

Quality Assuring Body: Quality Council for Trades and Occupations (QCTO)

Sub Framework: Occupational Qualifications Sub-Framework

Field: Field 06 - Manufacturing, Engineering and Technology

Subfield: Undefined

NQF Level: 3

Credits: 153

Originator/Development Quality Partner (DQP): Manufacturing Engineering and Related Services Education Authority (Merseta)

Originating Provider/Assessment Quality Partner (AQP): National Artisan Moderation Body (NAMB)

Qualification Type: Occupational Qualification

Registered qualifications and or learning programmes to be replaced:

- None

RATIONALE

A shortage of Engineering Pattern Repairer skills and capacity within the industry was identified as one of the major gaps within the Foundry Industry. The range of typical learners that will enter this qualification are people who would like to gain access to employment opportunities in engineering patternmaking and repair.

This qualification resides as one of several in the mechanical engineering and manufacturing environments and makes allowance mobility within the broader foundry, toolmaking environment. The significant work within the industry rests with Engineering Pattern Repair as the workload for pattern patching and repair far exceed that of the Patternmaker. Opportunities abound for employment for people who will hold this qualification.

The main benefits of this qualification for the learner are that the learner has an opportunity to be recognised as a qualified. Qualified learner will have access to skilled employment opportunities within the mechanical engineering and manufacturing environments. Society will be served by qualified persons who will not only undertake work with improved skills but are also contribute to the competitiveness of South Africa's manufacturing sector.

PURPOSE

Engineering Patternmakers construct full size engineering patterns from specific construction material such as timber, polymer (resin) or metal to produce metal castings, vacuum form tooling and tooling as a positive or negative shape for specific products used in various manufacturing industries.

RULES OF COMBINATION

Knowledge Modules:

Total number of credits for Knowledge Modules: 50

List of Practical Skill Modules:

Total number of credits for Practical Skill Modules: 54

This qualification also requires the following Work Experience Modules:

Total number of credits for Work Experience Modules: 51

ENTRY REQUIREMENTS

- NQF Level 2 with Mathematics and Science

Or

- N2 Engineering Studies with Mathematics and Engineering Science

EXIT LEVEL OUTCOMES

- **Exit Level Outcome 1**

Inspect, plan and prepare pattern equipment and materials for manufacturing processes of pattern

Associated Assessment Criteria

- Drawings are read and interpreted with reference to projected views, materials, machining processes, tolerances, finishing, references and volumes (quantities) in accordance to specification
- Corrective occupational health and safety measures are developed and applied in accordance with task requirements
- The simulation and prototyping results are interpreted to verify and adjust pattern design
- Demonstrate knowledge and understanding of assisting, advising and planning product development, pattern design, production processes, equipment and material, including machining of pattern components and assembly of patterns

- **Exit Level Outcome 2**

Manufacture and repair simple engineering patterns

- Wood is planned on woodworking machines to layout requirements according to standard operating procedures.
- Wood is marked out, measured, cut to size and sanded to layout requirements according to standard operating procedures.
- Applicable safety, health and environmental principles and procedures are applied according to standard operating procedures.
- Patterns and repaired to standard industry requirements
- Pattern equipment is constructed to layout requirements
- Pattern equipment is sanded and painted according to standard operating procedures.
- A three-dimensional regular shaped wooden pattern equipment is manufactured to production specifications.
- Pattern equipment is shaped by hand or machine to layout requirements.

- Finished pattern is polished for completion to specification requirements
 - Coreprints are added to the pattern to layout requirements
- Fasteners are utilised correctly to layout requirements. Finish three dimensional regular shaped wooden pattern equipment.

INTERNATIONAL COMPARABILITY

An International comparability study was undertaken to evaluate a selected number of Engineering Pattern Repairer qualification from various countries in terms of their scope, levels and curriculum content.

The purpose of this exercise is to benchmark the Engineering Pattern Patch Repairer qualification against best practice internationally. The benchmark is against three namely: Germany, United States of America (USA) and India.

Germany

Germany has a vibrant foundry industry of over 900 individual plants, on which their heavy engineering plant manufacturing sector as well as the highly developed rail, sea and road transportation sector is based. Germany is a leader in wind energy turbine development, and leads the world in the demanding technology required for these applications. Their training and research establishments are world-renowned.

USA

The United States of America has been one of the leaders in casting technology of both non-ferrous and ferrous metals and their alloys. There are approximately two thousand foundries in the USA and the research institutions are globally recognised for both the quality and quantity of the research projects published.

India

India became the second largest casting manufacturer in the world from 2010. Its foundry industry developed over many years and recently grew at significant levels. It produces for all the engineering sectors including automotive; agricultural implements and tractors, infrastructure projects and manufactured products. The Indian Institute of Foundry men, is represented at the BRICS Foundry Forum, of which South Africa is also a member. Similar to other two countries, India's approach was found to be comparable.

Although the compared countries do not uniquely provide similar qualification, some modules in the above learning programmes are similar to those offered in this qualification. All occupations are regarded as trade/occupational qualifications and prescribe a set of national standards. The jobs related to the occupations require very similar knowledge and variety of similar skills sets

Conclusion

The South African occupational qualification is comparable to benchmarked countries in terms of the content coverage and the delivery approaches.

INTERGRATED ASSESSMENT

Integrated Formative Assessment:

The Skills Development Provider will use the curriculum to guide them on the stipulated internal assessment criteria and weighting. They will also apply the scope of practical skills and applied knowledge as stipulated by the internal assessment criteria. This formative assessment leads to entrance into the integrated External Summative Assessment.

Integrated Summative Assessment:

An External Integrated Summative Assessment, conducted through the relevant QCTO Assessment Quality Partner is required for the issuing of this qualification. The External Integrated Summative Assessment will focus on the Exit Level Outcomes and Associated Assessment Criteria.

RECOGNITION OF PRIOR LEARNING (RPL)

RPL for Access to the External Integrated Summative Assessment:

Accredited providers and approved workplaces must apply the internal assessment criteria specified in the related curriculum document to establish and confirm prior learning. Accredited providers and workplaces must confirm prior learning by issuing a statement of result or certifying a work experience record.

RPL for access to the qualification:

Accredited providers and approved workplaces may recognise prior learning against the relevant access requirements.

ARTICULATION

Horizontal

This qualification articulates horizontally with the following qualification:

- Occupational Certificate: Lathe Operator NQF level 3, Occupational Certificate: Milling Machine Operator NQF level 3, Occupational Certificate: Surface Grinding Operator NQF level 3 , Occupational Certificate: Manufacturing Workshop Assistant NQF level 3

Vertical

This qualification articulates horizontally with the following qualification:

- Occupational Certificate: CNC Turning Machinist NQF Level 4, Occupational Certificate: EDM Wire Operator NQF Level 4 , Occupational Certificate: EDM Plunge Operator NQF Level 4

NOTES

Qualifying for External Assessment:

In order to qualify for an external assessment, learners must provide proof of completion of all required knowledge and practical modules by means of statements of results and a record of completed work experience.

Additional Legal or Physical Entry Requirements:

None

Criteria for the Accreditation of Providers

Accreditation of providers will be done against the criteria as reflected in the relevant curriculum on the QCTO website.

The curriculum title and code is Engineering Pattern Repairer: 652204-000-01-00:

Encompassed Trades

This qualification encompasses the following trades as recorded on the NLRD:

- None

Assessment Quality Partner (AQP)

National Artisan Moderation Body (NAMB)

MODULES

COMPONENT	ID	MODULE TITLE	NQF LEVEL	CREDITS
Knowledge	652204000-KM-01	Applied Mathematics and Sciences	4	5
Knowledge	652204000-KM-02	Metallurgy and Melting Processes	4	22
Knowledge	652204000-KM-03	Health, Safety, Quality and Legislation	3	10
Knowledge	652204000-KM-04	Environment and Energy Efficiency	4	5
Knowledge	652204000-KM-05	Tools, Equipment, Materials and Workplace Practice	4	12
Knowledge	652204000-KM-06	Sand Technology and Sand Casting	4	4

PARENT QUALIFICATION

SAQA ID	Curriculum Code	Title	NQF Level	Credits
	652204-000-01-00	Engineering Patternmaker	4	541

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ERIVED QUALIFICATIONS REGISTERED AS PART QUALIFICATIONS

SAQA ID	Curriculum Code	Title	NQF Level	Credits
	652204-000-01-00	National Occupational Qualification: Engineering Pattern Repairer	3	153