



# Government Gazette Staatskoerant

REPUBLIC OF SOUTH AFRICA  
REPUBLIEK VAN SUID-AFRIKA

Vol. 447

Pretoria, 20 September 2002

**No. 23842**



9771682584003



**AIDS HELPLINE: 0800-0123-22 Prevention is the cure**



---



---

## CONTENTS • INHOUD

No.		Page No.	Gazette No.
<b>GOVERNMENT NOTICES</b>			
<b>South African Qualifications Authority</b>			
<i>Government Notices</i>			
1178	National Standards Bodies Regulations: Standards Generating Body (SGB) for Manufacturing and Assembly registered by NSB 06, Manufacturing, Engineering and Technology .....	3	23842
1179	do.: Standards Generating Body (SGB) for Chemical Engineering registered by NSB 06, Manufacturing, Engineering and Technology .....	16	23842
1180	do.: Standards Generating Body (SGB) for Manufacturing and Assembly registered by NSB 06, Manufacturing, Engineering and Technology .....	23	23842
1181	Standards Generating Bodies: National Standards Body 09, Health Sciences and Social Services .....	69	23842
1182	National Standards Bodies Regulations: Standards Generating Body (SGB) for Manufacturing and Assembly registered by NSB 06, Manufacturing, Engineering and Technology .....	73	23842
1183	do.: Standards Generating Body (SGB) for Manufacturing and Assembly registered by NSB 06, Manufacturing, Engineering and Technology .....	94	23842
1184	National Standards Bodies Regulations: Standards Generating Body (SGB) for Food registered by NSB 06, Manufacturing, Engineering and Technology .....	107	23842
1185	do.: Standards Generating Body (SGB) for Manufacturing and Assembly registered by NSB 06, Manufacturing, Engineering and Technology .....	118	23842
1186	do.: Standards Generating Body (SGB) for Manufacturing and Assembly registered by NSB 06, Manufacturing, Engineering and Technology .....	246	23842

---



---



## GOVERNMENT NOTICES

## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

No. 1178

20 September 2002



Established in terms of Act 58 of 1995

## SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)

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

**Manufacturing and Assembly**

Registered by NSB 06, Manufacturing, Engineering and Technology, publishes the following qualifications and unit standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the qualification and unit standards upon which qualifications are based. The full qualification and unit standards can be accessed via the SAQA web-site at [www.saga.org.za](http://www.saga.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, 659 Pienaar street, Brooklyn, Pretoria.

Comment on the unit standards should reach SAQA at the address *below and no later than 21 October 2002*. All correspondence should be marked **Standards Setting – SGB for Manufacturing and Assembly** and addressed to

The Director: Standards Setting and Development  
SAQA

Attention: Mr. D Mphuthing

Postnet Suite 248

Private Bag X06

Waterkloof

0145

or faxed to 012 – 482 0907

**SAMUEL B.A. ISAACS**  
EXECUTIVE OFFICER



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Engineering Fabrication: NQF Level 2**

**Field:** Manufacturing, engineering and technology - NSB 06

**Sub-field:** Manufacturing & assembly

**Level:** 2

**Credit:** 159

**Issue date:**

**Review date:**

**Rationale of the qualification:**

This is the first qualification in a series for learners who want to follow a career in the field of engineering fabrication, which includes boiler making, sheet metal working, welding and vehicle body building. This qualification focuses on developing skills and knowledge necessary to begin such a career.

It enables learners who have gained relevant experience in the workplace to gain credits through the RPL process. The qualification also forms the basis for further learning in the field of engineering fabrication where the learner will be able to specialise in one of the following skill areas: Light / Heavy Fabrication or Welding.



**Purpose:**

The purpose of this qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of engineering fabrication skills and to meet the challenges of such an environment.

The chief skill that is recognised in this qualification is the ability to produce simple components using a variety of fabrication methods. This capability requires an understanding of basic fabrication theory; machinery functioning, operation and maintenance; engineering materials and tools; concepts of measurement; basic engineering drawing and development of components and simple methods of cutting and joining metals.

Hand skills play a vital role in this qualification.

Qualified learners will also understand:

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

With this understanding, learners will be able to participate in workplace activities

**Access to the Qualification:**

Open Access

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

This qualification assumes learners have a General Education and Training Certificate at NQF Level 1, or alternatively, ABET qualifications.



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

- Literacy and numeracy
- Basic concepts of science and technology

#### **Exit Level Outcomes and Assessment Criteria:**

##### **Exit level outcome 1**

Demonstrate an understanding of fabrication methods and an ability to produce simple components that meet quality and output requirements, working safely and in an environmentally aware manner.

##### **Associated Assessment Criteria**

- Output and quality requirements are met
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of fabrication, the various fabrication methods and the functioning of machinery

##### **Exit level outcome 2**

Identify engineering materials used in the fabrication process and describe their characteristics and applications.

##### **Associated Assessment Criteria**

- Fabrication materials are identified and their properties described
- Can respond to questions and discuss issues related to the common applications and methods of fabricating using engineering materials

##### **Exit level outcome 3**

Demonstrate an ability to read, interpret and produce basic engineering drawings and sketches.

##### **Associated Assessment Criteria**

- Components to be fabricated are identified and requirements interpreted from engineering drawing or sketch
- Engineering drawing or sketch is produced to meet job requirements



- Can respond to questions and discuss issues related to engineering drawing concepts and material lists

#### Exit level outcome 4

Demonstrate an ability to select, use and care for fabrication machinery.

#### Associated Assessment Criteria

- Machinery is used in accordance with manufacturer's specifications
- Lubricating agents are applied consistently and systematically
- Can respond to questions and discuss issues related to the use and maintenance of machinery

#### Exit level outcome 5

Work effectively with others, understand own role in the organisation and understand the purpose of the organisation in the economy of the country.

#### Associated Assessment Criteria

- Receive and act on information or decisions
- Report or pass on relevant information
- Respond to questions and discuss issues at the level of the qualification related to own role and the purpose of the organisation

#### Exit level outcome 6

Demonstrate the ability to communicate with peers and members of supervisory / management levels by summarising information and expressing opinions on given information in spoken form.

#### Associated Assessment Criteria

- Communication is effective, regular and ongoing
- Information is clear and accurate and conveyed in a timely manner
- Relationships with peers and supervisory / management levels are established and functioning

#### Exit level outcome 7

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning.



**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained

**International comparability**

Other, similar outcomes-based qualifications, certificates or skills standards in New Zealand and the United Kingdom have been used extensively to inform this qualification and its associated standards, and it compares favourably with them.

**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.

Some assessment aspects will demand practical demonstration while others may not. 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 crossfield outcomes have been achieved.

**Recognition of prior learning:**

This qualification may be obtained through RPL. The learner should be thoroughly briefed on the mechanism to be used and support and guidance should be provided. Care should be taken that the mechanism used provides the learner with an opportunity to demonstrate competence and is not so onerous as to prevent learners from taking up the RPL option towards gaining a qualification.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the relevant ETQA
- Moderation of assessment should be overseen by the relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA guidelines

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of engineering fabrication and a minimum of two years' experience in an engineering fabrication environment. The subject matter experience of the assessor can be established by recognition of prior learning
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good inter-personal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



## NATIONAL CERTIFICATE IN ENGINEERING FABRICATION – NQF LEVEL 2

Level 2 Fundamental	NLRD ID		Level 2 Core	NLRD ID		Level 2 Elective Choice of:	NLRD ID	
<b>Communication</b>			<b>Fabrication (Light / Heavy)</b>			<b>Directly related to the core</b>		
Maintain and adapt oral communication	8962	5	Select, use and care for engineering hand tools	12216	8	Join metals using the resistance welding process	12482	4
Access and use information from texts	8963	5	Select, use and care for engineering measuring equipment	12476	4	<b>Indirectly related to the core</b>		
Write for a defined context	8964	5	Select, use and care for engineering power tools	12219	6	Perform basic first aid	12483	4
Communicate at work	8964	5	Identify engineering materials, their characteristics and applications and common metal tests used in engineering	12477	4	Perform basic fire fighting	12484	4
<b>Maths</b>			Draw and interpret simple engineering drawings	12478	10	Manage personal finance	12464	6
Measure, estimate and calculate physical quantities and explore, describe and represent geometrical relationships in two dimensions in different life or workplace contexts	12444	3	Mechanically cut, drill and punch fabrication materials	12239	10	Operate a personal computer system	12485	6
Demonstrate understanding of rational and irrational numbers, and number systems, within the context of relevant calculations	12472	3	Form and shape sheet metal using hand or power operated machines	12240	8	Use a personal computer system	12486	3
Use mathematics to investigate and monitor the	7469	2	Weld work pieces with the shielded metal arc welding process in the down hand	12479	20	Other standards or additional learning related to the purpose	12487	



financial aspects of personal and community life			position			of the qualification		
Apply basic knowledge of statistics in order to investigate life and work related problems	12443	3	Weld workpieces with the oxy-acetylene gas welding process in the down hand position	12480	10	<b>Minimum elective credits required for qualification</b>		<b>12</b>
Work with a range of patterns and basic functions to solve related problems	9007	5	Cut materials using the oxy-fuel gas cutting process (manual cutting)	12243	10			
			Sling loads	12481	4			
			<b>Safety, Health, Environment and Quality Assurance</b>					
Understand and deal with HIV/Aids personally and in the workplace	12474	3	Work safely and use safety equipment	9443	4			
Develop a personal learning plan and prepare for assessment reflecting the outcomes stated below	12475	6	<b>Business relations</b>					
			Explain the individual's role within business	12466	4			
			Develop a learning plan and a portfolio for assessment	12465	6			
			Understand and deal with HIV/AIDS	12463	3			
<b>Total Fundamental</b>		<b>45</b>	<b>Total Core</b>		<b>11</b>	<b>Total Elective</b>		<b>12</b>
					<b>1</b>			
<b>Total for qualification</b>		<b>16</b>						
		<b>8</b>						



**NATIONAL CERTIFICATE IN ENGINEERING FABRICATION – NQF LEVEL 2**

**Unit standards developed for this qualification:**

**UNIT STANDARDS ON NQF LEVEL 2****CORE**

- Title 1:** Draw and interpret simple engineering drawings
- Title 2:** Mechanically cut, drill and punch fabrication materials
- Title 3:** Form and shape sheetmetal using hand or power operated machines
- Title 4:** Weld workpieces with the shielded metal arc welding process in the downhand position
- Title 5:** Weld workpieces with the oxy-acetylene gas welding process in the downhand position
- Title 6:** Cut metals using the oxy-fuel gas cutting process (manual cutting)

**ELECTIVE**

- Title 7:** Join metals using the resistance welding process

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN NATIONAL CERTIFICATE IN ENGINEERING FABRICATION – NQF LEVEL 2****Title 1: Draw and interpret simple engineering drawings**

**Specific outcome 1.1:** Interpret engineering drawings

- Identify components and assemblies
- Recognise and interpret material requirements
- Identify dimensions and detailed instructions
- Identify and interpret symbols and conventions

**Specific outcome 1.2:** Produce drawings

**Specific outcome 1.3:** Check drawings for compliance with job requirements

**Specific outcome 1.4:** Recognise problems and report to appropriate personnel

**Title 2: Mechanically cut, drill and punch fabrication materials**

**Specific outcome 2.1:** Prepare for work activity

- Interpret job instructions and determine sequence of operations
- Select equipment and lubricants
- Prepare equipment for operation, including routine maintenance and pre-operational checks
  - Select and fit correct tooling
  - Replace worn tooling, if required



- Verify material properties with supervisor
- Prepare material for cutting, drilling and punching operations
- Identify potential hazards and take preventative action

Specific outcome 2.2: Cut, drill and punch metals

- Confirm blade clearances, drill speeds and feeds
- Cut, drill and punch materials to specifications
- Dispose of waste materials
- Store reusable material
- Clean and restore work area

Specific outcome 2.3: Apply quality checks on cut, drilled and punched material

- Inspect and measure cut materials
- Identify and report non-conformances

Specific outcome 2.4: Recognise and report problems

Specific outcome 2.5: Report outcomes of work done

Specific outcome 2.6: Apply safe working practices and discuss issues related to safety of self, fellow workers, machines, equipment, materials and the environment

### **Title 3: Form and shape sheetmetal using hand or power operated machines**

Specific outcome 3.1: Prepare for forming and shaping material

- Interpret job instructions and determine sequence of operations
- Select and prepare equipment for operation including routine maintenance and pre-operational checks
- Check that equipment and materials required are at the workstation
- Evaluate limitations of materials
- Perform calculations
- Mark off workpiece according to job requirements
- Identify potential hazards and take preventative action

Specific outcome 3.2: Form and shape materials

- Adjust machine settings
- Carry out forming and shaping operations
- Dispose of waste material
- Store reusable materials

Specific outcome 3.3: Visually inspect and measure fabricated items for conformance

Specific outcome 3.4: Identify and report non-conformances to appropriate personnel

Specific outcome 3.5: Report outcomes of work done



Specific outcome 3.6: Apply safe working practices and discuss issues related to safety of self, fellow workers, machines, equipment, materials and the environment

**Title 4: Weld workpieces with the shielded metal arc welding process in the downhand position**

Specific outcome 4.1: Describe and explain the gas metal arc welding process

Specific outcome 4.2: Select, assemble and conduct pre operational checks of gas metal arc welding equipment

Specific outcome 4.3: Prepare work pieces prior to welding

Specific outcome 4.4: Weld workpieces

Specific outcome 4.5: Inspect welded work piece for defects

Specific outcome 4.6: Care and store welding consumables and equipment

**Title 5: Weld workpieces with the oxy-acetylene gas welding process in the downhand position**

Specific outcome 5.1: Describe and explain the oxyacetylene gas welding process

Specific outcome 5.2: Select, assemble and conduct pre operational checks of oxyacetylene gas welding equipment

Specific outcome 5.3: Prepare work pieces prior to welding

Specific outcome 5.4: Weld metals with oxyacetylene gas welding process

Specific outcome 5.5: Inspect welded work piece for defects

Specific outcome 5.6: Care and store welding consumables and equipment

**Title 6: Cut metals using the oxy-fuel gas cutting process (manual cutting)**

Specific outcome 6.1: Describe the oxy-fuel cutting process

Specific outcome 6.2: Prepare for the oxy fuel cutting operation

Specific outcome 6.3: Cut material

Specific outcome 6.4: Care and storage of cutting equipment, tools, and materials

**Title 7: Join metals using the resistance welding process**

Specific outcome 7.1: Prepare for work activity

- Interpret job instructions and determine sequence of operations
- Find relevant worksite procedure and determine operational requirements
- Select and prepare equipment for operation including routine maintenance and pre-operational checks



- Implement maintenance procedures for copper electrodes

- Adjust settings and assemble equipment
- Check that consumables required are at the workstation
- Prepare materials for welding
- Identify hazards and take preventative action

Specific outcome 7.2: Join metals using the resistance welding process

- Set up workpiece
- Establish welding parameters
- Weld materials
- Dispose of waste materials
- Store reusable material

Specific outcome 7.3: Apply quality checks on welded metals

- Identify and correct welding defects
- Clean welds after welding
- Check completed weld using visual examination

Specific outcome 7.4: Recognise and report problems of quality, operation, output, safety

Specific outcome 7.5: Report outcomes of work done

Specific outcome 7.6: Apply safe working practices and discuss issues related to safety of self, fellow workers, machines, equipment, materials and the environment



**TITLE 4: Demonstrate knowledge of basic Good Manufacturing Practices (GMP) in a Chemical Manufacturing environment**

- SO 1: Demonstrate knowledge of GMP as it relates to self and others.
- SO 2: Demonstrate knowledge of GMP as it pertains to the use of tools and equipment.
- SO 3: Demonstrate knowledge of GMP as it pertains to material and product handling and storage.

**TITLE 5: Establish equipment start-up conditions to specified state**

- SO 1: Demonstrate an understanding of the start up conditions for equipment
- SO 2: Accomplish start up conditions for equipment by completing a range of checks and tests
- SO 3: Demonstrate an understanding of actions to correct abnormal start up conditions

**TITLE 6: Shut down equipment to a specific state**

- SO 1: Establish equipment shutdown conditions
- SO 2: Shut down equipment to a specified state

**TITLE 7: Start up and operate equipment to specified state**

- SO 1: Establish conditions for and start up designated equipment
- SO 2: Achieve and maintain normal operating conditions
- SO 3: Communicate information concerning operating conditions
- SO 4: Correct abnormal equipment operating conditions

**UNIT STANDARD TITLES AND SPECIFIC OUTCOMES (SO) AT NQF 3****TITLE 1: Collect and interpret non-routine information regarding system conditions**

- SO 1: Gather information pertaining to faults affecting system condition
- SO 2: Diagnose faults affecting system conditions and take appropriate action
- SO 3: Record field readings, of non-routine system conditions
- SO 4: Communicate non-routine information on system conditions

**TITLE 2: Conform to and apply legislation and operational instructions in chemical processing**

- SO 1: Explain relevant legislation and related standard operating procedures
- SO 2: Review compliance in the workplace with relevant legislation and related standard operation procedures in a critical manner
- SO 3: Comply with relevant legislation and related standard operating procedures
- SO 4: Comment on compliance with relevant legislation and related standard operating procedures

**TITLE 3: Contribute to the maintenance of a system**

- SO 1: Prepare the system for maintenance
- SO 2: Prepare the work area for maintenance
- SO 3: Accept system back after maintenance is completed

**TITLE 4: Establish system start up conditions**

- SO 1: Prepare for system start up
- SO 2: Complete checks and tests for system start up
- SO 3: Communicate information concerning checks and tests



SO 4: Report and rectify abnormal pre start up conditions of a system

**TITLE 5: Monitor and maintain system conditions**

SO 1: Hand over and accept a shift

SO 2: Prepare for and record system routines and checks

SO 3: Complete routine system checks

SO 4: Maintain availability of system consumables

SO 5: Demonstrate an understanding of maintaining the system free of contaminants

**TITLE 6: Respond to hazardous conditions or emergencies**

SO 1: Report incidents, hazardous conditions or emergencies

SO 2: Respond to incidents, hazard conditions or emergencies

SO 3: Correct incidents, hazardous conditions or emergencies

**TITLE 7: Shut down the system to a specified state**

SO 1: Establish shut down conditions for the system

SO 2: Shut down the system to a specified state

SO 3: Communicate information concerning system shut down

SO 4: Correct abnormal system shut down conditions

**TITLE 8: Solve operating problems using process chemistry and related technology**

SO 1: Identify and quantify the process variables deviating from the standard during process operation

SO 2: Establish and execute the optimum action to be taken

SO 3: Select solutions

SO 4: Implement solutions and carryout follow-up activities

**TITLE 9: Start up the system**

SO 1: Start designated system

SO 2: Achieve normal operating conditions

SO 3: Communicate information concerning system start-up

SO 4: Correct abnormal system start-up conditions

**UNIT STANDARD TITLES AND SPECIFIC OUTCOMES (SO) AT NQF 4**

**TITLE 1: Collect, interpret and communicate process conditions**

SO 1: Monitor and analyse information concerning process conditions

SO 2: Communicate information on process conditions

SO 3: Exchange information on process conditions at handover

**TITLE 2: Control the process within set parameters**

SO 1: Exchange of information during control of process

SO 2: Control process effectively

**TITLE 3: Establish process start up conditions**

SO 1: Prepare for process start up

SO 2: Complete checks and tests for process start up

SO 3: Communicate information concerning checks and tests



SO 4: Report and rectify abnormal pre start up process conditions

**TITLE 4: Respond to abnormal process conditions**

SO 1: Diagnose faults affecting process conditions as per operating principles and theory

SO 2: Correct abnormal process conditions as per operating principles and theory

SO 3: Communicate abnormal process conditions on actions taken

**TITLE 5: Respond to hazardous and emergency conditions**

SO 1: Report incidents, hazardous conditions and / or emergencies

SO 2: Respond to incidents, hazardous conditions or emergencies according to procedures

**TITLE 6: Shut down the process to a specified state**

SO 1: Establish shut down conditions for the process

SO 2: Shut down the process to a specified state

SO 3: Communicate information concerning process shut down

SO 4: Correct abnormal process shut down conditions

**TITLE 7: Starting the process**

SO 1: Demonstrate an understanding of the start-up process

SO 2: Start designated process

SO 3: Achieve normal operating conditions

SO 4: Communicate information concerning process start up



No. 1180

20 September 2002

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

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

**Manufacturing and Assembly**

Registered by NSB 06, Manufacturing, Engineering and Technology, publishes the following qualifications and unit standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the qualification and unit standards upon which qualifications are based. The full qualification and unit standards can be accessed via the SAQA web-site at [www.saga.org.za](http://www.saga.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, 659 Pienaar street, Brooklyn, Pretoria.

Comment on the unit standards should reach SAQA at the address *below and no later than 21 October 2002*. All correspondence should be marked **Standards Setting – SGB for Manufacturing and Assembly** and addressed to

The Director: Standards Setting and Development  
SAQA

Attention: Mr. D Mphuthing

Postnet Suite 248

Private Bag X06

Waterkloof

0145

or faxed to 012 – 482 0907



**SAMUEL B.A. ISAACS**  
**EXECUTIVE OFFICER**



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY**

**Title:** National Certificate in Autotronics: Level 2

**Field:** Manufacturing, Engineering and Technology

**Sub-field:** Manufacturing & Assembly

**Level:** 2

**Credits:** 128

**Issued:**

**Review:**

**Rationale for the qualification**

The automobile is subject to ever increasing technological advances. These advances are continuously being incorporated into the electrical systems of automobiles. They represent the integration of mechanical, hydraulic, pneumatic, electronic and electrical systems and are managed by microelectronic control known as Computer Integrated Auto Management (CIAM) Systems. Consequently, the auto-electrical skills required to maintain such automobiles are changing to incorporate more electronic skills.

The field of autotronics deals with the installation, diagnosis and repair of CIAM systems. People working in the field of autotronics require specialised technical skills



and knowledge as well as highly developed analytical skills to enable them to install, diagnose and repair CIAM systems.

This is the first qualification in a series for learners who want to follow a career in autotronics

This series will reflect the skills, knowledge and understanding required to perform effectively in industry, whether in micro, small, medium or large enterprises.

For those who have been in the work place for a long time, this qualification represents part of the RPL process that acknowledges workplace skills acquired without the benefit of formal education and training.

For the new entrant, this qualification recognises the applied competence needed by a productive person in a structured workplace.

This qualification forms the basis for further learning in the field of autotronics.

#### **Purpose of the qualification**

The purpose of this qualification is to provide learners, education providers, training providers and employers with the standard and range of learning required to work effectively within the autotronics environment and meet the challenges of such an environment.

The primary skills that are recognised by this qualification include the ability to:

- Use and maintain engineering hand and power tools
- Perform basic welding functions
- Remove, fit and service automobile batteries
- Construct basic auto-electrical circuits
- Assemble, fit and repair automobile auxiliary harnesses
- Remove and fit mechanical and electrical automobile components

These capabilities require an understanding of electrical concepts and related circuit diagrams, concepts of joining materials, use of hand tools and the work and safety



procedures associated with working with batteries and auxiliary harnesses. Hand skills play a large role in this qualification.

Qualifying learners will be able to relate what they see and experience to scientific and technological principles and concepts.

What learners achieve in this qualification will serve as a basis for further learning where they will engage more directly in the installation, diagnosis and repair of autotronic systems.

### **Access to the qualification**

Open access.

This qualification series recognises the skills, knowledge and values relevant to the workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge and skill gained to activities in the workplace
- Are already workers and have acquired the skills and knowledge without attending formal courses
- Are part of a learnership programme that integrates structured learning and work experience.

### **Learning assumed to be in place**

This qualification assumes learners have a GETC at NQF level 1 or equivalent, or alternatively an ABET Level 4 qualification.

The qualifications must include:

- Basic concepts of science and technology

### **Exit level Outcomes**

#### **Exit level outcome 1**

Demonstrate an understanding of basic hand-skills using engineering hand and power tools and welding/joining equipment to construct simple parts that meet quality requirements, working safely and in an environmentally aware manner.



**Associated Assessment Criteria**

- Appropriate tools and materials are selected.
- Materials, tools and equipment are correctly stored on completion of work task.
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to the tools and equipment used.

**Exit level outcome 2**

Demonstrate an understanding of how to remove, fit and service an automobile battery and related components with care, in a safe and environmentally aware manner

**Associated Assessment Criteria**

- Appropriate tools, personal and automobile protective equipment are correctly chosen and used.
- Removal and fitting procedures are followed.
- Appropriate leads and terminals are correctly chosen and used.
- Safe working practices are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to automobile batteries and related components.

**Exit level outcome 3**

Demonstrate an understanding of electrical concepts and an ability to build basic auto-electrical circuits in a safe and environmentally aware manner.

**Associated Assessment Criteria**

- Auto-electrical circuits are correctly wired and working.
- Components and conductors are correctly selected.
- Tools and equipment are correctly selected and used.
- Safe working practices are adhered to.



- Can respond to questions and discuss issues related to the construction of auto-electrical circuits.

- 

**Exit level outcome 4**

Demonstrate an understanding of and an ability to assemble, fit and repair automobile auxiliary harnesses in accordance with procedures and instructions.

**Associated Assessment Criteria**

- Harnesses are assembled and fitted correctly.
- Tools and components are correctly selected and used.
- Harnesses are correctly routed.
- Harnesses are tested and repaired.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to the assembly, fitting and repair of automobile harnesses.

- 

**Exit level outcome 5**

Demonstrate an understanding of and an ability to remove and fit mechanical and electrical automobile components in a safe environmentally aware manner.

**Associated Assessment Criteria**

- Automobile components are correctly selected, fitted and removed.
- Correct tools are selected and used.
- Automobile components are correctly positioned and fastened.
- Customer care policies are adhered to.
- Safe working practices are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to the removal and fitting of automobile components.



**Exit level outcome 6**

Demonstrate an understanding of and an ability to care for and safely use automobile lifting equipment.

**Associated Assessment Criteria**

- Lifting equipment is correctly selected.
- Safety inspections are carried out.
- Any faulty conditions on lifting equipment are reported.
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to automobile lifting equipment.

**Exit level outcome 7**

Communicate with peers and members of supervisory/management levels by demonstrating the ability to summarise information and express opinions on given information in spoken and written form.

**Associated Assessment Criteria**

- Communication is regular and ongoing.
- Information is clear and accurate and conveyed in a timely manner.
- Relationships with peers and supervisory/management levels are established and functioning.

**Exit level outcome 8**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning.



**Associated Assessment Criteria**

- Options are explained.
- Preparation requirements are explained.
- Learning plan is developed.

**International comparability**

As a starting point, the series of qualifications in the field of autotronics of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in Germany and New Zealand. Extensive reference was made to training materials from Germany when constructing these qualifications to ensure the relevance of the qualifications content and to benchmark with best practice worldwide.

**Integrated Assessment**

The integrated assessment must be based on a summative assessment guide. The guide must spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in primary activities as well as other interactions) or by relevant simulations.
- Asking questions and initiating short discussions to test understanding.
- Looking at records, reports and formative assessments.

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 required for autotronics. The assessment process should also establish how the critical outcomes, have been advanced by the learning process.



**Recognition of prior learning**

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

**Articulation possibilities**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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 and have a qualification in engineering.

To ensure quality of the assessment process the moderation should cover all of the following:

- Assessor credentials
- The assessment instrument
- The assessment process

Where assessment and moderation are taking place in sectors other than the MERSETA, assessment and moderation should be in terms of a memorandum of understanding negotiated with the MERS ETQA.

**Criteria for the registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualifications in the field of engineering with a minimum of four years experience in the field of autotronics or related field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory processes and practices



3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interest of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and the language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA.
5. Any other criteria required by the MERS ETQA or any other ETQA.



## Rules of combination

## NATIONAL CERTIFICATE IN AUTOTRONICS – NQF LEVEL 2

<b>Fundamental</b>	<b>Credits</b>	<b>NLRD ID</b>
Demonstrate an understanding of rational and irrational numbers and number systems within the context of relevant calculations	3	12442
Use mathematics to investigate and monitor the financial aspects of personal and community life	2	7469
Apply basic knowledge of statistics and probability in order to investigate life and work related problems	3	12443
Measure, estimate and calculate physical quantities and explore, describe and represent geometrical relationships in two dimensions in different life or workplace contexts	3	12444
Work with a range of patterns and basic functions to solve related problems	5	8307
Maintain and adapt oral communication	5	8962
Access and use information from texts	5	8963
Write for a defined context	5	8964
Communicate at work	5	12461
Total fundamental	36	
<b>Core</b>		
Select, use and care for engineering hand tools	8	12216
Select, use and care for engineering power tools	6	12219
Select and use automobile lifting equipment	3	12213
Perform basic welding/joining of metals	8	12382



Remove, test, fit and service automobile batteries	8	12210
Build basic auto-electrical circuits	16	12211
Assemble, fit and repair automobile auxiliary harnesses	12	12212
Remove and fit automobile mechanical and electrical components	12	12214
Work safely and use safety equipment	7	9443
Total Core	80	

<b>Elective</b>		
Read, interpret and produce basic engineering drawings	6	12215
Work in a team	3	9322
Understand and deal with HIV/AIDS	3	12463
Manage personal finance	6	12464
Develop a learning plan and a portfolio for assessment	6	12465
Explain the individual's role within business	4	12466
Perform basic first aid	4	12467
Perform basic fire fighting	4	12468
Total electives (minimum)		
Total for qualification		



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY**

**Title:** National Certificate in Autotronics: Level 3

**Field:** Manufacturing, Engineering and Technology

**Sub –field:** Manufacturing & Assembly

**Level:** 3

**Credits:** 141

**Issued:**

**Review:**

**Rationale for the qualification**

The automobile is subject to ever increasing technological advances. These advances are continuously being incorporated into the electrical systems of automobiles. They represent the integration of mechanical, hydraulic, pneumatic, electronic and electrical systems and are managed by microelectronic control known as Computer Integrated Auto Management (CIAM) Systems. Consequently, the auto-electrical skills required to maintain such automobiles are changing to incorporate more electronic skills.

The field of Autotronics deals with the installation, diagnosis and repair of CIAM systems. People working in the field of autotronics require specialised technical skills



and knowledge as well as highly developed analytical skills to enable them to install, diagnose and repair CIAM systems.

This is the second qualification in a series for learners who want to follow a career in autotronics.

This series will reflect the skills, knowledge and understanding required to perform effectively in industry, whether in micro, small, medium or large enterprises.

For those who have been in the work place for a long time, this qualification represents part of the RPL process that acknowledges workplace skills acquired without the benefit of formal education and training.

For the new entrant, this qualification recognises the applied competence needed by a productive person in a structured workplace.

This qualification forms the basis for further learning in the field of autotronics.

#### **Purpose of the qualification**

The purpose of this qualification is to provide learners, education providers, training providers and employers with the standard and range of learning required to work effectively in the autotronics environment and meet the challenges of such an environment.

The primary skills that are recognised by this qualification include the ability to:

- Test and repair conventional automobile ignition systems
- Trace and repair faults on auto-electrical circuits in the automobile
- Construct and test basic electronic circuits
- Diagnose, test and repair automobile charging systems
- Diagnose, test and repair automobile starting systems
- Construct basic electro-pneumatic and electro-hydraulic circuits

These capabilities require an understanding of electrical, electronic, pneumatic and hydraulic concepts and related hand skills. Analytical and fault finding skills play a large role in this qualification.



Qualifying learners will also be able to relate what they are doing to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

What learners achieve in this qualification will serve as a basis for further learning where they will engage further in the installation, diagnosis and repair of autotronic systems.

### **Access to the qualification**

Open access.

This qualification series recognises the skills, knowledge and values relevant to the workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge and skill gained to activities in the workplace
- Are already workers and have acquired the skills and knowledge without attending formal courses
- Are part of a learnership programme that integrates structured learning and work experience.

### **Learning assumed to be in place**

It is assumed that learners entering a programme to achieve this qualification have an autotronics level 2 qualification or have the relevant experience.

### **Exit level Outcomes**

#### **Exit level outcome 1**

Demonstrate an understanding of and an ability to test and repair conventional ignition systems on automobiles



**Associated Assessment Criteria**

- Appropriate tools, test equipment and components are identified and selected.
- Testing and repairs are carried out without any damage.
- Automobile ignition system is operating to specifications.
- Safe working practices and procedures are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to the conventional ignition system.

- 

**Exit level outcome 2**

Demonstrate an understanding of and an ability to trace and repair faults to auto-electrical circuits on automobiles.

**Associated Assessment Criteria**

- Appropriate tools, personal and automobile protective equipment are correctly chosen and used.
- Appropriate hand tools and test equipment are identified and used correctly.
- Faults are located and repaired and circuit is operating to specifications.
- Safe working practices are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to auto-electrical circuits on automobiles.

- 

**Exit level outcome 3**

Demonstrate an understanding of electrical/electronic concepts and the ability to construct and test a basic electronic circuit.

**Associated Assessment Criteria**

- Components and conductors are correctly selected and fitted.
- Tools and equipment are correctly selected and used.



- Electronic circuit constructed functions to specifications.
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to the construction of electronic circuits.

#### **Exit level outcome 4**

Demonstrate an understanding of and an ability to test and repair automobile charging systems.

#### **Associated Assessment Criteria**

- Tools, test equipment and components are correctly selected and used.
- Charging system components are correctly removed and fitted.
- Automobile charging system is tested and repaired and functions to specifications.
- Relevant documentation is used and completed correctly.
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to the conventional automobile charging system.

#### **Exit level outcome 5**

Demonstrate an understanding of and an ability to test and repair conventional automobile starting systems.

#### **Associated Assessment Criteria**

- Tools, test equipment and components are correctly selected and used.
- Starting system components are correctly removed and fitted.
- Automobile starting system is tested and repaired and functions to specifications
- Relevant documentation is used and completed correctly.
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to the conventional automobile starting system.



**Exit level outcome 6**

Demonstrate an understanding of and an ability to build basic electro-pneumatic and electro-hydraulic systems.

**Associated Assessment Criteria**

- Tools and relevant components are correctly identified, selected and used.
- Basic electro-pneumatic and electro-hydraulic circuits are correctly built from circuit diagram or per instruction.
- Electro-pneumatic/hydraulic systems are functioning to specifications.
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to electro-pneumatic and electro-hydraulic systems.

**Exit level outcome 7**

Demonstrate the ability to generate and retrieve files and store information and an understanding of the logic of using different paths for retrieving files using a personal computer.

**Associated Assessment Criteria**

- Can respond to questions and discuss issues related to computer hardware and software.
- Can generate, save and retrieve documents within a computer system.

**Exit level outcome 8**

Communicate with peers, customers and members of supervisory/management levels by demonstrating the ability to gather and summarise information from a range of sources and produce coherent presentations in a prescribed format.



**Associated Assessment Criteria**

- Information is gathered from a range of sources and accurately summarised into a prescribed format.
- Information is clear and accurate and presented in a timely manner in the required format to appropriate parties.
- Relationships with peers and supervisory/management levels are established and functioning.
- 

**Exit level outcome 9**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning.

**Associated Assessment Criteria**

- Options are explained.
- Preparation requirements are explained.
- Learning plan is developed.

**International comparability**

As a starting point, the series of qualifications in the field of autotronics of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in Germany and New Zealand. Extensive reference was made to training materials from Germany when constructing these qualifications to ensure the relevance of the qualifications content and to benchmark with best practice worldwide.

**Integrated Assessment**

The integrated assessment must be based on a summative assessment guide. The guide must spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in primary activities as well as other interactions) or by relevant simulations



- Asking questions and initiating short discussions to test understanding
- Looking at records, reports and formative assessments

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 required for autotronics. The assessment process should also establish how the critical outcomes, have been advanced by the learning process.

### **Recognition of prior learning**

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

### **Articulation possibilities**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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 and have a qualification in engineering.

To ensure the quality of the assessment process, the moderation should cover all of the following:

- Assessor credentials



- The assessment instrument
- The assessment process

Where assessment and moderation are taking place in sectors other than the MERSETA, assessment and moderation should be in terms of a memorandum of understanding negotiated with the MERS ETQA.

#### **Criteria for the registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualifications in the field of engineering- with a minimum of four years experience in the field of autotronics or related field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory processes and practices
3. Good interpersonal skills and ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interest of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and the language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA.
5. Any other criteria required by the MERS ETQA or any other ETQA.



## Rules of combination

## NATIONAL CERTIFICATE IN AUTOTRONICS – NQF LEVEL 3

Fundamental	Credits	NLRD ID
	2	12448
Use mathematics to investigate and monitor the financial aspects of personal and business issues	5	
Investigate life-related problems using data and probabilities	5	7456
Measure, estimate and calculate physical quantities and explore, describe and represent, interpret and justify geometrical relationships in two and three dimensional space relevant to the life or workplace of the community	4	12450
Accommodate audience and context needs in oral communication	5	8968
Interpret and use information from texts	5	8969
Write texts for a range of communicative contexts	5	8970
Compile feasibility and commissioning reports	3	9529
Communicate with clients	3	9528
Total fundamental		37
<b>Core</b>		
Service and repair conventional automobile ignition systems	6	12220
Trace and repair auto-electrical circuit faults on automobiles	20	12221
Construct and test basic electronic circuits	16	12218



Diagnose, test and repair conventional automobile charging systems	16	12222	
Construct simple electro-pneumatic/hydraulic circuits	12	12224	
Operate a personal computer system	6	12451	
<b>Total Core</b>			<b>76</b>
<b>Elective</b>			
Demonstrate a knowledge of and produce word processing documents using basic functions	3	12452	
Demonstrate a knowledge of and produce computer spreadsheets using basic functions	3	12454	
Perform the role of a safety, health and environmental protection representative	4	12455	
Explain and use organizational procedures	6	12456	
Manage basic business finance	6	9526	
Manage work time effectively	3	9530	
Show understanding of diversity in the workplace	3	9531	
Use communication skills and handle and resolve conflict in the workplace	3	9533	
Develop learning strategies and techniques	3	12457	
<b>Total electives (minimum)</b>			<b>344</b>
<b>Total for qualification</b>			<b>141</b>



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Autotronics--: NQF Level 4****Field:** Manufacturing, Engineering and Technology**Sub -field:** Manufacturing & Assembly**Level:** 4**Credits:** 135**Issued:****Review:****Rationale for the qualification**

The automobile is subject to ever increasing technological advances. These advances are continuously being incorporated into the electrical systems of automobiles. They represent the integration of mechanical, hydraulic, pneumatic, electronic and electrical systems and are managed by microelectronic control known as Computer Integrated Auto Management (CIAM) Systems. Consequently, the auto-electrical skills required to maintain such automobiles are changing to incorporate more electronic skills.

The field of autotronics deals with the installation, diagnosis and repair of CIAM systems. People working in the field of autotronics require specialised technical skills and knowledge and well as highly developed analytical skills to enable them to install, diagnose and repair CIAM systems.



This is the third qualification in a series for learners who want to follow a career in Autotronics.

This series will reflect the skills, knowledge and understanding required to perform effectively in industry, whether in micro, small, medium or large enterprises.

For those who have been in the work place for a long time, this qualification represents part of the RPL process that acknowledges workplace skills acquired without the benefit of formal education and training.

For the new entrant, this qualification recognises the applied competence needed by a productive person in a structured workplace.

This qualification forms the basis for further learning in the field of mechatronics within the higher education band.

#### **Purpose of the qualification**

The purpose of this qualification is to provide learners, education providers, training providers and employers with the standard and range of learning required to work effectively in the autotronics environment and meet the challenges of such an environment.

The primary skills that are recognised by this qualification include the ability to:

- Diagnose, service and maintain automobile air-conditioning systems
- Construct and test advanced electronic circuits
- Fit and wire up auxiliary auto-electrical equipment
- Trace and repair faults in advanced auto-electrical circuits on the automobile
- Service and repair faults on electronic automobile ignition systems
- Diagnose, test and repair electronic automobile fuel injection systems

These capabilities require an understanding of electrical, electronic, pneumatic, hydraulic, refrigeration and control system concepts and related advanced theoretical, analytical and hand skills.

Qualifying learners will be able to relate what they see and experience to scientific and technological principles and concepts.



What learners achieve in this qualification will serve as a basis for further learning where they will engage further in the installation, diagnosing and repair of autotronic systems within the higher education and training band.

### **Access to the qualification**

Open access.

This qualification series recognises the skills, knowledge and values relevant to the workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge and skill gained to activities in the workplace
- Are already workers and have acquired the skills and knowledge without attending formal courses
- Are part of a learnership programme that integrates structured learning and work experience.

### **Learning assumed to be in place**

It is assumed that learners entering a programme to achieve this qualification have an Autotronics level 3 qualification or have the relevant experience.

### **Exit level Outcomes**

#### **Exit level outcome 1**

Demonstrate an understanding of and an ability to diagnose, service and maintain automobile air-conditioning systems.

### **Associated Assessment Criteria**

- Appropriate tools, test equipment and components are identified and selected.
- Testing and repair is carried out without any damage.
- Air conditioning system is operating to specifications.
- Air conditioning system is serviced to specifications.
- Safe working practices and procedures are adhered to.
- Relevant documentation is used and completed correctly.



- Can respond to questions and discuss issues related to the automobile air conditioning system.

#### **Exit level outcome 2**

Demonstrate an understanding of auto-electrical fault finding and an ability to trace and repair faults on advanced auto-electrical circuits on the automobile.

#### **Associated Assessment Criteria**

- Appropriate tools, personal and automobile protective equipment are correctly selected and used.
- Appropriate hand tools and test equipment are identified and used correctly.
- Faults are located and repaired.
- Circuit is operating to specifications.
- Safe working practices are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to auto-electrical circuits.

#### **Exit level outcome 3**

Demonstrate an understanding of electrical and electronic concepts and the ability to construct and test an advanced electronic circuit.

#### **Associated Assessment Criteria**

- Components and conductors are correctly selected and fitted.
- Tools and equipment are correctly selected and used.
- Safe working practices are adhered to.
- Test equipment is correctly selected and used in accordance to procedures.
- Can respond to questions and discuss issues related to the construction of advanced electronic circuits.

#### **Exit level outcome 4**

Demonstrate an understanding of and an ability to service and repair automobile electronic ignition systems.



**Associated Assessment Criteria**

- Tools, test equipment and components are correctly selected and used.
- Electronic ignition system components are correctly removed and fitted.
- Automobile electronic ignition system is tested and repaired and functioning to specifications.
- Electronic ignition system faults are correctly diagnosed.
- Relevant documentation is used and completed correctly.
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to automobile electronic ignition systems.

**Exit level outcome 5**

Demonstrate an understanding of and an ability to diagnose, test and repair automobile electronic fuel injection systems.

**Associated Assessment Criteria**

- Tools, test equipment and components are correctly selected and used.
- Electronic fuel injection system components are correctly removed and fitted.
- Automobile electronic fuel injection system is tested and repaired and functioning to specifications.
- Electronic fuel injection system faults are correctly diagnosed.
- Relevant documentation is used and completed correctly.
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to automobile electronic fuel injection systems.

**Exit level outcome 6**

Demonstrate an understanding of and an ability to fit and wire up auxiliary auto-electrical equipment.

**Associated Assessment Criteria**

- Tools and relevant auxiliary components are correctly identified, selected and used.



- Auxiliary auto-electrical equipment circuits are correctly built from circuit diagram or per instruction.
- Auxiliary auto-electrical systems are functioning to specifications.
- Safe working practices are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to auxiliary auto-electrical equipment and wiring of such systems.

#### **Exit level outcome 7**

Maintain and support procedures to solve a variety of problems, both familiar and unfamiliar, within an Autotronics environment and operate within familiar and new situations, taking responsibility and making decisions

#### **Associated Assessment Criteria**

- Solutions to problems are based on a clear analysis of information gathered through diagnostic procedures.
- Procedures are modified to respond to unfamiliar problems where appropriate.
- Can respond to questions and discuss issues related to familiar and unfamiliar problems arising in the Autotronics environment.
- All actions related to problem solving are accurately recorded for future reference.

#### **Exit level outcome 8**

Communicate and present information clearly and reliably and demonstrate the ability to analyse information to identify problems and determine trends

#### **Associated Assessment Criteria**

- Conditions, evidence and incidences are reported accurately in a timely manner and discussed with peers and management.
- Data gathered through diagnostic procedures is examined systematically and analysis is repeated until problem is solved.
- Records are available for scrutiny and future reference.



**Exit level outcome 9**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning.

**Associated Assessment Criteria**

- Options are explained.
- Preparation requirements are explained.
- Learning plan is developed.

**International comparability**

As a starting point, the series of qualifications in the field of Autotronics of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in Germany and New Zealand. Extensive reference was made to training materials from Germany when constructing these qualifications to ensure the relevance of the qualifications content and to benchmark with best practice worldwide.

**Integrated Assessment**

The integrated assessment must be based on a summative assessment guide. The guide must spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in primary activities as well as other interactions) or by relevant simulations
- Asking questions and initiating short discussions to test understanding
- Looking at records, reports and formative assessments

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 required for Autotronics. The assessment process should also establish how the critical outcomes, have been advanced by the learning process.



**Recognition of prior learning**

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

**Articulation possibilities**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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 and have a qualification in engineering.

To ensure the quality of the assessment process the moderation should cover all of the following:

- Assessor credentials
- The assessment instrument
- The assessment process

**Criteria for the registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualifications in the field of engineering- with a minimum of four years experience in the field of Autotronics or related field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory processes and practices
3. Good interpersonal skills and ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interest of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and the language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA.
5. Any other criteria required by the MERS ETQA or any other ETQA.



Rules of combination

**NATIONAL CERTIFICATE IN AUTOTRONICS – NQF LEVEL 4**

<b>Fundamental</b>	<b>Credits</b>	<b>NLRD ID</b>	35
Use mathematics to investigate and monitor the financial aspects of personal , business and national issues	4	12415	
Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	4	12416	
Measure, estimate and calculate physical quantities and explore, critique and prove geometrical relationships in two and three dimensional space in the life and workplace of the adult with increasing responsibilities	4	12417	
Engage in sustained oral communication and evaluate spoken texts	5	12418	
Read, analyse and respond to a variety of texts	5	12419	
Write for a wide range of contexts	5	12420	
Write a technical report	4	12421	
Communicate in an assertive manner with clients and fellow workers	4	12422	
<b>Total fundamental</b>			
<b>Core</b>			
Diagnose, service and maintain automobile air conditioning systems	12	12425	
Construct and test advanced electronic circuits	16	12226	
Trace and repair faults on advanced auto-electrical circuits	16	12227	
Diagnose, test and repair electronic automobile fuel injection systems	16	12230	
Fit and wire up auxiliary auto-electrical equipment	12	12229	
Service and repair electronic automobile ignition systems	12	12228	
<b>Total Core</b>		84	



<b>Elective</b>		
Lead a team, plan, allocate and assess their work		
Contribute to the implementation and maintenance of business processes	4	12426
Manage basic business and personal finance	10	12427
Develop a personal financial plan	6	12428
Total electives (minimum)	2	12429
Total for qualification		22
		145



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Autotronics:- NQF Level 5****Field:** Manufacturing, Engineering and Technology**Sub -field:** Manufacturing & Assembly**Level:** 5**Credits:** 134**Issued:****Review:****Rationale for the qualification**

The automobile is subject to ever increasing technological advances. These advances are continuously being incorporated into the electrical systems of automobiles. They represent the integration of mechanical, hydraulic, pneumatic, electronic and electrical systems and are managed by microelectronic control known as Computer Integrated Auto Management (CIAM) Systems. Consequently, the auto-electrical skills required to maintain such automobiles are changing to incorporate more electronic skills.

The field of autotronics deals with the installation, diagnosis and repair of CIAM systems. People working in the field of autotronics require specialised technical skills and knowledge and well as highly developed analytical skills to enable them to install, diagnose and repair CIAM systems.



This is the fourth qualification in a series for learners who want to follow a career in autotronics.

This series will reflect the skills, knowledge and understanding required to perform effectively in industry, whether in micro, small, medium or large enterprises.

For those who have been in the work place for a long time, this qualification represents part of the RPL process that acknowledges workplace skills acquired without the benefit of formal education and training.

For the new entrant, this qualification recognises the applied competence needed by a productive person in a structured workplace.

This qualification forms the basis for further learning in the field of mechatronics within the higher education band.

#### **Purpose of the qualification**

The purpose of this qualification is to provide learners, education providers, training providers and employers with the standard and range of learning required to work effectively in the autotronics environment and meet the challenges of such an environment.

The primary skills that are recognised by this qualification include the ability to:

- Diagnose and repair engine management systems
- Diagnose and repair vehicle stability traction and drive control (VSTDC) systems
- Diagnose and repair communication and entertainment systems
- Diagnose and repair supplementary restraint systems
- Diagnose and repair climate control system
- Diagnose and repair automobile convenience systems

Advanced hand skills, theoretical and analytical skills play a large role in this qualification.



Qualified learners will also understand:

- How to maintain and influence relationships in a complex production environment
- How to achieve change
- How to work with a range of information sources to optimise performance and quality

With this understanding learners will be able to participate in workplace activities.

Qualifying learners will also be able to relate what they see and experience to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

### **Access to the qualification**

Open access.

This qualification series recognises skills, knowledge and values relevant to the workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge and skill gained to activities in the workplace
- Are already workers and have acquired the skills and knowledge without attending formal courses
- Are part of a learnership programme that integrates structured learning and work experience.

### **Learning assumed to be in place**

It is assumed that learners entering a programme to achieve this qualification have an autotronics level 4 qualification or have the relevant experience.

### **Exit level Outcomes**

#### **Exit level outcome 1**

Demonstrate an understanding of and an ability to diagnose, service and maintain automobile engine management systems.



**Associated Assessment Criteria**

- Appropriate tools, test equipment and components are identified and selected.
- Testing and repairs are carried out without any damage.
- Systems are operating to specifications.
- Safe working practices and procedures are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to automobile engine management systems.

**Exit level outcome 2**

Demonstrate an understanding of and an ability to diagnose and repair vehicle stability, traction and drive control (VSTDC) systems.

**Associated Assessment Criteria**

- Appropriate personal and vehicle protective equipment are correctly chosen and used.
- Appropriate hand tools and test equipment are identified and used correctly.
- Faults are located and repaired.
- System is operating to specifications.
- Safe working practices are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to VSTDC systems.

**Exit level outcome 3**

Demonstrate an understanding of and an ability to diagnose and repair communication and entertainment systems.

**Associated Assessment Criteria**

- Tools and test equipment are correctly selected and used.
- Components are correctly selected and fitted.
- Communication and entertainment system is functioning to specifications.



- Safe working practices are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to communication and entertainment systems.

- 

**Exit level outcome 4**

Demonstrate an understanding of and an ability to service and repair automobile climate control systems

**Associated Assessment Criteria**

- Tools, test equipment and components are correctly selected and used.
- Diagnostics codes are correctly interpreted and cleared.
- System faults are correctly diagnosed, repaired and checked
- Automobile climate control systems are operating to specifications.
- Safe working practices are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to climate control systems.

- 

**Exit level outcome 5**

Demonstrate an understanding of and an ability to diagnose, test and repair automobile supplementary restraint systems.

**Associated Assessment Criteria**

- Tools, test equipment and components are correctly selected and used.
- Supplementary restraint system components are correctly removed and fitted.
- Automobile supplementary restraint system is tested and repaired and functioning to specifications.
- Fault conditions are correctly diagnosed.
- Relevant documentation is used and completed correctly.
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to automobile supplementary restraint systems.



**Exit level outcome 6**

Demonstrate an understanding of and an ability to diagnose and repair automobile convenience systems.

**Associated Assessment Criteria**

- Tools and relevant auxiliary components are correctly identified, selected and used.
- Faults are correctly diagnosed and repaired.
- Convenience systems are operating to specifications.
- Safe working practices are adhered to.
- Relevant documentation is used and completed correctly.
- Can respond to questions and discuss issues related to automobile convenience systems.

**Exit level outcome 7**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning.

**Associated Assessment Criteria**

- Options are explained.
- Preparation requirements are explained.
- Learning plan is developed.

**International comparability**

As a starting point, the series of qualifications in the field of autotronics of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in Germany and New Zealand. Extensive reference was made to training materials from Germany when constructing these qualifications to ensure the relevance of the qualifications content and to benchmark with best practice worldwide.



### **Integrated Assessment**

The integrated assessment must be based on a summative assessment guide. The guide must spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in primary activities as well as other interactions) or by relevant simulations.
- Asking questions and initiating short discussions to test understanding.
- Looking at records, reports and formative assessments.

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 required for autotronics. The assessment process should also establish how the critical outcomes, have been advanced by the learning process.

### **Recognition of prior learning**

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

### **Articulation possibilities**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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 and have a qualification in engineering.

To ensure the quality of the assessment process the moderation should cover all of the following:

- Assessor credentials
- The assessment instrument
- The assessment process

**Criteria for the registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualifications in the field of engineering- with a minimum of four years experience in the field of autotronics or related field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory processes and practices
3. Good interpersonal skills and ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interest of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and the language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA.
5. Any other criteria required by the MERS ETQA or any other ETQA.



**Rules of combination****NATIONAL CERTIFICATE IN AUTOTRONICS – NQF LEVEL 5**

<b>Fundamental</b>	<b>Credits</b>	<b>NLRD ID</b>	
Use mathematical and statistical techniques effectively	20	12432	
Use communication techniques effectively	8	12433	
Total fundamental			28
<b>Core</b>			
Diagnose and repair vehicle stability, traction and drive control (VSTDC) systems	20	12434	
Diagnose and repair communication and entertainment systems	16	12233	
Diagnose and repair supplementary restraint systems	12	12234	
Diagnose and repair climate control systems	10	12438	
Diagnose and repair automobile convenience systems	16	12236	
Diagnose and repair engine management systems	20	12231	
Total Core			94
<b>Elective</b>			
Diagnose and repair starter and alternator combination (ISAD) systems	8	12237	
Manage a team	4	9406	
Develop the skills of a work team	10	12458	



Optimise the safety, health and environmental protection system	6	12459	
Analyse work requirements and plan ahead	4	9405	
Total electives (minimum)			12
Total for qualification			134



**NATIONAL CERTIFICATE IN AUTOTRONICS – NQF LEVEL 5****UNIT STANDARDS ON NQF LEVEL 5**

- Title 1:** Diagnose and repair vehicle stability, traction and drive control (VSTDC) systems
- Title 2:** Diagnose and repair communication and entertainment systems
- Title 3:** Diagnose and repair supplementary restraint systems
- Title 4:** Diagnose and repair climate control systems
- Title 5:** Diagnose and repair automobile convenience systems
- Title 6:** Diagnose and repair engine management systems
- Title 7:** Diagnose and repair starter and alternator combination (ISAD) systems

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN AUTOTRONICS – NQF LEVEL 5**

- Title 1:** **Diagnose and repair vehicle stability, traction and drive control (VSTDC) systems**
- Specific outcome 1.1: Discuss and report incidents and problems related to engine management systems and complete fault finding reports and requisition forms
- Specific outcome 1.2: Discuss and explain the function of stability, traction and drive control related components
- Specific outcome 1.3: Identify and select vehicle stability, traction and drive control components
- Specific outcome 1.4: Diagnose and repair vehicle stability, traction and drive control related components
- Specific outcome 1.5: Apply the relevant system safety and servicing precautions when working with vehicle stability, traction and drive control
- Specific outcome 1.6: Discuss and explain data transmission between systems
- Specific outcome 1.7: Discuss and report incidents and problems related to VSTDC systems and complete fault finding reports and requisitions



**Title 2: Diagnose and repair communication and entertainment systems**

- Specific outcome 2.1: Discuss and explain the operation of a vehicle communication and entertainment system and related sub-systems
- Specific outcome 2.2: Discuss and explain the function of communication and entertainment system components and related input/output devices
- Specific outcome 2.3: Identify and select communication/entertainment components
- Specific outcome 2.4: Diagnose and test communication/entertainment systems and related components
- Specific outcome 2.5: Apply the relevant system safety and servicing precautions when working with communication and entertainment systems
- Specific outcome 2.6: Discuss and report incidents and problems related to communication and entertainment systems and complete fault finding reports and requisitions

**Title 3: Diagnose and repair supplementary restraint systems**

- Specific outcome 3.1: Discuss and explain the operation of supplementary restraint systems
- Specific outcome 3.2: Discuss and explain the function of supplementary restraint system components
- Specific outcome 3.3: Identify and select supplementary restraint system components
- Specific outcome 3.4: Diagnose and test supplementary restraint systems and related components
- Specific outcome 3.5: Apply the relevant system safety and servicing precautions when working with supplementary restraint systems
- Specific outcome 3.6: Discuss and report incidents and problems related to supplementary restraint systems and complete fault finding reports and requisition forms

**Title 4: Diagnose and repair climate control systems**

- Specific outcome 4.1: Discuss and explain the basic operation of a vehicle climate control system
- Specific outcome 4.2: Discuss and explain the function of climate control related input and output devices
- Specific outcome 4.3: Identify and select engine management system components
- Specific outcome 4.4: Identify and select engine management system components
- Specific outcome 4.5: Apply the relevant system safety and servicing precautions when working with climate control systems
- Specific outcome 4.6: Discuss and report incidents and problems related to climate control systems and complete fault finding reports and requisitions



**Title 5: Diagnose and repair automobile convenience systems**

- Specific outcome 5.1: Discuss and explain the basic operation of vehicle convenience systems
- Specific outcome 5.2: Discuss and explain the function of convenience system components
- Specific outcome 5.3: Identify and select convenience system components
- Specific outcome 5.4: Diagnose and repair convenience system/s and related components
- Specific outcome 5.5: Apply the relevant system safety and servicing precautions when working with vehicle convenience system/s
- Specific outcome 5.6: Check convenience system operation
- Specific outcome 5.7: Discuss and report incidents and problems related to convenience system/s and complete fault finding reports and requisition forms

**Title 6: Diagnose and repair engine management systems**

- Specific outcome 6.1: Discuss and explain the operation of an engine management system
- Specific outcome 6.2: Discuss and explain the function of petrol and diesel engine management related input and output devices
- Specific outcome 6.3: Identify and select engine management system components
- Specific outcome 6.4: Diagnose and test engine management systems and related components
- Specific outcome 6.5: Apply the relevant system safety and servicing precautions when repairing and making adjustments to engine management systems
- Specific outcome 6.6: Discuss and report incidents and problems related to engine management systems and complete fault finding reports and requisition forms

**Title 7: Diagnose and repair starter and alternator Combination (ISAD) systems**

- Specific outcome 7.1: Discuss and explain the operation of an integrated starter and alternator (ISAD) system
- Specific outcome 7.2: Discuss and explain the function of (ISAD) system components
- Specific outcome 7.3: Identify and select ISAD components
- Specific outcome 7.4: Diagnose and test ISAD and related components
- Specific outcome 7.5: Apply the relevant system safety and servicing precautions when working with ISAD
- Specific outcome 7.6: Discuss and report incidents and problems related to ISAD systems and complete fault finding reports and requisitions



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

In order to proceed with the recognition of Standards Generating Bodies in terms of Government Regulations 19(1)(c) and 22(2) of 28 March 1998, National Standards Body 09, Health Sciences and Social Services, invites public comment with respect to *the acceptability of the nominees and the representativeness of the key education and training stakeholder interest groups listed as SGB applicants below.*

**In addition, the NSB invite submissions from interested parties wishing to serve on such an SGB.** Interested parties should take note of the section on SGB Information below.

**All nominations/ applications should be accompanied by curricula vitae.**

More information regarding this application may be obtained on the SAQA website or from the SAQA offices.

Comment should reach the NSB at the address below by not later than **21 October 2002**. All correspondence should be marked **SGB for Chiropractic at Level 8** and be addressed to:

The Director: Standards Setting and  
Development  
SAQA  
*Attention: Mr. D Mphuthing*  
Postnet Suite 248  
Private Bag X06  
Waterkloof  
0145  
or faxed to 012 - 482 0992

**SGB INFORMATION**

As a necessary step in the development and implementation of the National Qualifications Framework, The National Standards Bodies are briefed [regulation 19(1)(c) of 28 March 1998] to recognise or establish Standards Generating Bodies (SGBs).

SGBs shall:

- a. generate standards and qualifications in accordance with the Authority requirements in identified sub-fields and levels;
- b. update and review standards;
- c. recommend standards and qualifications to National Standards Bodies;
- d. recommend criteria for the registration of assessors and moderators or moderating bodies; and
- e. perform such other functions as may from time-to-time be delegated by their National Standards Body.



Any bodies wishing to nominate representatives, make application to serve on, or make any other submission with regard to the above SGB should note the following information.

SGBs should be composed of organisations, which shall be key education and training stakeholder interest groups and experts in the sub-field. The NSB, when making its final decisions will have due regard for, among other things, *'the need for representativeness and equity, redress and relevant expertise in terms of the work of the SGBs.'*

Organisations proposing to nominate persons to SGBs should be sensitive to the need for **equity** and **redress**, and shall nominate persons who-

- (a) will be able to consider issues of productivity, fairness, public interest and international comparability as related to education and training in the sub-field;
  - (b) enjoy credibility in the sub-field in question, who enjoy respect; have the necessary expertise and experience in the sub-field and have the support or backing of the nominating body;
  - (c) are able to advocate and mediate the needs and interests of all levels within the sub-field covered by the Standards Generating Body;
  - (d) are able to exercise critical judgement at a high level; and
  - (e) are committed to a communication process between the Standards Generating Body, the National Standards Body and the Constituency.
-



**PUBLIC NOTICE BY NSB 09, HEALTH SCIENCES AND SOCIAL SERVICES, OF AN  
APPLICATION TO REGISTER AN SGB FOR CHIROPRACTIC**

NSB 09 has received an application to recognise and register an SGB for Chiropractic for NQF level 8

**Proposed Brief of the SGB**

1. Develop learning pathways for a potential qualification and unit standards in the area of Chiropractic at level 8 [Regulation 24 (1)(a)].
2. Generate a Master of Technology degree in the area of chiropractic in terms of requirements of relevant legislation and the establishment of best practises and ethics across the working environment [Regulation 24 (1)(a)].
3. Ensure that practicing professionals fulfil the requirements for registration with the Allied Health Professions Council of South Africa [Regulation 24 (1)(e)].
4. Recommend the qualification and standards generated under 1 and 2 above to the NSB [Regulation 24 (1)(c)].
5. Recommend criteria for the registration of assessors and moderators or moderating bodies [Regulation 24 (1)(d)].
6. Liaise with other NSBs and SGBs – within and outside NSB 09 – which have vested interests in the subject of chiropractic [Regulation 24 (1)(e)].
7. Perform such other functions as may from time to time be delegated by NSB 09: Health Sciences and Social Services [Regulation 24 (1)(e)].

**PROPOSED COMPOSITION OF THE SGB**

NOMINEE	WORKPLACE	NOMINATING BODY	QUALIFICATION / EXPERIENCE
Anderson, Michael	Technikon Witwatersrand	Student Chiropractic Association	B Comm; B Sc (Biological Studies); B Tech (Chiropractic); 1 year clinical & 1 year lecturing experience
Arthur, Mavis	Technikon Witwatersrand	Technikon	RN; RM; D Ed (UNISA); 3 years clinical experience; 21 years' lecturing; 9 years' as Head of School of Health Sciences
Boshoff, Willem H	Board of Health Funders	Chiropractic Association of South Africa (CASA)	Palmer College of Chiropractic; Dip Sports Medicine; Team Doctor (RFU) for 32 years
Bromfield, Bridget	Private Practitioner	CASA	M Dip Tech (Chiropractic); 6 years clinical experience; 1 year as international sports events' chiropractor



Engelbrecht, Reginald	Private Practitioner	CASA	Palmer College of Chiropractic (Hons); 38 years clinical experience; 15 years with AHSPC
Koporaal, Charmaine M	Technikon Natal	Technikon	M Tec (Chiropractic); 4 years clinical experience; 2 years' lecturing;
Mitchell, Jennifer	Private Practitioner	CASA	D Chiropractic; 8 years lecturing experience; 5 years' clinical
Till, Anthony G	Director: Canadian Memorial Chiropractic College	CASA	D Chiropractic; 23 years clinical experience; 16 years' lecturing
van den Bos, Michael J	CASA	CASA	D Chiropractic; 4 years clinical experience; 3 years' lecturing
Yelverton, Christopher	Technikon Witwatersrand	Technikon	M Chiropractic; 5 years clinical experience; 3 years' lecturing



No. 1182

20 September 2002

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

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

**Manufacturing and Assembly**

Registered by NSB 06, Manufacturing, Engineering and Technology, publishes the following qualifications and unit standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the qualification and unit standards upon which qualifications are based. The full qualification and unit standards can be accessed via the SAQA web-site at [www.saga.org.za](http://www.saga.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, 659 Pienaar street, Brooklyn, Pretoria.

Comment on the unit standards should reach SAQA at the address *below and no later than 21 October 2002*. All correspondence should be marked **Standards Setting – SGB for Manufacturing and Assembly** and addressed to

The Director: Standards Setting and Development  
SAQA

Attention: Mr. D Mphuthing

Postnet Suite 248

Private Bag X06

Waterkloof

0145

or faxed to 012 – 482 0907



PP SAMUEL B.A. ISAACS  
EXECUTIVE OFFICER



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Engineering Fabrication (Light OR Heavy): NQF Level 3**

**Field:** Manufacturing, engineering and technology - NSB 06

**Sub-field:** Manufacturing & assembly

**Level:** 3

**Credit:** 151

**Issue date:**

**Review date:**

**Rationale of the qualification:**

This qualification is the second in a series for learners who want to follow a career in the field of engineering fabrication, which includes boilermaking, sheetmetal working and vehicle body building. This qualification is for learners who want to specialise in light OR heavy fabrication within the context of boilermaking, sheetmetal working or vehicle body building, and it focuses on developing skills and knowledge necessary to progress in such a career. It enables learners who have gained relevant experience in the workplace to gain credits through the RPL process. The qualification also forms the basis for further learning in the field of engineering fabrication where the learner will be able to specialise in light OR heavy fabrication at NQF Level 4.

**Purpose:**

The purpose of this qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of engineering fabrication (light OR heavy) and to meet the challenges of such an environment.



The chief skill that is recognised in this qualification is the ability to produce components of some complexity using a variety of fabrication methods. This capability requires an understanding of, and the ability to, lay out and mark off shapes; set up and use powered machinery; develop and fabricate from drawings and sketches and cut and join components. Hand skills play a vital role in this qualification.

Qualifying learners will be able to relate what they are doing to scientific principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

**Access to the Qualification:**

Open access

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

This qualification assumes learners have a National Certificate in Engineering Fabrication (Level 2). If the learner does not already have such a qualification, learning in preparation for this qualification would also have to include:

- Language and maths beyond basic literacy and numeracy
- Basic concepts of science and technology related to fabrication methods, engineering materials, tools and machines used in the fabrication process
- An ability to produce simple components using a variety of fabrication methods
- An ability to perform routine maintenance on machinery
- Concepts of organising factors in labour, business and the economy
- Role and purpose of procedures related to workplace relationships, roles and responsibilities



**Exit Level Outcomes and Assessment Criteria:****Exit level outcome 1**

Demonstrate an ability to produce components of some complexity using a variety of fabrication methods and operations, meeting output requirements and working safely with due care for fellow workers and the environment.

**Associated Assessment Criteria**

- Output and quality requirements are met
- Fabrication time limits are adhered to
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of fabrication and the various fabrication methods and their respective operations at this level

**Exit level outcome 2**

Demonstrate an ability to read, interpret and produce detailed plating and structural steel drawings.

**Associated Assessment Criteria**

- Components and assemblies to be fabricated are identified and requirements are interpreted from drawing
- Drawing is produced to meet job requirements
- Material list is compiled

**Exit level outcome 3**

Demonstrate an ability to select and apply appropriate inspection methods to determine component compliance with specifications.

**Associated Assessment Criteria**

- Appropriate inspection methods are chosen and applied
- Can respond to questions and discuss issues related to various inspection methods and procedures and the principles underpinning such methods



**Exit level outcome 4**

Select appropriate procedures to solve familiar problems within a fabrication environment and operate within clearly defined contexts, with some scope for personal decision-making and responsibility.

**Associated Assessment Criteria**

- Appropriate procedures are selected to solve problems in an efficient and effective manner
- Unfamiliar problems are accurately reported to appropriate personnel
- Can respond to questions and discuss issues related to familiar problems in the fabrication of components and assemblies

**Exit level outcome 5**

Contribute to workgroup efforts and support the maintenance of a safe, effective and efficient workplace

**Associated Assessment Criteria**

- Production schedules and assignments are met
- Production workflow is managed efficiently
- Safe working practices are adhered to
- Workgroup goals are met
- Assistance and support is provided where required
- Active participation in workgroup discussions, in workgroup problem solving activities and in the implementation of solutions
- Relevant information is received and passed on

**Exit level outcome 6**

Demonstrate the ability to communicate with peers and members of supervisory / management levels and to use information gathered and summarised from a range of sources to produce simple written reports

**Associated Assessment Criteria**

- Information is gathered from a range of sources and accurately summarised
- Information is clearly presented in a timely manner in the required format to appropriate parties
- Relationships with peers and supervisory / management levels are established and functioning



**Exit level outcome 6**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning.

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained

**International comparability**

Other, similar outcomes-based qualifications, certificates or skills standards in New Zealand and the United Kingdom have been used extensively to inform this qualification and its associated standards, and it compares favourably with them.

**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.

Some assessment aspects will demand practical demonstration while others may not. 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 crossfield outcomes have been achieved

**Recognition of prior learning:**

This qualification may be obtained through a process of RPL. This qualification may be obtained through RPL. The learner should be thoroughly briefed on the mechanism to be used and support and guidance should be provided. Care should be taken that the mechanism used provides the learner with an opportunity to demonstrate competence and is not so onerous as to prevent learners from taking up the RPL option towards gaining a qualification.



**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the relevant ETQA
- Moderation of assessment should be overseen by the relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA guidelines

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of engineering fabrication and a minimum of two years' experience in a light / heavy fabrication environment. The subject matter experience of the assessor can be established by recognition of prior learning
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



# **NATIONAL CERTIFICATE IN ENGINEERING FABRICATION (LIGHT OR HEAVY) – NQF LEVEL 3**

Level 3 Fundamental	Credits	NLRD ID	Level 3 Core	Credits	NLRD ID	Level 3 Elective Choice of:	Credits	NLRD ID
<b>Communication</b>			<b>Fabrication (Light OR Heavy)</b>			<b>Directly related to core</b>		
Accommodate audience and context needs in oral communication	5		Form and shape sheet, plate, pipe and structural sections using power machines	15		Weld workpieces with the gas metal arc welding process in the downhand position	20	
Interpret and use information from texts	5		Lay out and mark off regular and irregular fabrication shapes	25		Weld workpieces with the gas tungsten arc welding process in the downhand position	20	
Write texts for a range of communicative contexts	5		Mechanically cut, drill, punch and assemble fabrication materials using powered machinery	8		Remove metals using oxy-fuel and air-carbon arc gouging processes	4	
Complete feasibility and commissioning reports	3		Assemble and mechanically join sheet, plate, tube, pipe and steel sections	4		Operate lift trucks	6	
Communicate with clients	3		Weld metals with the oxy-acetylene gas welding process in all positions	8		Operate cranes		
<b>Mathematics</b>			Weld workpieces with the shielded metal arc welding process in all positions	25		Other standards or additional learning related to the purpose of the qualification	10	
Use mathematics to investigate and monitor the financial aspects of personal and business issues	5		<b>Life Skills</b>			<b>Minimum elective credits required for qualification</b>		
Investigate life and work related problems using data and probabilities	5		Develop learning strategies and techniques	3			<b>12</b>	
Describe, apply and calculate, shape and motion in 2- and 3-dimensional space in different contexts	4		<b>Business relations</b>					
Demonstrate understanding of the use of different number bases and measurement units and an awareness of error in the context of relevant calculations	2		Manage basic business finance	6				
			Manage work time effectively	3				



			Explain and use organizational procedures	6				
<b>Total Fundamental</b>	<b>36</b>		<b>Total Core</b>	<b>103</b>		<b>Total Elective</b>	<b>12</b>	
<b>Total for qualification</b>	<b>151</b>							



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Engineering Fabrication (Light OR Heavy): NQF Level 4**

**Field:** Manufacturing, engineering and technology - NSB 06

**Sub-field:** Manufacturing & assembly

**Level:** 4

**Credit:** 150

**Issue date:**

**Review date:**

**Rationale of the qualification:**

This is the third qualification in a series for learners who want to follow a career in the field of engineering fabrication, which includes boilermaking, sheetmetal working and vehicle body building. This qualification is for learners who want to specialise in light OR heavy fabrication within the context of boilermaking, sheetmetal working and vehicle body building, and it focuses on developing skills and knowledge necessary to progress in such a career.

It enables learners who have gained relevant experience in the workplace to gain credits through the RPL process. The qualification also forms the basis for further learning in the field of engineering fabrication within the higher education and training band.

**Purpose:**

The purpose of this qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of engineering fabrication (light / heavy) and to meet the challenges of such an environment.



The chief skill that is recognised in this qualification is the ability to produce complex components using a variety of fabrication methods. This capability requires an understanding of, and the ability to, lay out and mark off shapes; set up and use powered machinery; develop and fabricate from complex drawings, and cut, assemble and join components using a variety of methods. This qualification also recognises the ability to co-ordinate teamwork. Hand skills play a vital role in this qualification.

Qualifying learners will be able to relate what they are doing to scientific principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

**Access to the Qualification:**

Open access

How can I acquire the qualification?

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

This qualification assumes learners have a National Certificate in Engineering Fabrication (Light OR Heavy) (NQF level 3). If the learner does not already have such a qualification, learning in preparation for this qualification would also have to include:

- Language and maths related to organising and controlling their environment
- An ability to weld components of some complexity using a variety of welding methods
- An ability to set up and assemble equipment and perform routine maintenance on equipment and machinery
- Concepts of organising factors in labour, business and the economy
- Role and purpose of procedures related to workplace relationships, roles and responsibilities



**Exit Level Outcomes and Assessment Criteria:****Exit level outcome 1**

Demonstrate an ability to produce complex components using a variety of fabrication methods and operations, meeting output requirements and working safely with due care for fellow workers and the environment.

**Associated Assessment Criteria**

- Output and quality requirements are met
- Fabrication time limits are adhered to
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of fabrication and the various fabrication methods and their respective operations at this level

**Exit level outcome 2**

Demonstrate an ability to read, interpret and produce complex plating and structural steel drawings.

**Associated Assessment Criteria**

- Components and assemblies to be fabricated are identified and requirements are interpreted from drawing
- Drawing is produced to meet job requirements
- Material list is compiled

**Exit level outcome 3**

Demonstrate an understanding of quality specifications and an ability to interpret these and evaluate fabricated components to determine compliance with specifications.

**Associated Assessment Criteria**

- Quality specifications are interpreted and applied to fabricated components and compliance is determined and reported
- Can respond to questions and discuss issues related to quality specifications and the principles underpinning such methods



**Exit level outcome 4**

Maintain and support procedures to solve a variety of problems, both familiar and unfamiliar, within a welding context and operate within familiar and new situations, taking responsibility and making decisions.

**Associated Assessment Criteria**

- Solutions to welding-related problems are based on a clear analysis of information gathered through diagnostic procedures
- Procedures are modified to respond to unfamiliar problems where appropriate
- All actions related to problem solving are accurately recorded for future reference
- Can respond to questions and discuss issues related to familiar problems in the welding of components and assemblies

**Exit level outcome 5**

Co-ordinate work team, promoting the maintenance of a safe and efficient workplace, and developing the skills and performance of workgroup members.

**Associated Assessment Criteria**

- Production schedules and assignments are met
- Production workflow is managed efficiently
- Workgroup goals are met
- Provide leadership in workgroup discussions, in workgroup problem solving activities and in the implementation of solutions
- Relevant information is received, processed and passed on
- Workgroup members are supported, coached and influenced to work effectively, efficiently and safely

**Exit level outcome 6**

Communicate with peers and members of supervisory / management levels by producing simple written reports using information gathered and summarised from a range of sources.

**Associated Assessment Criteria**

- Information is gathered from a range of sources and accurately summarised
- Information is clearly presented in a timely manner in the required format to appropriate parties
- Relationships with peers and supervisory / management levels are established and functioning



**Exit level outcome 7**

Demonstrate the ability to communicate and present information clearly and reliably, and to analyse information in order to identify problems and determine trends.

**Associated Assessment Criteria**

- Conditions, evidence and incidences are reported accurately in a timely manner and discussed with peers and management
- Data gathered through diagnostic procedures is examined systematically and analysis is repeated until problem is solved
- Records are available for scrutiny and future reference

**Exit level outcome 8**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning.

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained

**International comparability**

Other, similar outcomes-based qualifications, certificates and skills standards in New Zealand and the United Kingdom have been used extensively to inform this qualification and its associated standards, and it compares favourably with them.

**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.

Some assessment aspects will demand practical demonstration while others may not. 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 crossfield outcomes have been achieved.



**Recognition of prior learning:**

This qualification may be obtained through RPL. The learner should be thoroughly briefed on the mechanism to be used and support and guidance should be provided. Care should be taken that the mechanism used provides the learner with an opportunity to demonstrate competence and is not so onerous as to prevent learners from taking up the RPL option towards gaining a qualification.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the relevant ETQA
- Moderation of assessment should be overseen by the relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA guidelines

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of engineering fabrication and a minimum of 2 years' experience in a light / heavy engineering fabrication environment. The subject matter experience of the assessor can be established by recognition of prior learning
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good inter-personal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



**NATIONAL CERTIFICATE IN ENGINEERING FABRICATION (LIGHT OR HEAVY) – NQF LEVEL 4**

Level 4 Fundamental	Credits	NLRD ID	Level 4 Core	Credits	NLRD ID	Level 4 Elective Choice of:	Credits	NLRD ID
<b>Communication</b>			<b>Fabrication (Light OR Heavy)</b>			<b>Directly related to core</b>		
Engage in sustained oral communication and evaluate spoken texts	5	8974	Develop and fabricate from complex drawings	28		Perform non-destructive tests on metal parts and components	6	
Read, analyse and respond to a variety of texts	5	8975	Cut, drill and punch, assemble and mechanically join structural steelwork	24		Test the physical properties of engineering metals	6	
Write for a wide range of contexts	5	8976	Weld workpieces with the shielded metal arc welding process in all positions	25		Weld workpieces with the gas metal arc welding process in all positions	15	
Write a technical report	4	9502	Perform heat treatment processes on engineering metals	8 (L3)		Weld workpieces with the gas tungsten arc welding process in all positions	20	
<b>Communicate in an assertive manner with clients and fellow workers</b>	4		<b>People interacting, leading and developing</b>			Remove metals using air-carbon arc gouging process	4 (L3)	
<b>Mathematics</b>			Lead a team, plan, allocate and assess their work	4		Use computer software to generate developments, reflecting the outcomes stated below	8	
Use mathematics to investigate and monitor the financial aspects of personal, business, and national issues	6	7468	<b>Business relations</b>			Develop a personal financial plan	2	
Apply knowledge of statistics and probability to critically interrogate	6	9015	Contribute to the implementation and maintenance of business processes	10		Other standards or additional learning related to the purpose of		



and effectively communicate findings on life related problems						the qualification		
Measure, estimate and calculate physical quantities and explore, critique and prove geometrical relationships in two and three-dimensional space in the life and workplace of the adult with increasing responsibilities	4					<b>Minimum elective credits required for qualification</b>	<b>12</b>	
<b>Total Fundamental</b>	<b>39</b>		<b>Total Core</b>	<b>99</b>		<b>Total Elective</b>	<b>12</b>	
<b>Total for qualification</b>	<b>150</b>							



**NATIONAL CERTIFICATE IN ENGINEERING FABRICATION (LIGHT / HEAVY) – NQF LEVEL 4**

Unit standards developed for this series of qualifications:

**UNIT STANDARDS ON NQF LEVEL 4****CORE**

- Title 1:** Develop and fabricate from complex drawings
- Title 2:** Cut, drill and punch, assemble and mechanically join structural steelwork
- Title 3:** Weld workpieces with the shielded metal arc welding process in all positions

**ELECTIVE**

- Title 4:** Weld workpieces with the gas metal arc welding process in all positions
- Title 5:** Weld workpieces with the gas tungsten arc welding process in all positions

**UNIT STANDARD ON NQF LEVEL 3****ELECTIVE**

- Title 6:** Remove metals using air-carbon arc gouging processes

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN NATIONAL CERTIFICATE IN ENGINEERING FABRICATION (LIGHT / HEAVY) – NQF LEVEL 4**

**Title 1: Develop and fabricate from complex drawings**

- Specific outcome 1.1:** Prepare for laying out, marking off, and forming and shaping of materials
- Interpret job instructions and determine sequence of operations
  - Check that equipment, tools and materials required are at the workstation
  - Prepare equipment and tools for operation, including routine maintenance and preoperational checks
  - Select materials
  - Perform pattern calculations
  - Determine lines of intersection
  - Identify and note appropriate level marks
  - Identify codes and standards in relation to dimensional accuracy
  - Analyse material characteristics
  - Perform calculations of force and leverage
  - Identify hazards and take preventative action



- Specific outcome 1.2: Mark out templates and patterns
- Make templates and patterns using X and Y co-ordinates
  - Mark out heavy wall tube connections
  - Produce templates for structural connections
  - Establish and transfer datum points to materials
- Specific outcome 1.3: Lay out and mark off structural sections
- Use structural section sketches to communicate job requirements to others in team
  - Lay out structural connections
  - Lay out and mark off pipe work
  - Mark off section material
- Specific outcome 1.4: Mark out surface developments
- Carry out pattern developments
  - Carry out surface developments using neutral surface calculations
  - Complete surface developments with allowances for joint preparation
  - Generate right, oblique and transition patterns
  - Inspect and measure surface development, templates and structural components for compliance
- Specific outcome 1.5: Form and shape materials
- Set machines
  - Carry out form and shape operations
  - Dispose of waste material
  - Store reusable materials
  - Inspect and measure fabricated items for compliance to job specifications
- Specific outcome 1.6: Identify and report non-conformances that cannot be rectified
- Specific outcome 1.7: Record information on work done and provide feedback to appropriate personnel
- Specific outcome 1.8: Apply safe working practices and discuss issues related to safety of self, fellow workers, machines, equipment, materials and the environment

**Title 2: Cut, drill and punch, assemble and mechanically join structural steelwork**

- Specific outcome 2.1: Prepare for work activity
- Interpret job instructions and determine sequence of operations
  - Select equipment and lubricants
  - Prepare machines for operation, including routine maintenance and pre-operational checks



- Select and fit correct tooling
  - Replace worn tooling, if required
  - Set up machines
  - Identify materials and verify material characteristics
  - Select types of mechanical joining methods
  - Identify potential hazards and take preventative action
- Specific outcome 2.2: Perform mechanical cutting, drilling and punching of materials
- Determine cutting parameters
  - Confirm blade clearances to achieve shearing
  - Cut, drill and punch materials to specifications
  - Dispose of waste materials
  - Store reusable material
  - Clean and restore work area
- Specific outcome 2.3: Perform assembly and mechanical joining of materials
- Assemble materials
  - Mechanically join materials
  - Construct jigs and fixtures
  - Perform site erection and layout
  - Correct distortion
  - Carry out finishing
- Specific outcome 2.4: Apply quality checks
- Inspect and measure cut, drilled and punched materials for compliance to job specifications
  - Inspect and measure assemblies and mechanical joints for compliance to job specifications
- Specific outcome 2.5: Identify, document and rectify non-conformances and report non-rectifiable problems to appropriate personnel
- Specific outcome 2.6: Record information on work done and provide feedback to appropriate personnel
- Specific outcome 2.7: Apply safe working practices and discuss issues related to safety of self, fellow workers, machines, equipment, materials and the environment

**Title 3: Weld workpieces with the shielded metal arc welding process in all positions**

- Specific outcome 3.1: Describe and assemble the shielded metal arc welding equipment
- Specific outcome 3.2: Select, assemble and conduct pre operational checks of shielded metal arc welding equipment



- Specific outcome 3.3: Prepare work pieces prior to welding
- Specific outcome 3.4: Weld workpieces
- Specific outcome 3.5: Inspect welded work piece
- Specific outcome 3.6: Care and store welding consumables and equipment

**Title 4: Weld workpieces with the gas metal arc welding process in all positions**

- Specific outcome 4.1: Describe the gas metal arc welding equipment
- Specific outcome 4.2: Select, assemble and conduct pre operational checks of gas metal arc welding equipment
- Specific outcome 4.3: Prepare work pieces prior to welding
- Specific outcome 4.4: Weld workpieces
- Specific outcome 4.5: Inspect welded work piece for defects in compliance with drawing specifications
- Specific outcome 4.6: Care and store welding consumables and equipment

**Title 5: Weld workpieces with the gas tungsten arc welding process in all positions**

- Specific outcome 5.1: Describe and explain the gas tungsten arc welding equipment
- Specific outcome 5.2: Select, assemble and conduct pre operational checks of gas tungsten arc welding equipment
- Specific outcome 5.3: Prepare work pieces prior to welding
- Specific outcome 5.4: Weld workpieces
- Specific outcome 5.5: Inspect welded work piece for defects
- Specific outcome 5.6: Care and store welding consumables and equipment

**Title 6: Remove metals using air-carbon arc gouging processes**

- Specific outcome 5.1: Describe and assemble the air-carbon arc gouging equipment
- Specific outcome 5.2: Select, assemble and conduct pre operational checks on air-carbon arc gouging equipment
- Specific outcome 5.3: Gouge workpieces
- Specific outcome 5.4: Inspect gouged work pieces
- Specific outcome 5.5: Care and store gouging consumables and equipment



No. 1183

20 September 2002

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

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

**Manufacturing and Assembly**

Registered by NSB 06, Manufacturing, Engineering and Technology, publishes the following qualifications and unit standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the qualification and unit standards upon which qualifications are based. The full qualification and unit standards can be accessed via the SAQA web-site at [www.saqa.org.za](http://www.saqa.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, 659 Pienaar street, Brooklyn, Pretoria.

Comment on the unit standards should reach SAQA at the address *below and no later than 21 October 2002*. All correspondence should be marked **Standards Setting – SGB for Manufacturing and Assembly** and addressed to

The Director: Standards Setting and Development  
SAQA  
*Attention: Mr. D Mphuthing*  
Postnet Suite 248  
Private Bag X06  
Waterkloof  
0145  
or faxed to 012 – 482 0907



1P SAMUEL B.A. ISAACS  
EXECUTIVE OFFICER



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Diploma in Rubber Technology: NQF Level 5**

**Field:** Manufacturing, engineering and technology

**Sub-field:** Manufacturing & assembly

**Level:** 5

**Credit:** 239

**Issue date:**

**Review date:**

**Rationale of the qualification:**

The rubber manufacturing industry is characterized by a sophisticated manufacturing and assembly process within a competitive and challenging environment. The rubber products produced must meet a wide variety of exacting safety, quality, customer and consumer specifications. The industry has to respond to quality issues and increasing competition in export and domestic markets and ensure the on-going development of new products required by changing customer needs. Within the rubber manufacturing and assembly industry, the rubber technology skills area is concerned with ensuring that all inputs to the manufacturing and assembly process deliver the required quality and quantity of product. People working as rubber technologists require specialized technical skills and knowledge in order to assure that material specifications critical to the manufacturing process are met, quality assurance practices are adhered to during the rubber manufacturing and assembly



process, and processes are in place to adapt to and meet the requirements of the constantly changing products that must be manufactured.

This is one of a series of qualifications for learners who want to follow a career in any industry in which rubber (elastomeric) materials are used.

For those who have been in the workplace for a long time, this qualification represents part of the RPL process to acknowledge workplace skills acquired without the benefit of formal education or training.

The qualification also forms the basis for further development within rubber technology, materials technology and management in the higher education and training band.

**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively as rubber technologists within the rubber manufacturing and assembly environment and meet the challenges of such an environment.

The chief skills that are recognised in this qualification are the ability to test and analyse rubber materials, components and products, determine requirements for rubber applications, perform auditing activities and manage projects. These skills require an in-depth understanding of rubber manufacturing and assembly processes and applicable rubber chemistry, rubber physics, organic chemistry and mathematical concepts.

Qualified learners will also understand:

- How to maintain and influence relationships in a complex production environment
- How to achieve change
- How to maintain quality specifications to optimise the quality assurance process
- How to work with a range of information sources to optimise performance

Qualifying learners will also be able to support the various policies and procedures related to the safety, health and environmental systems that govern their workplace.



**Access to the Qualification:****Open Access**

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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

**Learning assumed to be in place:**

This qualification assumes learners have a rubber manufacturing and assembly related qualification at NQF level 4 and the equivalent of physical science at NQF level 4.

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

- Communication, mathematics and physical science at NQF level 4
- An understanding of rubber materials, components and products and their functions
- An understanding of the rubber manufacturing process (stages of and what happens at each stage)
- Concepts of influencing small levels of changes in quality assurance practices
- Dealing with change in relation to procedures that support workplace relationships, procedures, roles and responsibilities

**Exit Level Outcomes and Assessment Criteria:****Exit level outcome 1**

Demonstrate an understanding of rubber compounding and processing and an ability to conduct investigations for verification purposes, to explain product non-conformances, for product modifications and for new product development



**Associated Assessment Criteria**

- Experimental design is determined based on evaluation of presented task
- Tests are conducted and reliability of test results confirmed
- Report on findings is generated
- Can respond to and discuss issues related to rubber compounding and physics as they apply to the testing and analysis of rubber materials, components and products

**Exit level outcome 2**

Demonstrate an ability to determine the requirements for common commercial rubber applications

**Associated Assessment Criteria**

- Predictions are formulated
- Relevant and appropriate information is collected
- Recommendations are made based on customer requirements
- Customer is satisfied with performance criteria of product in use, recommendations made and cost/quality relationship
- Report is compiled
- Recommendations made are justified with reference to rubber chemistry and physics

**Exit level outcome 3**

Demonstrate an ability to implement new projects in a rubber manufacturing and assembly process

**Associated Assessment Criteria**

- Project plan is formulated with performance indicators
- Project is completed
- Feasibility of implementing project results is determined
- Report is generated and applicable persons briefed
- Can respond to and discuss issues related to project management



**Exit level outcome 4**

Demonstrate an ability to audit materials, components, process performance and final product for compliance with specifications, e.g. policies and procedures, company performance criteria.

**Associated Assessment Criteria**

- Audit plan is produced
- Affected stakeholders are informed of audit plan
- Audit data is collected and recorded
- Findings are evaluated for conformance / non-conformance to legislation, company policy and procedures
- Findings report is compiled, processed and circulated to affected parties
- Audit findings and suitable recommendations are discussed with affected parties
- Corrective action(s) / improvements made are evaluated, recorded and processed
- Can respond to and discuss issues related to auditing activities

**Exit level outcome 5**

Demonstrate an ability to coordinate work activities and plan, schedule and arrange work

**Associated Assessment Criteria**

- Work schedules are met
- Work activities are planned
- Goals set are specific, measurable and achievable and aligned to customer and business needs
- Schedules are developed in consultation with relevant parties and any scheduling conflicts are resolved



**Exit level outcome 6**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained
- Learning plan is developed

**International comparability**

This qualification has been designed in response to a need from the rubber manufacturing and assembly industry for persons at NQF level 5 with a particular set of skills. No direct international comparisons were found for this qualification at the equivalent of NQF level 5. However, this qualification articulates into further learning within the higher education band in materials and polymer technology. Such higher level qualifications are found in many countries such as Australia, New Zealand, United Kingdom, the United States and Canada.

**Integrated Assessment:**

The integrated assessment 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

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 which underpin the activities and the manufacturing process. The assessment process should also establish how the critical outcomes have been advanced by the learning process.

**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 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.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

To assure the quality of the assessment process, the moderation should cover one or more of the following:

1. assessor credentials
2. the assessment instrument
3. the assessment process (including preparation and post-assessment feedback)

Where assessment and moderation are taking place in sectors other than the Manufacturing, Engineering and Related Services, assessment and moderation should be in terms of a Memorandum of Understanding negotiated with the MERS ETQA

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate tertiary 3 year or equivalent qualification in the field of chemistry and physics – with a minimum of 7 years in a rubber manufacturing and assembly environment. The subject matter experience of the assessor can be established by recognition of prior learning.



2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA

### National Diploma in Rubber Technology: NQF Level 5

Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
	Use communication techniques effectively	5	8
	<b>Mathematics</b>		
	Use mathematical and statistical techniques effectively as a rubber technologist	5	34
	<b>Total fundamental</b>		<b>42</b>
Core			
NLRD	Title	Level	Credits
	<b>Rubber Technology</b>		
	Test and analyse rubber materials, components and products	5	45
	Determine requirements for rubber applications	5	60
	Perform auditing activities	5	12
	<b>Business skills</b>		
	Implement new projects in a rubber manufacturing and assembly process	5	30
	<b>Quality</b>		
	Optimise the quality assurance system	5	6
	<b>Business relations</b>		
	Maintain business processes	5	10
	<b>People interacting, leading and developing</b>		
9406	Manage a team	5	4
	<b>Total Core</b>		<b>167</b>
Elective			
NLRD	Titles		Credits
	Choice of a minimum of 30 elective credits to be drawn from the following learning areas:		
	• Business management, e.g. purchasing, stock control, accounting		
	• Technical drawing		
	• Mercantile law		
	• Physics		
	<b>Minimum elective credits towards qualification</b>		<b>30</b>
	<b>Total for qualification</b>		<b>239</b>



### National Diploma in Rubber Technology: NQF Level 5

Title	Level	Credits	NLRD ID
<b>Communication</b>			
Use communication techniques effectively	5	8	
<b>Mathematics</b>			
Use mathematical and statistical techniques effectively as a rubber technologist	5	34	
<b>Total fundamental</b>		<b>42</b>	

Title	Level	Credits	NLRD ID
<b>Rubber Technology</b>			
Test and analyse rubber materials, components and products	5	45	
Determine requirements for rubber applications	5	60	
Perform auditing activities	5	12	
<b>Business skills</b>			
Implement new projects in a rubber manufacturing and assembly process	5	30	
<b>Quality</b>			
Optimise the quality assurance system	5	6	
<b>Business relations</b>			
Maintain business processes	5	10	
<b>People interacting, leading and developing</b>			
Manage a team	5	4	9406
<b>Total Core</b>		<b>167</b>	
<b>Titles</b>		<b>Credits</b>	<b>NLRD ID</b>
Choice of a minimum of 30 elective credits to be drawn from the following learning areas:			
• Business management, e.g. purchasing, stock control, accounting			
• Technical drawing			
• Mercantile law			
• Physics			
<b>Minimum elective credits towards qualification</b>		<b>30</b>	
<b>Total for qualification</b>		<b>249</b>	



**NATIONAL DIPLOMA IN RUBBER TECHNOLOGY – NQF LEVEL 5****UNIT STANDARDS ON NQF LEVEL 5****FUNDAMENTAL**

**Title 1** Use mathematical and statistical techniques effectively as a rubber technologist

**CORE**

**Title 1:** Test and analyse rubber materials, components and products

**Title 2:** Determine requirements for rubber applications

**Title 3:** Perform auditing activities

**Title 4:** Implement new projects in a rubber manufacturing and assembly process

**UNIT STANDARDS AND SPECIFIC OUTCOMES FOR THE NATIONAL DIPLOMA IN RUBBER TECHNOLOGY – NQF LEVEL 5**

**Title 1: Use mathematical and statistical techniques effectively as a rubber technologist**

**Specific outcome 1.1:** Discuss and explain a range of mathematical and statistical techniques used in the rubber technology field and applicable mathematical and statistical theory

**Specific outcome 1.2:** Demonstrate an ability to perform basic differentiation and integration of polynomials and logarithms and use mathematics for chemometrics

**Specific outcome 1.3:** Apply mathematical techniques to:

- Forecast needs
- Determine optimum parameters
- Use and work with formulations
- Quantify productivity gains

**Specific outcome 1.4:** Perform statistical analyses

**Specific outcome 1.5:** Perform costing, estimating and budget calculations

**Title 2: Test and analyse rubber materials, components and products**

**Specific outcome 2.1:** Evaluate the presented task

**Specific outcome 2.2:** Determine experimental design

**Specific outcome 2.3:** Select and/or prepare the required test samples

**Specific outcome 2.4:** Perform the experiment

**Specific outcome 2.5:** Analyse and interpret data based on the experiment's objectives

**Specific outcome 2.6:** Assess the reliability of the test results

**Specific outcome 2.7:** Report on findings

**Specific outcome 2.8:** Monitor the implementation of recommendations made



**Title 3: Determine requirements for rubber applications**

- Specific outcome 3.1: Make predictions based on customer requirements
- Specific outcome 3.2: Collect appropriate information pertaining to the project needs from a range of data sources
- Communicate cost implications of data collection process to customer prior to starting process and obtain approval
- Specific outcome 3.3: Compare the specifications of various possible raw materials with the final application in mind
- Specific outcome 3.4: Recommend a particular formulation and processing requirements where appropriate
- Specific outcome 3.5: Compile recommendations in a structured report
- Specific outcome 3.6: Confirm performance criteria of product in use with customer/consumer and make the necessary adjustments to the recommendations
- Specific outcome 3.7: Justify recommendations made with reference to rubber chemistry and physics

**Title 4: Perform auditing activities**

- Specific outcome 4.1: Plan and prepare for the audit process
- Specific outcome 4.2: Communicate the audit plan with affected parties
- Specific outcome 4.3: Conduct the audit process
- Specific outcome 4.4: Interpret and evaluate findings
- Specific outcome 4.5: Compile an audit report
- Specific outcome 4.6: Report on the audit findings
- Specific outcome 4.7: Follow-up and evaluate corrective action(s) / improvements made

**Title 5: Implement new projects in a rubber manufacturing and assembly process**

- Specific outcome 5.1: Determine project requirements
- Specific outcome 5.2: Research the availability of local project expertise
- Specific outcome 5.3: Select and brief project team
- Specific outcome 5.4: Collect project data from a variety of sources
- Specific outcome 5.5: Formulate project plan and performance indicators and present plan to affected parties
- Specific outcome 5.6: Manage the implementation of the project
- Specific outcome 4.7: Sign off project and compile project report
- Specific outcome 4.8: Brief applicable persons on way forward
- Specific outcome 4.9: Discuss and explain project planning, management and implementation



**QUALIFICATIONS****Section A: Layout and Formatting of the Qualification**

- a) Title
- b) Rationale
- c) Level, total credits required credits and learning components assigned to the qualification; Minimum credits required at specific levels or maximum credits when these exceed the minima specified in regulation 8 or 9
- d) Access to the qualification
- e) Field and sub-field of the qualification
- f) A statement of the purpose of the qualification.
- g) Assumptions of learning already in place before the programmes leading to the qualification are commenced.
- h) Exit level outcomes as contemplated in regulation 5(1)(b) and (c) and the associated assessment criteria.
- i) International comparability
- j) Integrated assessment appropriately incorporated to ensure that the purpose of the qualification is achieved.
- k) Recognition of prior learning (RPL)
- l) Articulation possibilities with related qualifications (either generic or specific arrangements for articulation).
- m) Moderation options including
  - Recommendation of a moderating body or bodies
  - Criteria for the registration of assessors



No. 1184

20 September 2002

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

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

**Food**

Registered by NSB 06, Manufacturing, Engineering and Technology, publishes the following qualifications and unit standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the qualification and unit standards upon which qualifications are based. The full qualification and unit standards can be accessed via the SAQA web-site at [www.saqa.org.za](http://www.saqa.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, 659 Pienaar street, Brooklyn, Pretoria.

Comment on the unit standards should reach SAQA at the address ***below and no later than 21 October 2002***. All correspondence should be marked **Standards Setting – SGB for Food** and addressed to

The Director: Standards Setting and Development  
SAQA

Attention: Mr. D Mphuthing


Postnet Suite 248

Private Bag X06

Waterkloof

0145

or faxed to 012 – 482 0907



**SAMUEL B.A. ISAACS**  
**EXECUTIVE OFFICER**



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Food and Beverage Laboratory Practices: Food and Beverage Laboratory Analysis NQF 3**

**Field:** Manufacturing, Engineering and Technology - NSB 06  
**Sub-field:** Manufacturing and Assembly  
**Level:** 3  
**Credit:** 120  
**Issue date:**  
**Review date:**

**Rationale of the qualification**

This qualification reflects the workplace-based need of the food and beverage manufacturing industry regarding laboratory practices, specifically towards assistant analyst skills. This need is expressed by employers and employees, both now and for the future. This qualification provides the learner with accessibility to be employed within the food and beverage manufacturing industry and provides the flexibility to pursue a quality control and assurance career with broad articulation within the different areas of the food and beverage industry.

The level of flexibility within the range of electives will allow the individual to pursue a career as a quality control and assurance analyst within the food and beverage analytical, microbiological and biochemical laboratory environment leading to articulation within the laboratory supervision environment.

**Purpose of the qualification**

This qualification is aimed at the learner who wants to obtain the skills in food and beverage laboratory analysis, or who already has the skills, but wants to obtain national recognition for these skills through a process of RPL.

A person acquiring this qualification will be able to perform the core functions that support the operations in a food and beverage analytical laboratory. In addition, and depending on the electives chosen, the learner will be able to perform quality evaluation techniques and procedures to establish the physical, chemical, sensory, compositional and microbiological quality of food and beverage products.

This qualification will allow a person to advance to a food and beverage quality control and assurance practices or supervision qualification at NQF level 4. The qualification will also enhance the social status and productivity within the food and beverage industry.



**Access to the qualification**

Open access.

**Credits assigned to the qualification**

In the fundamental component of the qualification, a learner must achieve or demonstrate his/her competence in the 20 credits in the field of Communication Studies and Language and 16 credits in the field of Physical, Mathematical, Computer and Life Sciences. Six additional credits are assigned to knowledge of chemistry principles, which forms an integrated part of the fundamental knowledge needed for food and beverage laboratory analysis.

The unit standards in the core and elective component of the qualification reflect the skills and competencies needed in order to be transportable in the food or beverage laboratory and quality control environment.

In the core component of the qualification a learner must achieve or demonstrate his/her competence in the 62 credits within the core group of unit standards.

The elective component of the qualification enables the person to pursue a learning path with interests of his/her own that can contribute to other learning pathways, such as microbiological analysis, chemical and compositional analysis, and sensory and physical analysis of food and beverage products.

A minimum of 16 credits must be chosen from the electives in order to achieve the 120 credits of the qualification. From the total of 120 credits of the qualification, the fundamental and core unit standards contribute to a minimum of 92 credits on level 3 and higher.

An average learner is currently taking 780 hours in order to achieve the learning outcomes as described within the core and elective group of unit standards, and 1200 hours to achieve the total credits of the whole qualification.

**Learning assumed to be in place**

A knowledge, comprehension and application of language, mathematics, natural science and technology principles at NQF levels 1 and 2.

**Exit level outcomes**

Qualifying learners can:

**Exit level 1:** Maintain and apply safety practices in a food and beverage quality assurance laboratory.

**Associated assessment criteria**

- Maintain safety aspects regarding housekeeping, handling and storing of equipment and reagents in a food and beverage laboratory according to standard operating procedures and safety principles.
- Demonstrate knowledge of food safety practices and procedures in a food and beverage environment.
- Monitor and control quality assurance practices in a food and beverage laboratory according to standard operating procedures.



**Exit level 2:** Perform core functions in a food and beverage quality assurance laboratory.

**Associated assessment criteria**

- Prepare glassware and media for determination procedures in a food and beverage laboratory according to standard operating procedures.
- Demonstrating knowledge of heating and cooling procedures.
- Demonstrate knowledge of fundamental chemical and physical reactions and fundamental biochemistry principles.
- Measure the temperature of food or beverage products according to standard operating procedures and evaluate the results.
- Take representative samples of food or beverage products according to standard operating procedures for analysis in a laboratory.
- Perform elementary acid-base titrations to prepare chemical solution with specific concentrations.

**Exit level 3:** Determine the microbiological quality of food or beverage products.

**Associated assessment criteria**

- Demonstrate knowledge of and apply microbiological principles in a food and beverage environment.
- Demonstrate an understanding of the connection between micro-organisms and food spoilage and how this will affect microbiological analysis of food and beverage products.
- Evaluate the microbiological quality of food or beverage products by means of pour plate methods according to standard operating procedures.
- Demonstrate knowledge of the nature and composition of food.

**Exit level 4:** Determine the chemical and compositional quality of food or beverage products.

**Associated assessment criteria**

- Evaluate the quality of a food or beverage product in terms of its pH according standard operating procedures.
- Evaluate the quality of a food or beverage product in terms of its moisture content (oven drying method) according to standard operating procedures.
- Demonstrate knowledge of the nature and composition of food.

**Exit level 5:** Determine the physical and sensory quality of food or beverage products.

**Associated assessment criteria**

- Evaluate the quality of a food or beverage product in terms of its viscosity according to standard operating procedures.
- Evaluate the quality of a food or beverage product by performing sensory evaluation according to standard operating procedures.
- Demonstrate knowledge of the nature and composition of food.

**Critical cross-field outcomes**

Critical cross-field outcomes have been addressed by the exit level outcomes as follows:

Critical cross-field outcomes	Evident in exit level outcome
While performing laboratory analyst tasks, qualifying learners can:	
1. Identify and solve problems in which response displays that responsible decisions, using critical and creative thinking, have been made by:	
• Applying knowledge and comprehension of health and safety practices,	1
• Monitoring and controlling quality assurance practices,	1



<ul style="list-style-type: none"> <li>Identifying and solving problems while performing laboratory analyst tasks.</li> </ul>	2, 3, 4, 5
2. Work effectively with others as a member of a team, group, organisation or community by: <ul style="list-style-type: none"> <li>Applying team-work to monitor and control quality assurance practices,</li> <li>Co-ordinating one's work with that of others in the direct surrounding area.</li> </ul>	1 2, 3, 4, 5
3. Organise and manage oneself and one's activities responsibly and effectively by: <ul style="list-style-type: none"> <li>Planning one's activities.</li> </ul>	2, 3, 4, 5
4. Collect, analyse, organise and critically evaluate information by: <ul style="list-style-type: none"> <li>Monitoring and controlling quality assurance practices,</li> <li>Taking samples, analysing it and evaluating the results in order to determine whether products conform to specifications.</li> </ul>	1 2, 3, 4, 5
5. Communicate effectively by using mathematical and/or language skills in the modes of oral and/or written presentations by: <ul style="list-style-type: none"> <li>Keeping records and noting results.</li> </ul>	2, 3, 4, 5
6. Use science and technology effectively and critically, showing responsibility towards the environment and health of others by: <ul style="list-style-type: none"> <li>Working according to health and safety regulations,</li> <li>Working with technologically advanced laboratory equipment according to SOP.</li> </ul>	1, 2, 3, 4, 5 2, 3, 4, 5
7. Demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation by: <ul style="list-style-type: none"> <li>Monitoring and controlling quality assurance practices,</li> <li>Identifying and solving problems during laboratory analyses of food and beverage samples.</li> </ul>	1 2, 3, 4, 5
8. Contribute to the full personal development of each learner and the social and economic development of the society at large by: <ul style="list-style-type: none"> <li>Maintaining and applying safety practices in a food and beverage quality assurance laboratory,</li> <li>Performing core functions in a food and beverage quality assurance laboratory,</li> <li>Determining the microbiological quality of food or beverage products.</li> <li>Determining the chemical and compositional quality of food or beverage products.</li> <li>Determining the physical and sensory quality of food or beverage products.</li> </ul>	1 2 3 4 5

### International comparability

Benchmarking was done against the NVQ from Britain, SVQ from Scotland as well as Australian, New Zealand and German qualifications. Similar qualifications, though not always unit standards based, were found. Qualifications resembling comparability was found on the New Zealand qualification framework at level 4. These qualifications (food and dairy manufacturing laboratory technology certificates on level 4) focuses on development of learners towards laboratory management and advanced scientific and technological development of laboratory methods, which are clearly qualifications with a different focus.

### Integrated assessment

The applied competence (practical, foundational and reflexive competencies) of this qualification will be achieved if the learner is able to perform core laboratory functions, as well as some quality evaluation techniques and procedures to establish one or more of the physical, chemical, sensory, compositional and microbiological quality of a range of food and beverage products.

The identifying and solving of problems, team work, organising one-self, the using of applied science, the implication of actions and reactions in the world as a set of related systems must be assessed during any combination of practical, foundational and reflexive competencies



assessment methods and tools to determine the whole person development and integration of applied knowledge and skills.

Applicable assessment tool(s) must be used to establish the foundational, reflexive and embedded knowledge to problem solving and application of the world as a set of related systems within the processing environment.

A detailed portfolio of evidence is required to proof the practical, applied and foundational competencies of the learner.

Assessors and moderators should develop and conduct their own integrated assessment by making use of a range of formative and summative assessment methods. Assessors should assess and give credit for the evidence of learning that has already been acquired through formal, informal and non-formal learning and work experience.

Unit standards in the qualification must be used to assess specific and critical cross-field outcomes. During integrated assessments the assessor should make use of formative and summative assessment methods and should assess combinations of practical, applied, foundational and reflexive competencies.

### **Recognition of prior learning**

This qualification may be achieved in part or completely through the recognition of prior learning, which includes formal, informal and non-formal learning and work experience.

### **Articulation possibilities**

This qualification will enable the qualifying learner to progress to learning for the national certificate in food and beverages quality control and assurance practices or quality control supervision qualification at NQF level 4.

### **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 for assessment and moderation; in terms of agreements reached around assessment and moderation between ETQAs (including professional bodies); and in terms of the moderation guideline detailed immediately below.
- Moderation must include both internal and external moderation of assessments at exit points of the qualification, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described both in individual unit standards, exit level outcomes as well as the integrated competence described in the qualification.

Anyone wishing to be assessed against this qualification may apply to be assessed by any assessment agency, assessor or provider institution that is accredited by the relevant ETQA.

### **Criteria for registration of assessors**

For an applicant to register as an assessor, the following are essential:

- The applicant needs well-developed interpersonal skills, as well as subject matter and assessment experience.
- The assessor needs to be competent in the planning and conducting of assessment of learning outcomes as described in the unit standard "Plan and conduct assessment of learning outcomes" at NQF level 5. The subject matter experience must be well developed within the field of food and beverage laboratory practices, procedures and quality assurance tests.
- The applicant should have a similar qualification than this one, with a minimum of 12 months field experience after he/she has completed the qualification or,



- A food science and technology qualification on NQF level 6 or higher, with a minimum of 12 months field experience after he/she has completed the qualification.
- The subject matter experience of the assessor can be established by recognition of prior learning.
- The assessors need to be registered with the Food and Beverage Education and Training Quality Assurance Body.
- Detailed documentary proof of educational qualification, practical training undergone, and experience gained by the applicant must be provided (portfolio of evidence).



**National Certificate in Food and Beverage Laboratory Practices: Food and Beverage Laboratory Analysis NQF 3 120 credits**

<b>Fundamental</b>			
<b>TITLE</b>	<b>CREDITS</b>	<b>LEVEL</b>	<b>NLRD</b>
Accommodate audience and context needs in oral communication.	3	5	
Interpret and use information from texts.	3	5	
Write texts for a range of communicative context.	3	5	8964
Use language and communication in an occupational learning programmes.	3	5	8973
<b>Field of Physical, Mathematical, Computer and Life Sciences</b>			
Demonstrate understanding of the use of different number bases and measurement units and an awareness of error in the context of relevant calculations.	3	2	
Use mathematics to investigate and monitor the financial aspects of personal and business issues.	3	5	8983
Investigate life and work related problems using data and probabilities.	3	5	
Measure, estimate and calculate physical quantities and explore, describe and represent, interpret and justify geometrical relationships in two and three-dimensional space relevant to the life or workplace of the community.	3	4	9008
Demonstrate knowledge of chemistry principles.	3	6	
<b>Total fundamental</b>			<b>42</b>
<b>Core</b>			
<b>TITLE</b>	<b>CREDITS</b>	<b>LEVEL</b>	<b>NLRD</b>
Prepare glassware and media for determination procedures in a food laboratory.	1	4	
Measure the temperature of food or beverage products and evaluate the readings.	1	1	
Take a representative food or beverage sample.	1	3	
Maintain food laboratory safety.	2	4	9114
Demonstrate knowledge of the nature and composition of food.	3	6	
Demonstrate knowledge of fundamental principles of biochemistry.	3	7	
Monitor and control quality assurance practices in a food or beverage-manufacturing environment.	3	4	8902
Demonstrate knowledge of fundamental chemical and physical reactions.	3	8	
Apply microbiological principles in a food or beverage environment.	3	6	9147



Demonstrate an understanding of food or beverage safety practices and procedures in a food or beverage-manufacturing environment.	3	7	9042
Demonstrate an understanding of heating and cooling procedures.	3	4	9113
Demonstrate an understanding of the relationship between micro-organisms and food spoilage.	4	8	8870
<b>Total Core</b>		<b>62</b>	<b>62</b>
<b>Electives (Choose a minimum of 16 credits)</b>	<b>CREDITS</b>	<b>LEVEL</b>	<b>NLRD</b>
Perform elementary acid-base titrations and interpret the results.	6	3	
Evaluate the quality of a food or beverage product in terms of its viscosity.	3	3	9163
Evaluate the microbiological quality of a food or beverage product by means of pour plate methods.	12	3	9164
Evaluate the quality of a food or beverage product in terms of its pH.	4	3	9138
Evaluate the quality of a food product in terms of its moisture content using the oven drying method.	3	3	9154
Produce and use spreadsheets for business.	5	3	
Produce word processing documents for business.	5	3	
Determine the quality of food products using sensory evaluation.	10	4	



**UNIT STANDARDS IN NATIONAL CERTIFICATE IN FOOD AND BEVERAGE LABORATORY PRACTICES: FOOD AND BEVERAGE LABORATORY ANALYSIS NQF 3****UNIT STANDARDS ON NQF LEVEL 1**

- Title 1:** Prepare glassware and media for determination procedures in a food laboratory (Registered, Dairy SGB).
- Title 2:** Measure the temperature of food or beverage products and evaluate the readings (Registered, Dairy SGB).
- Title 3:** Take a representative food or beverage sample (Registered, Dairy SGB).

**UNIT STANDARDS ON NQF LEVEL 2**

- Title 1:** Maintain food laboratory safety (Registered, Dairy SGB).

**UNIT STANDARDS AT NQF LEVEL 3**

- Title 1:** Demonstrate knowledge of the nature and composition of food (To be registered).
- Title 2:** Demonstrate knowledge of fundamental principles of biochemistry (To be registered).
- Title 3:** Monitor and control quality assurance practices in a food or beverage manufacturing environment (Registered, Food SGB).
- Title 4:** Demonstrate knowledge of fundamental chemical and physical reactions (To be registered).
- Title 5:** Apply microbiological principles in a food or beverage environment (Registered, Dairy SGB).
- Title 6:** Demonstrate an understanding of food or beverage safety practices and procedures in a food or beverage manufacturing environment (Registered, Food SGB).
- Title 7:** Demonstrate an understanding of heating and cooling procedures (Registered, Food SGB).
- Title 8:** Perform elementary acid-base titrations and interpret the results (To be registered).
- Title 9:** Evaluate the quality of a food or beverage product in terms of its viscosity (Registered, Dairy SGB).
- Title 10:** Evaluate the microbiological quality of a food or beverage product by means of pour plate methods (Registered, Dairy SGB).
- Title 11:** Evaluate the quality of a food or beverage product in terms of its pH (Registered, Dairy SGB).
- Title 12:** Evaluate the quality of a food product in terms of its moisture content using the oven drying method (Registered, Dairy SGB).
- Title 13:** Produce and use spreadsheets for business (Registered, NSB 10).
- Title 14:** Produce word processing documents for business (Registered, NSB 10).
- Title 15:** Accommodate audience and context needs in oral communication (Registered, NSB 04).
- Title 16:** Interpret and use information from texts (Registered, NSB 04).
- Title 17:** Write texts for a range of communicative context (Registered, NSB 04).
- Title 18:** Use language and communication in an occupational learning programmes (Registered, NSB 04).
- Title 19:** Demonstrate understanding of the use of different numbers bases and measurement units and an awareness of error in the context of relevant calculations (Registered, NSB 10).
- Title 20:** Use mathematics to investigate and monitor the financial aspects of personal and business issues (Registered, NSB 10).
- Title 21:** Investigate life and work related problems using data and probabilities (Registered, NSB 10).



- Title 22:** Measure, estimate and calculate physical quantities and explore, describe and represent, interpret and justify geometrical relationships in two and three-dimensional space relevant to the life or workplace of the community (Registered, NSB 10).
- Title 23:** Demonstrate knowledge of chemistry principles (To be sourced from NSB 10).

#### **UNIT STANDARDS AT NQF LEVEL 4**

- Title 1:** Demonstrate an understanding of the relationship between micro-organisms and food spoilage (Registered, Food SGB).
- Title 2:** Determine the quality of food products using sensory evaluation (Registered, Food SGB).

#### **UNIT STANDARDS AND SPECIFIC OUTCOMES IN NATIONAL CERTIFICATE IN FOOD AND BEVERAGE LABORATORY PRACTICES: FOOD AND BEVERAGE LABORATORY ANALYSIS NQF 3**

##### **UNIT STANDARDS AT NQF LEVEL 3**

- 1. TITLE:** Demonstrate knowledge of the nature and composition of food.
- Specific outcome 1.1:** Demonstrate knowledge of the components of food products and its nutritional importance.
- Specific outcome 1.2:** Demonstrate knowledge of the functional properties of food.
- Specific outcome 1.3:** Demonstrate knowledge of the effects of processing on food components.
- Specific outcome 1.4:** Demonstrate knowledge of methods of food preservation.
- 2. TITLE:** Demonstrate knowledge of fundamental principles of biochemistry.
- Specific outcome 2.1:** Demonstrate knowledge of cells in living organisms.
- Specific outcome 2.2:** Demonstrate knowledge of vital processes and systems in living organisms.
- Specific outcome 2.3:** Demonstrate knowledge of enzymes in living organisms.
- Specific outcome 2.4:** Demonstrate knowledge of hormones in living organisms.
- 3. TITLE:** Demonstrate knowledge of fundamental chemical and physical reactions.
- Specific outcome 3.1:** Demonstrate knowledge of fundamental physical reactions.
- Specific outcome 3.2:** Demonstrate knowledge of the reactions of light.
- Specific outcome 3.3:** Demonstrate knowledge of fundamental chemical reactions.
- Specific outcome 3.4:** Demonstrate knowledge of the rate and mechanism of chemical reactions.
- 4. TITLE:** Perform elementary acid-base titrations and interpret the results.
- Specific outcome 4.1:** Demonstrate knowledge of elementary acid-base titrations.
- Specific outcome 4.2:** Prepare for elementary acid-base titrations in an analytical laboratory.
- Specific outcome 4.3:** Perform elementary acid-base titrations in an analytical laboratory.
- Specific outcome 4.4:** Report on the results of the acid-base titrations.



No. 1185

20 September 2002

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

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

**Manufacturing and Assembly**


Registered by NSB 06, Manufacturing, Engineering and Technology, publishes the following qualifications and unit standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the qualification and unit standards upon which qualifications are based. The full qualification and unit standards can be accessed via the SAQA web-site at [www.saga.org.za](http://www.saga.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, 659 Pienaar street, Brooklyn, Pretoria.

Comment on the unit standards should reach SAQA at the address *below and no later than 21 October 2002*. All correspondence should be marked **Standards Setting – SGB for Manufacturing and Assembly** and addressed to

The Director: Standards Setting and Development  
SAQA

Attention: Mr. D Mphuthing  
Postnet Suite 248  
Private Bag X06  
Waterkloof  
0145  
or faxed to 012 – 482 0907

  
11 SAMUEL B.A. ISAACS  
EXECUTIVE OFFICER



**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING) NQF LEVEL 2**  
**UNIT STANDARDS ON NQF LEVEL 2**

**CORE**

- Title 1:** Identify engineering materials, their characteristics and applications and common metal tests and treatments used in engineering
- Title 2:** Select, use and care for engineering measuring equipment
- Title 3:** Select, use and care for engineering power tools
- Title 4:** Select, use and care for engineering hand tools
- Title 5:** Perform basic welding / joining of metals
- Title 6:** Mark off basic engineering shapes
- Title 7:** Read, interpret and produce basic engineering drawings
- Title 8:** Maintain static seals in machines and / or equipment
- Title 9:** Maintain indirect drives
- Title 10:** Maintain pipe systems
- Title 11:** Perform routine maintenance
- Title 12:** Sling loads

**ELECTIVE**

- Title 13:** Operate and monitor a drilling machine to produce simple components
- Title 14:** Operate and monitor a surface grinding machine to produce simple components
- Title 15:** Operate and monitor a milling machine to produce simple components
- Title 16:** Operate and monitor a lathe to produce simple components

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN**  
**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING) NQF LEVEL 2**

- Title 1: Identify engineering materials, their characteristics and applications and common metal tests and treatments used in engineering**

- Specific outcome 1.1:** Identify materials used in common engineering applications
- Specific outcome 1.2:** Discuss the physical properties of engineering materials used in common engineering applications
- Specific outcome 1.3:** Explain the common applications and methods of processing and manufacturing using engineering materials
- Specific outcome 1.4:** Demonstrate an understanding of the common metal tests used in engineering
- Specific outcome 1.5:** Demonstrate an understanding of heat treatment processes
- Specific outcome 1.6:** Explain the effects external factors have on engineering materials



**Title 2: Select, use and care for engineering measuring equipment**

- Specific outcome 2.1: Explain and discuss basic units of measure and symbols
- Specific outcome 2.2: Select and use engineering measuring equipment
- Specific outcome 2.3: Care for and maintain measuring equipment
- Specific outcome 2.4: Recognise and report problems, changes and/or malfunctions while working
- Specific outcome 2.5: Work safely with due care for self, fellow workers, equipment, materials and the environment

**Title 3: Select, use and care for engineering power tools**

- Specific outcome 3.1: Select and use engineering power tools
- Specific outcome 3.2: Care for and maintain engineering power tools
- Specific outcome 3.3: Check on power supply connections to equipment
- Specific outcome 3.4: Recognise and report problems, changes and/or malfunctions while working

**Title 4: Select, use and care for engineering hand tools**

- Specific outcome 4.1: Select and use engineering hand tools
- Specific outcome 4.2: Care for and maintain hand tools
- Specific outcome 4.3: Recognise and report problems, changes and/or malfunctions while working
- Specific outcome 4.4: Work safely with due care for self, fellow workers, equipment, materials and the environment

**Title 5: Perform basic welding / joining of metals**

- Specific outcome 5.1: Prepare for work activity
- Specific outcome 5.2: Weld/join metals
- Specific outcome 5.3: Apply quality checks on completed weld/joint
- Specific outcome 5.4: Perform finishing activities
- Specific outcome 5.5: Report out of compliance or unsafe conditions while working
- Specific outcome 5.6: Work safely with due care for self, fellow workers, equipment, materials and the environment

**Title 6: Mark off basic engineering shapes**

- Specific outcome 6.1: Plan and prepare materials for marking off
- Specific outcome 6.2: Mark off materials
- Specific outcome 6.3: Apply quality checks on completed work
- Specific outcome 6.4: Care for and store marking off equipment



**Title 7: Read, interpret and produce basic engineering drawings**

- Specific outcome 7.1: Discuss and explain basic engineering drawing concepts and material lists
- Specific outcome 7.2: Interpret basic engineering drawings
- Specific outcome 7.3: Produce drawing

**Title 8: Maintain static seals in machines and / or equipment**

- Specific outcome 8.1: Plan and prepare for seal replacement
- Specific outcome 8.2: Prepare site and equipment for seal replacement
- Specific outcome 8.3: Maintain static seals
- Specific outcome 8.4: Check equipment for compliance with operational requirements
- Specific outcome 8.5: Record information on work done
- Specific outcome 8.6: Discuss and explain incidents and problems related to replacing static seals
- Specific outcome 8.7: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 9: Maintain indirect drives**

- Specific outcome 9.1: Plan and prepare for indirect drive maintenance
- Specific outcome 9.2: Prepare site and equipment for indirect drive maintenance
- Specific outcome 9.3: Maintain indirect drive
- Specific outcome 9.4: Align indirect drives
- Specific outcome 9.5: Apply quality checks on completed work
- Specific outcome 9.6: Conduct post-maintenance activities

**Title 10: Maintain pipe systems**

- Specific outcome 10.1: Plan and prepare for pipe system maintenance
- Specific outcome 10.2: Prepare site and equipment for pipe system maintenance
- Specific outcome 10.3: Maintain pipe system
- Specific outcome 10.4: Apply quality checks on completed work
- Specific outcome 10.5: Conduct post-repair activities

**Title 11: Perform routine maintenance**

- Specific outcome 11.1: Plan and prepare for routine maintenance
- Specific outcome 11.2: Monitor the condition of machinery and equipment
- Specific outcome 11.3: Perform routine maintenance
- Specific outcome 11.4: Apply quality checks on completed work



**Title 12: Sling loads**

- Specific outcome 12.1: Plan and prepare for load slinging activity
- Specific outcome 12.2: Prepare site and equipment for load slinging
- Specific outcome 12.3: Sling load
- Specific outcome 12.4: Signal the lifting equipment operator
- Specific outcome 12.5: Conduct post-slinging activities
- Specific outcome 12.6: Care for and store load slinging equipment

**Title 13: Operate and monitor a drilling machine to produce simple components**

- Specific outcome 13.1: Prepare for work activity
- Specific outcome 13.2: Set drilling machine
- Specific outcome 13.3: Perform drilling operations
- Specific outcome 13.4: Apply quality checks on machined component

**Title 14: Operate and monitor a surface grinding machine to produce simple components**

- Specific outcome 14.1: Prepare for work activity
- Specific outcome 14.2: Set grinding machine
- Specific outcome 14.3: Set grinding machine
- Specific outcome 14.4: Apply quality checks on machined component

**Title 15: Operate and monitor a milling machine to produce simple components**

- Specific outcome 15.1: Prepare for work activity
- Specific outcome 15.2: Set milling machine
- Specific outcome 15.3: Perform milling operations
- Specific outcome 15.4: Apply quality checks on machined component

**Title 16: Operate and monitor a lathe to produce simple components**

- Specific outcome 16.1: Prepare for work activity
- Specific outcome 16.2: Set lathe
- Specific outcome 16.3: Perform turning operations
- Specific outcome 16.4: Apply quality checks on machined component
- Specific outcome 16.5: Recognise and report problems, changes and/or malfunctions while operating



**National Certificate in Mechanical Engineering (Fitting) NQF Level 3****UNIT STANDARDS ON NQF LEVEL 3****CORE**

- Title 1: Grind tools and drill bits**
- Title 2: Maintain bearings in machines and equipment**
- Title 3: Maintain pumps**
- Title 4: Maintain heat exchangers and pressure vessels**
- Title 5: Maintain direct drives**
- Title 6: Maintain dynamic seals in machines and / or equipment**
- Title 7: Maintain brakes and clutches**
- Title 8: Maintain lubricating systems**

**ELECTIVE**

- Title 9: Maintain conveyor systems**
- Title 10: Perform heat treatment processes on engineering metals**
- Title 11: Perform non-destructive tests on metal parts and components**
- Title 12: Test the physical properties of engineering metals**
- Title 13:**

**Unit standards and specific outcomes in National Certificate in Mechanical Engineering (Fitting)**  
**NQF Level 3**

**Title 1: Grind tools and drill bits**

- Specific outcome 1.1:** Plan and prepare for tool grinding
- Specific outcome 1.2:** Prepare site and equipment
- Specific outcome 1.3:** Inspect and assess tool condition
- Specific outcome 1.4:** Grind tool
- Specific outcome 1.5:** Check tool for compliance with manufacturer specifications
- Specific outcome 1.6:** Care for and store tool grinding tools and equipment
- Specific outcome 1.7:** Record information on work done
- Specific outcome 1.8:** Discuss and explain incidents and problems related to tool grinding
- Specific outcome 1.9:** Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 2: Maintain bearings in machines and equipment**

- Specific outcome 2.1:** Plan and prepare for bearing replacement



- Specific outcome 2.2: Prepare site and equipment for bearing replacement
- Specific outcome 2.3: Check bearings in situ
- Specific outcome 2.4: Remove and inspect bearings
- Specific outcome 2.5: Install bearings to machines and equipment

**Title 3: Maintain pumps**

- Specific outcome 3.1: Plan and prepare for pump maintenance
- Specific outcome 3.2: Prepare site and equipment
- Specific outcome 3.3: Inspect and assess pump condition
- Specific outcome 3.4: Maintain pump
- Specific outcome 3.5: Check pump for compliance with operational requirements
- Specific outcome 3.6: Care for and store system maintenance tools and equipment

**Title 4: Maintain heat exchangers and pressure vessels**

- Specific outcome 4.1: Plan and prepare for heat exchanger and pressure vessel maintenance / pressure testing
- Specific outcome 4.2: Prepare site and equipment
- Specific outcome 4.3: Inspect and assess heat exchanger / pressure vessel condition
- Specific outcome 4.4: Maintain heat exchanger and pressure vessels
- Specific outcome 4.5: Conduct pressure test
- Specific outcome 4.6: Check heat exchanger for compliance with operational requirements

**Title 5: Maintain direct drives**

- Specific outcome 5.1: Plan and prepare for direct drive maintenance
- Specific outcome 5.2: Prepare site and equipment for direct drive maintenance
- Specific outcome 5.3: Maintain direct drive
- Specific outcome 5.4: Align direct drives
- Specific outcome 5.5: Apply quality checks on completed work
- Specific outcome 5.6: Conduct post-maintenance activities

**Title 6: Maintain dynamic seals in machines and / or equipment**

- Specific outcome 6.1: Plan and prepare for seal replacement
- Specific outcome 6.2: Prepare site and equipment for seal replacement
- Specific outcome 6.3: Maintain dynamic seals
- Specific outcome 6.4: Check equipment for compliance with operational requirements



**Title 7: Maintain brakes and clutches**

- Specific outcome 7.1: Plan and prepare for brake and clutch maintenance
- Specific outcome 7.2: Prepare site and equipment for brake and clutch maintenance
- Specific outcome 7.3: Check brakes and clutches in situ
- Specific outcome 7.4: Install brakes and clutches to machines and equipment

**Title 8: Maintain lubricating systems**

- Specific outcome 8.1: Plan and prepare for repairs to lubricating system
- Specific outcome 8.2: Prepare site and equipment
- Specific outcome 8.3: Inspect and assess lubricating system functioning
- Specific outcome 8.4: Rectify lubrication system faults

**Title 9: Maintain conveyor systems**

- Specific outcome 9.1: Plan and prepare for conveyor system maintenance
- Specific outcome 9.2: Prepare site and equipment
- Specific outcome 9.3: Inspect and assess conveyor system
- Specific outcome 9.4: Maintain conveyor system

**Title 10: Perform heat treatment processes on engineering metals**

- Specific outcome 10.1: Discuss and explain the heat treatment of metals
- Specific outcome 10.2: Determine heat treatment requirements
- Specific outcome 10.3: Prepare materials and equipment for heat treatment process
- Specific outcome 10.4: Complete heat treatment of metals

**Title 11: Perform non-destructive tests on metal parts and components**

- Specific outcome 11.1: Receive samples and check against documentation
- Specific outcome 11.2: Carry out testing using ultrasonic methods
- Specific outcome 11.3: Test parts for surface defects using magnetic particle inspection
- Specific outcome 11.4: Recognise and report problems, changes and/or malfunctions while working

**Title 12: Test the physical properties of engineering metals**

- Specific outcome 12.1: Receive samples and check against documentation
- Specific outcome 12.2: Prepare for tests
- Specific outcome 12.3: Complete tests and interpret and record results
- Specific outcome 12.4: Store samples
- Specific outcome 12.5: Care for test equipment



**Title 13: Produce detailed engineering drawings**

Specific outcome 13.1: Determine drawing requirements

Specific outcome 13.2: Perform calculations to produce drawing

Specific outcome 13.3: Produce drawings



**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING) NQF LEVEL 4****UNIT STANDARDS ON NQF LEVEL 4****CORE**

- Title 1:** Maintain gearboxes  
**Title 2:** Maintain compressors  
**Title 3:** Maintain fluid power / pneumatic systems  
**Title 4:** Diagnose and repair faults on equipment and machinery during production/operation  
**Title 5:** Align machines and equipment using laser technology

**ELECTIVE**

- Title 6:** Maintain safety valves  
**Title 7:** Stopple operational pipelines  
**Title 8:** Refurbish machines  
**Title 9:** Commission assembly / machine  
**Title 10:** Produce complex engineering drawings

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN  
NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING) NQF LEVEL 4****Title 1: Maintain gearboxes**

- Specific outcome 1.1: Plan and prepare for gearbox maintenance  
Specific outcome 1.2: Prepare site and equipment  
Specific outcome 1.3: Inspect and assess gearbox maintenance requirements  
Specific outcome 1.4: Maintain gearbox  
Specific outcome 1.5: Check gearbox for compliance with operational requirements  
Specific outcome 1.6: Care for and store system maintenance tools and equipment  
Specific outcome 1.7: Record information on work done  
Specific outcome 1.8: Discuss and explain incidents and problems related to gearbox maintenance  
Specific outcome 1.9: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 2: Maintain compressors**

- Specific outcome 2.1: Plan and prepare for compressor maintenance



- Specific outcome 2.2: Prepare site and equipment
- Specific outcome 2.3: Inspect and assess compressor maintenance requirements
- Specific outcome 2.4: Maintain compressor

**Title 3: Maintain fluid power / pneumatic systems**

- Specific outcome 3.1: Plan and prepare for fluid power / pneumatic system maintenance
- Specific outcome 3.2: Prepare site and equipment for maintenance activity
- Specific outcome 3.3: Maintain fluid power / pneumatic system
- Specific outcome 3.4: Apply quality checks on completed work
- Specific outcome 3.5: Conduct post-repair activities

**Title 4: Diagnose and repair faults on equipment and machinery during production/operation**

- Specific outcome 4.1: Monitor the performance of equipment and machinery during operation
- Specific outcome 4.2: Perform minor repairs on line
- Specific outcome 4.3: Determine major equipment and machinery component repairs
- Specific outcome 4.4: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 5: Align machines and equipment using laser technology**

- Specific outcome 5.1: Plan and prepare for machine and equipment alignment
- Specific outcome 5.2: Prepare site and equipment for machine and equipment alignment
- Specific outcome 5.3: Align machines and equipment
- Specific outcome 5.4: Apply quality checks on completed work
- Specific outcome 5.5: Conduct post-alignment activities
- Specific outcome 5.6: Care for and store alignment tools and equipment
- Specific outcome 5.7: Discuss and explain incidents and problems related to machine and equipment alignment

**Title 6: Maintain safety valves**

- Specific outcome 6.1: Plan and prepare for safety valve maintenance
- Specific outcome 6.2: Prepare site and equipment
- Specific outcome 6.3: Inspect and assess safety valve maintenance requirements
- Specific outcome 6.4: Maintain safety valve

**Title 7: Stopple operational pipelines**

- Specific outcome 7.1: Plan and prepare for work activity



- Specific outcome 7.2: Prepare site and equipment for drilling into and plugging the operational pipe line
- Specific outcome 7.3: Drill into the operational pipeline, tap the fitting and install the pipeline plug
- Specific outcome 7.4: Check stopping process for conformance to specifications
- Specific outcome 7.5: Identify non-conforming components, changes and / or malfunctions and take appropriate corrective action

**Title 8: Refurbish machines**

- Specific outcome 8.1: Plan and prepare for refurbishment
- Specific outcome 8.2: Prepare site and equipment
- Specific outcome 8.3: Carry out fault diagnosis on machines
- Specific outcome 8.4: Refurbish machines
- Specific outcome 8.5: Recognise and report problems or changes while working
- Specific outcome 8.6: Record information on work done
- Specific outcome 8.7: Discuss and explain incidents and problems related to refurbishment activity

**Title 9: Commission assembly / machine**

- Specific outcome 9.1: Plan and prepare for commissioning
- Specific outcome 9.2: Commission machine / assembly
- Specific outcome 9.3: Identify non-conformances, diagnose faults and take corrective action
- Specific outcome 9.4: Complete commissioning activity

**Title 10: Produce complex engineering drawings**

- Specific outcome 10.1: Determine drawing requirements
- Specific outcome 10.2: Perform calculations to produce drawing
- Specific outcome 10.3: Produce drawings
- Specific outcome 10.4: Record information on work done



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Fitting and Machining) NQF Level 2**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 2

**Credit:** 185

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of engineering machining is characterized by work-to-order, low volume manufacture of components using different machining methods for use in a variety of industries including the automotive, metal, appliance manufacturing, plastic, tyre and rubber industries. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured.

The field of engineering fitting is characterized by the provision of engineering maintenance, repair and installation services and support in a variety of industries. The equipment requiring such service and support ranges from sophisticated equipment to antiquated single station machines. People working in the mechanical engineering field require specialized technical skills and knowledge, as well as highly developed hand skills in order to meet the mechanical engineering requirements of diverse industries.



This is the first qualification in a series for learners who want to follow a career in the field of engineering fitting and machining. This qualification focuses on developing skills and knowledge necessary to begin such a career.

It also provides learners who have gained relevant experience in the workplace with an opportunity to obtain credits through an RPL process.

The qualification also forms the basis for further learning in field of engineering fitting and machining where the learner will be able to specialize.

**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of engineering fitting and machining skills and to meet the challenges of such an environment.

The primary skills that are recognised in this qualification are the ability to machine simple components using a variety of machining methods and the ability to apply basic mechanical assembly, maintenance and repair fundamentals to recognise and respond to equipment component defects. These capabilities require an understanding of basic machining theory, machinery functioning and maintenance, engineering materials and tools and concepts of measurement, and basic engineering drawings. Hand skills play a large role in this qualification.

Qualified learners will also understand:

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

With this understanding learners will be able to participate in workplace activities.

**Access to the Qualification:**

Open access.

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

This qualification assumes learners have a General Education and Training Certificate at NQF level 1, or alternatively, an ABET level 4 qualification.

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

- Literacy and numeracy
- Basic concepts of science and technology

**Exit Level Outcomes and Assessment Criteria:****Exit level outcome 1**

Demonstrate an understanding of a variety of machining methods and an ability to produce simple components that meet quality and output requirements, working safely and in an environmentally aware manner.

**Associated Assessment Criteria**

- Output and quality requirements are met
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of machining, the various machining methods and the functioning of machinery.

**Exit level outcome 2:**

Demonstrate an understanding of the mechanical equipment maintenance process and an ability to recognise and respond to equipment component maintenance requirements that will result in increased levels of safety, health, quality or efficiency.

**Associated Assessment Criteria**

- Appropriate checks are performed on components
- Components are maintained to specifications.
- Non-conformances and actions taken are reported accurately and clearly
- Can respond to questions and discuss issues related to the basic component maintenance process relevant to the outcomes

**Exit level outcome 3:**

Understand and use appropriate hand and power tools, machinery and equipment to:



- make simple adjustments to equipment and process
- maintain mechanical components

**Associated Assessment Criteria**

- Mechanical components are maintained to specification
- Adjustments made are appropriate
- Downtime is minimised
- No material or product is damaged or its quality compromised
- Quality, safety and environmental procedures are followed

**Exit level outcome 4**

Identify engineering materials used in the machining process and describe their characteristics and applications.

**Associated Assessment Criteria**

- Engineering materials are identified and their physical properties described
- Can respond to questions and discuss issues related to the common applications and methods of processing and manufacturing using engineering materials

**Exit level outcome 5**

Demonstrate an ability to read, interpret and produce basic engineering drawings.

**Associated Assessment Criteria**

- Components to be machined are identified and requirements interpreted from engineering drawing
- Engineering drawing produced meets job requirements
- Can respond to questions and discuss issues related to engineering drawing concepts and material lists

**Exit level outcome 6**

Demonstrate a familiarity with routine maintenance procedures and operations for machinery

**Associated Assessment Criteria**

- Process agents are applied consistently and systematically
- Pre-operational checks are performed and identified problems reported to appropriate personnel
- Can respond to questions and discuss issues related to routine maintenance on machinery

**Exit level outcome 7**

Recognise and respond to routine problems related to the machining process.



**Associated Assessment Criteria**

- Various options are considered before a solution is chosen
- Lessons learnt in previous performances are used
- Responses are appropriate to the nature of the problem
- Problems are accurately reported to relevant personnel in a timely manner
- Can respond to questions and discuss issues related to routine problems encountered while working

**Exit level outcome 8**

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

**Associated Assessment Criteria**

- Communication is effective, regular and ongoing
- Information is clear and accurate and conveyed in a timely manner
- Relationships with peers and supervisory/management levels are established and functioning

**Exit level outcome 9**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability**

As a starting point, the series of qualifications in the field of mechanical engineering covering machining, fitting, fitting and machining, and tooling manufacture specialisations, of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in New Zealand and Australia. It was found to be difficult to compare the New Zealand and Australian narrow focus qualifications with these broad-based qualifications that also include fundamentals and generic core standards. It was further difficult to undertake such comparisons given that the New Zealand and Australian qualifications, although they are in the same field of mechanical engineering and cover the same areas of specialisation (thus containing a large degree of similar content) are conceptualized as three year qualifications without exit level outcomes at the intermediate levels (NQF levels 2 and 3). This notwithstanding, the technical content of this series of



qualifications for mechanical engineering (with the various specialisations) of which the highest qualification is at level 4 does correspond with the equivalent level of qualification in mechanical engineering (with the various specialisations) in Australia and New Zealand.

**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.

Some assessment aspects will demand practical demonstration while others may not. In some case 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.

**Recognition of prior learning:**

This qualification may be obtained through RPL. The learner should be thoroughly briefed of the mechanism to be used and support and guidance should be provided. Care should be taken that the mechanism used provides the learner with an opportunity to demonstrate competence and is not too onerous as to prevent learners from taking up the RPL option towards gaining a qualification.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the MERS ETQA or any other relevant ETQA



- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the MERS ETQA or any other relevant ETQA
- Moderation of assessment should be overseen by the MERS ETQA or any other relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA procedures

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of mechanical engineering (fitting and machining) – with a minimum of 3 years' experience working in the field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



**National Certificate in Mechanical Engineering (Fitting and Machining) NQF Level 2**

<b>Fundamental</b>			
<b>NLRD</b>	<b>Title</b>	<b>Level</b>	<b>Credits</b>
	<b>Communication</b>		
8962	Maintain and adapt oral communication	2	5
8963	Access and use information from texts	2	5
8964	Write for a defined context	2	5
	Communicate at work	2	5
	<b>Mathematics</b>		
8982	Demonstrate an understanding of rational and irrational numbers and number systems within the context of relevant calculations	2	3
8983	Use mathematics to investigate and monitor the financial aspects of personal and community life	2	2
9009	Apply basic knowledge of statistics and probability in order to investigate life and work related problems	2	3
9008	Measure, estimate and calculate physical quantities and explore, describe and represent geometrical relationships in two dimensions in different life or workplace contexts	2	3
9007	Work with a range of patterns and basic functions to solve related problems	2	5
<b>Core</b>			
<b>NLRD</b>	<b>Title</b>	<b>Level</b>	<b>Credits</b>
	<b>Materials</b>		
	Identify engineering materials, their characteristics and applications, and common metal tests and treatments used in engineering	2	4
	<b>Tools, equipment and machines</b>		



Select, use and care for engineering measuring equipment	2	4
Select, use and care for engineering power tools	2	6
Select, use and care for engineering hand tools	2	8
Perform basic welding / joining of metals	2	8
Mark off basic engineering shapes	2	2
Perform routine maintenance	2	8
Sling loads	2	4
<b>Drawings and design</b>		
Read, interpret and produce basic engineering drawings	2	6
<b>Machining</b>		
Operate and monitor a drilling machine to produce simple components	2	6
Operate and monitor a surface grinding machine to produce simple components	2	8
Operate and monitor a milling machine to produce simple components	2	12
Operate and monitor a lathe to produce simple components	2	12
<b>Maintain and repair</b>		
Maintain static seals in machines and / or equipment	2	4
Maintain indirect drives	2	6
Maintain pipe systems	2	20
<b>Safety, Health &amp; Environment</b>		
Keep the work area safe and productive	2	8
<b>Business Relations</b>		
Explain the individual's role within business	2	4
<b>People interacting, leading and developing</b>		



	Develop a learning plan and a portfolio for assessment	2	6
	Understand and deal with HIV/AIDs	2	3

<b>Elective</b>			
<b>NLRD</b>	<b>Safety, Health &amp; Environment</b>		
	Perform basic first aid	2	4
	Perform basic fire fighting	2	2
	<b>Information technology</b>		
7547	Operate a personal computer system	2	6
7548	Use a personal computer operating system	2	3
	<b>Suggested additional learning</b>		
9268	Manage basic personal finance	2	6
	<b>Minimum elective credits required</b>		<b>10</b>



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Fitting and Machining) NQF Level 3**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 3

**Credit:** 174

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of engineering machining is characterized by work-to-order, low volume manufacture of components using different machining methods for use in a variety of industries including the automotive, metal, appliance manufacturing, plastic, tyre and rubber industries. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured.

The field of engineering fitting is characterized by the provision of engineering maintenance, repair and installation services and support in a variety of industries. The equipment requiring such service and support ranges from sophisticated equipment to antiquated single station machines. People working in the mechanical engineering field require specialized technical skills and knowledge, as well as highly developed hand skills in order to meet the mechanical engineering requirements of diverse industries.



This is the second qualification in a series for learners who want to follow a career in the field of engineering fitting and machining.

It also provides learners who have gained relevant experience in the workplace with an opportunity to obtain credits through an RPL process.

The qualification also forms the basis for further learning in the field of engineering fitting and machining where the learner will be able to specialize.

**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of fitting and engineering machining skills and meet the challenges of such an environment.

The primary skills that are recognised in this qualification are the ability to produce components of some complexity using a variety of machining methods and the ability to fault find, dismantle, maintain, repair and install complex mechanical assemblies and diagnose and repair equipment and machinery during production/operation. These capabilities require an understanding of advanced machining and mechanical theory, detailed engineering drawings and a variety of tests and treatments used on engineering metals. Hand skills play a large role in this qualification.

Qualifying learners will also be able to relate what they are doing to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

**Access to the Qualification:**

Open access.

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

This qualification assumes learners have a national certificate in mechanical engineering (fitting and machining) level 2.

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

- Language and maths beyond basic literacy and numeracy
- Basic concepts of science and technology related to machining methods, engineering materials and tools used in the machining process
- An ability to produce simple components using a variety of machining methods
- An ability to apply basic mechanical assembly, maintenance and repair fundamentals to recognise and respond to equipment component defects.
- Concepts of organising factors in labour, business and the economy
- Role and purpose of procedures related to workplace relationships, roles and responsibilities

**Exit Level Outcomes and Assessment Criteria:****Exit level outcome 1**

Demonstrate an ability to produce components of some complexity using a variety of machining methods and operations, meeting output requirements and working safely with due care for fellow workers and the environment

**Associated Assessment Criteria**

- Output and quality requirements are met
- Machining time limits are adhered to
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of machining and the various machining methods and their respective operations at this level

**Exit level outcome 2**

Demonstrate an ability to select and apply appropriate inspection methods to determine component compliance with specifications

**Associated Assessment Criteria**



- Appropriate inspection methods are chosen and applied
- Can respond to questions and discuss issues related to various inspection methods and procedures and the principles underpinning such methods

**Exit level outcome 3:**

Demonstrate an understanding of and an ability to fault find, dismantle, maintain, assemble and install a variety of mechanical assemblies and make close tolerance adjustments to equipment and process, meeting output requirements and working safely with due care for fellow workers and the environment

**Associated Assessment Criteria**

- Condition of equipment and machinery is monitored
- Faults in equipment and machinery are diagnosed.
- Equipment and machinery are maintained to required standards and overhauled at required intervals
- Dismantling sequence of assemblies meets specifications
- Assemblies and installations meet specifications
- Safe working practices are adhered to

**Exit level outcome 4**

Demonstrate an understanding of lubrication systems and an ability to maintain such systems

**Associated Assessment Criteria**

- Lubrication systems are maintained to specifications
- Can respond to questions and discuss issues related to the lubrication systems of equipment and machinery within the plant

**Exit level outcome 5**

Demonstrate an ability to read and interpret detailed engineering drawings.

**Associated Assessment Criteria**

- Components and assemblies to be machined identified and requirements interpreted from engineering drawing
- Machined components and assemblies meet drawing specifications

**Exit level outcome 6**

Select appropriate procedures to solve familiar problems within an engineering machining and fitting environment and operate within clearly defined contexts, with some scope for personal decision-making and responsibility



**Associated Assessment Criteria**

- Appropriate procedures are selected to solve problems in an efficient and effective manner
- Unfamiliar problems are accurately reported to appropriate personnel
- Can respond to questions and discuss issues related to familiar problems in the machining of components and assemblies

**Exit level outcome 7**

Communicate with peers, customers and members of supervisory/management levels by demonstrating the ability to gather and summarise information from a range of sources and produce coherent presentations in a prescribed format

**Associated Assessment Criteria**

- Information is gathered from a range of sources and accurately summarised into a prescribed format.
- Information is clear and accurate and presented in a timely manner in the required format to appropriate parties.
- Relationships with peers and supervisory./management levels are established and functioning

**Exit level outcome 8**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability**

This qualification was compared to other, similar outcomes- based qualifications, certifications or skills standards in New Zealand, Australia and the United Kingdom.

**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.



Some assessment aspects will demand practical demonstration while others may not. In some case inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It will be 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.

**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 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.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the MERS ETQA or any other relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the MERS ETQA or any other relevant ETQA
- Moderation of assessment should be overseen by the MERS ETQA or any other relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA procedures

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:



1. Appropriate qualification in the field of mechanical engineering (fitting and machining) – with a minimum of 3 years' experience working in the field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
8968	Accommodate audience and context needs in oral communication	3	5
8969	Interpret and use information from texts	3	5
8970	Write texts for a range of communicative contexts	3	5
9529	Compile feasibility and commissioning reports	3	3
9528	Communicate with clients	3	3
	<b>Mathematics</b>		
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	3	2
9014	Use mathematics to investigate and monitor the financial aspects of personal and business issues	3	5
9012	Investigate life-related problems using data and probabilities	3	5
9013	Measure, estimate and calculate physical quantities and explore, describe and represent, interpret and justify geometrical relationships in two and three dimensional space relevant to the life or workplace of the community	3	4
Core			
NLRD	Title	Level	Credits
	<b>Machining</b>		
	Produce components by performing engineering milling operations	3	20
	Produce components by performing engineering turning operations	3	20



	Produce components by performing engineering grinding operations	3	12
	Grind tools and drill bits	3	4
	<b>Maintain and repair</b>		
	Maintain bearings in machines and equipment	3	8
	Maintain pumps	3	24
	Maintain heat exchangers and pressure vessels	3	8
	Maintain direct drives	3	6
	Maintain dynamic seals in machines and equipment	3	3
	Maintain brakes and clutches	3	6
	Maintain lubricating systems	3	4
	<b>Business Relations</b>		
9526	Manage basic business finance	3	6
9530	Manage work time effectively	3	3



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Fitting and Machining) NQF Level 4**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 4

**Credit:** 179

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of engineering machining is characterized by work-to-order, low volume manufacture of components using different machining methods for use in a variety of industries including the automotive, metal, appliance manufacturing, plastic, tyre and rubber industries. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured.

The field of engineering fitting is characterized by the provision of engineering maintenance, repair and installation services and support in a variety of industries. The equipment requiring such service and support ranges from sophisticated equipment to antiquated single station machines. People working in the mechanical engineering field require specialized technical skills and knowledge, as well as highly developed hand skills in order to meet the mechanical engineering requirements of diverse industries.



This is a third qualification in a series for learners who want to follow a career in the field of engineering fitting and machining.

It also provides learners who have gained relevant experience in the workplace with an opportunity to obtain credits through an RPL process.

The qualification also forms the basis for further learning in the field of engineering fitting and machining where the learner will be able to specialize.

**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of fitting and engineering machining skills and meet the challenges of such an environment.

The primary skills that are recognised in this qualification are the ability to produce complex components using a variety of machining methods and the ability to maintain and overhaul complex equipment and machinery, and assemble and install complex components using technology aids. These capabilities require an understanding of advanced machining and mechanical theory and complex engineering drawings. Hand skills play a large role in this qualification.

The learner must furthermore choose from a number of elective unit standards for various machining methods and for computer numerical controlled (CNC) programming, setting and operation. Although the CNC unit standards are elective at present, it is recommended that learners choose these standards.

Qualified learners will also understand:

- How to plan, schedule and evaluate own work
- How to interact with team leaders and develop the capacity of team members to maintain and support quality, safety and health systems

With this understanding learners will be able to participate in workplace activities.

Qualifying learners will also be able to relate what they see and experience to scientific and technological principles and concepts.

**Access to the Qualification:**

Open access.



This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

This qualification assumes learners have a national certificate in engineering machining (fitting and machining specialisation) level 3.

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

- Language and maths related to organising and controlling their environment
- Maths and applicable scientific and technological concepts related to machining of components and the dismantling, maintenance, repair and installation of assemblies
- An ability to produce components of some complexity using a variety of machining methods
- Maths and applicable scientific and technological concepts related to the dismantling, maintenance, repair and installation of assemblies
- The ability to dismantle, maintain, repair and install a variety of assemblies
- Concepts of contributing factors in labour, business and the economy
- Role and purpose of systems which support workplace relationships, procedures, roles and responsibilities

**Exit Level Outcomes and Assessment Criteria:**

**Exit level outcome 1**

Demonstrate an ability to produce complex components using a variety of machining methods and operations, meeting output requirements and working safely with due care for fellow workers and the environment

**Associated Assessment Criteria**

- Output and quality requirements met
- Machining time limits are adhered to
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of machining and the various machining methods and their respective operations at this level



**Exit level outcome 2**

Demonstrate an understanding of quality specifications and an ability to interpret these and evaluate components machined to determine compliance

**Associated Assessment Criteria**

- Quality specifications interpreted and applied to machined component and compliance determined and reported
- Can respond to questions and discuss issues related to quality specifications and the principles underpinning such specifications

**Exit level outcome 3**

Demonstrate an understanding of and an ability to fault find, dismantle, maintain, repair and install complex mechanical assemblies, meeting output requirements and working safely with due care for fellow workers and the environment

**Associated Assessment Criteria**

- Condition of equipment and machinery is monitored and faults diagnosed
- Assemblies are maintained and refurbished to required standards
- Output requirements are met
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to assembly, maintenance and refurbishment of complex assemblies

**Exit level outcome 4**

Demonstrate an understanding of production/operation maintenance requirements and an ability to diagnose and repair faults on machinery and equipment during production/operation

**Associated Assessment Criteria**

- Recurrent equipment and machinery faults and their root causes identified
- Minor repairs on line are performed
- Documentation on major repair requirements completed
- Equipment and machinery components requiring major repair dismantled and dispatched to workshop
- Major repair requirements reported
- Production time schedule maintained
- Potential production and maintenance problems are explained and discussed



**Exit level outcome 5**

Demonstrate an understanding of fluid power/pneumatic systems and an ability to maintain such systems

**Associated Assessment Criteria**

- Fluid power/pneumatic systems are maintained to specifications
- Can respond to questions and discuss issues related to the fluid power/pneumatic systems of equipment and machinery within the plant

**Exit level outcome 6**

Demonstrate an ability to read and interpret complex engineering drawings

**Associated Assessment Criteria**

- Components and assemblies to be machined identified and requirements interpreted from engineering drawing
- Machined components and assemblies meet drawing specifications

**Exit level outcome 7**

Maintain and support procedures to solve a variety of problems, both familiar and unfamiliar, within an engineering machining context and operate within familiar and new situations, taking responsibility and making decisions

**Associated Assessment Criteria**

- Solutions to machining problems are based on a clear analysis of information gathered through diagnostic procedures.
- Procedures are modified to respond to unfamiliar problems where appropriate
- Can respond to questions and discuss issues related to familiar and unfamiliar problems arising in the machining of complex components
- All actions related to problem solving are accurately recorded for future reference

**Exit level outcome 8**

Communicate and present information clearly and reliably and demonstrate the ability to analyse information to identify problems and determine trends

**Associated Assessment Criteria**

- Conditions, evidence and incidences are reported accurately in a timely manner and discussed with peers and management
- Data gathered through diagnostic procedures is examined systematically and analysis is repeated until problem is solved.
- Records are available for scrutiny and future reference



**Exit level outcome 9**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability**

This qualification was compared to other, similar outcomes- based qualifications, certifications or skills standards in New Zealand, Australia and the United Kingdom.

**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.

Some assessment aspects will demand practical demonstration while others may not. In some case inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It will be 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.

**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 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.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the MERS ETQA or any other relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the MERS ETQA or any other relevant ETQA
- Moderation of assessment should be overseen by the MERS ETQA or any other relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA procedures

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of mechanical engineering (fitting and machining) – with a minimum of 3 years' experience working in the field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
8968	Engage in sustained oral communication and evaluate spoken texts	4	5
8969	Read, analyse and respond to a variety of texts	4	5
8970	Write for a wide range of contexts	4	5
9529	Write a technical report **	4	4
9528	Communicate in an assertive manner with clients and fellow workers **	4	4
	<b>Mathematics</b>		
9014	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	4	4
9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	4	6
9016	Measure, estimate and calculate physical quantities and explore, critique and prove geometrical relationships in two and three dimensional space in the life and workplace of the adult with increasing responsibilities	4	6
	<b>Life Skills</b>		
	Develop a personal financial plan *	4	2
Core			
NLRD	Title	Level	Credits
	<b>Machining</b>		
	Produce complex components using milling machines	4	20
	Produce complex components using lathes	4	20
	<b>Maintain and repair</b>		



	Maintain gearboxes	4	10
	Maintain compressors	4	16
	Maintain a fluid power/pneumatic system	4	12
	Diagnose and repair faults on equipment and machinery during production/operation	4	24
	Align machines and equipment using laser technology	4	6
<b>Elective</b>			
<b>NLRD</b>	<b>Titles</b>		<b>Credits</b>
	<b>Machining</b>		
	Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine	4	24
	Grind tools and cutters used in engineering machining operations	4	8
	Produce complex components by performing internal and external grinding operations	4	12
	Produce components by performing horizontal boring operations	4	12
	Produce components by performing vertical boring operations	4	8
	Set automatic production lathes	4	10
	Write programmes for CNC machining centres using proprietary software	4	30
	Produce components using wire cutting operations	4	10
	<b>Maintain and repair</b>		
	Maintain safety valves	4	4
	Stopple engineering pipelines	4	16
	Refurbish machines	4	24
	Commission assembly/machine	4	8
	<b>Drawings and design</b>		
	Produce complex engineering drawings	4	6



	<b>People interacting, leading and developing</b>		
	Develop the skills of a work group*	5	10
	<b>Business Relations</b>		
	Contribute to the implementation and maintenance of business processes *	4	10



**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING AND MACHINING) NQF LEVEL 2**  
**UNIT STANDARDS ON NQF LEVEL 2**

**CORE**

- Title 1:** Identify engineering metals, their characteristics and applications and common metal tests and treatments used in engineering
- Title 2:** Select, use and care for engineering measuring equipment
- Title 3:** Select, use and care for engineering power tools
- Title 4:** Select, use and care for engineering hand tools
- Title 5:** Perform basic welding / joining of metals
- Title 6:** Mark off basic engineering shapes
- Title 7:** Perform routine maintenance
- Title 8:** Read, interpret and produce engineering drawings
- Title 9:** Operate and monitor a drilling machine to produce simple components
- Title 10:** Operate and monitor a surface grinding machine to produce simple components
- Title 11:** Operate and monitor a milling machine to produce simple components
- Title 12:** Operate and monitor a lathe to produce simple components
- Title 13:** Maintain static seals in machines and / or equipment
- Title 14:** Maintain indirect drives
- Title 15:** Maintain pipe systems

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN**  
**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING AND MACHINING) NQF LEVEL 2**

- Title 1: Identify engineering materials, their characteristics and applications and common metal tests and treatments used in engineering**
- Specific outcome 1.1: Identify materials used in common engineering applications
- Specific outcome 1.2: Discuss the physical properties of engineering materials used in common engineering applications
- Specific outcome 1.3: Explain the common applications and methods of processing and manufacturing using engineering materials
- Specific outcome 1.4: Demonstrate an understanding of the common metal tests used in engineering
- Specific outcome 1.5: Demonstrate an understanding of heat treatment processes



Specific outcome 1.6: Explain the effects external factors have on engineering materials

**Title 2: Select, use and care for engineering measuring equipment**

Specific outcome 2.1: Explain and discuss basic units of measure and symbols

Specific outcome 2.2: Select and use engineering measuring equipment

Specific outcome 2.3: Care for and maintain measuring equipment

Specific outcome 2.4: Recognise and report problems, changes and/or malfunctions while working

Specific outcome 2.5: Work safely with due care for self, fellow workers, equipment, materials and the environment

**Title 3: Select, use and care for engineering power tools**

Specific outcome 3.1: Select and use engineering power tools

Specific outcome 3.2: Care for and maintain engineering power tools

Specific outcome 3.3: Check on power supply connections to equipment

Specific outcome 3.4: Recognise and report problems, changes and/or malfunctions while working

**Title 4: Select, use and care for engineering hand tools**

Specific outcome 4.1: Select and use engineering hand tools

Specific outcome 4.2: Care for and maintain hand tools

Specific outcome 4.3: Recognise and report problems, changes and/or malfunctions while working

Specific outcome 4.4: Work safely with due care for self, fellow workers, equipment, materials and the environment

**Title 5: Perform basic welding / joining of metals**

Specific outcome 5.1: Prepare for work activity

Specific outcome 5.2: Weld/join metals

Specific outcome 5.3: Apply quality checks on completed weld/joint

Specific outcome 5.4: Perform finishing activities

Specific outcome 5.5: Report out of compliance or unsafe conditions while working

Specific outcome 5.6: Work safely with due care for self, fellow workers, equipment, materials and the environment

**Title 6: Mark off basic engineering shapes**

Specific outcome 6.1: Plan and prepare materials for marking off

Specific outcome 6.2: Mark off materials

Specific outcome 6.3: Apply quality checks on completed work



Specific outcome 6.4: Care for and store marking off equipment

**Title 7: Perform routine maintenance**

Specific outcome 7.1: Plan and prepare for routine maintenance

Specific outcome 7.2: Monitor the condition of machinery and equipment

Specific outcome 7.3: Perform routine maintenance

Specific outcome 7.4: Apply quality checks on completed work

**Title 8: Read, interpret and produce basic engineering drawings**

Specific outcome 8.1: Discuss and explain basic engineering drawing concepts and material lists

Specific outcome 8.2: Interpret basic engineering drawings

Specific outcome 8.3: Produce drawing

**Title 9: Operate and monitor a drilling machine to produce simple components**

Specific outcome 9.1: Prepare for work activity

Specific outcome 9.2: Set drilling machine

Specific outcome 9.3: Perform drilling operations

Specific outcome 9.4: Apply quality checks on machined component

**Title 10: Operate and monitor a surface grinding machine to produce simple components**

Specific outcome 10.1: Prepare for work activity

Specific outcome 10.2: Set grinding machine

Specific outcome 10.3: Set grinding machine

Specific outcome 10.4: Apply quality checks on machined component

**Title 11: Operate and monitor a milling machine to produce simple components**

Specific outcome 11.1: Prepare for work activity

Specific outcome 11.2: Set milling machine

Specific outcome 11.3: Perform milling operations

Specific outcome 11.4: Apply quality checks on machined component

**Title 12: Operate and monitor a lathe to produce simple components**

Specific outcome 12.1: Prepare for work activity

Specific outcome 12.2: Set lathe

Specific outcome 12.3: Perform turning operations



Specific outcome 12.4: Apply quality checks on machined component

Specific outcome 12.5: Recognise and report problems, changes and/or malfunctions while operating

**Title 13: Maintain static seals in machines and / or equipment**

Specific outcome 13.1: Plan and prepare for seal replacement

Specific outcome 13.2: Prepare site and equipment for seal replacement

Specific outcome 13.3: Maintain static seals

Specific outcome 13.4: Check equipment for compliance with operational requirements

Specific outcome 13.5: Record information on work done

Specific outcome 13.6: Discuss and explain incidents and problems related to replacing static seals

Specific outcome 13.7: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 14: Maintain indirect drives**

Specific outcome 14.1: Plan and prepare for indirect drive maintenance

Specific outcome 14.2: Prepare site and equipment for indirect drive maintenance

Specific outcome 14.3: Maintain indirect drive

Specific outcome 14.4: Align indirect drives

Specific outcome 14.5: Apply quality checks on completed work

Specific outcome 14.6: Conduct post-maintenance activities

**Title 15: Maintain pipe systems**

Specific outcome 15.1: Plan and prepare for pipe system maintenance

Specific outcome 15.2: Prepare site and equipment for pipe system maintenance

Specific outcome 15.3: Maintain pipe system

Specific outcome 15.4: Apply quality checks on completed work

Specific outcome 15.5: Conduct post-repair activities



**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING AND MACHINING) NQF LEVEL 3****UNIT STANDARDS ON NQF LEVEL 3****CORE**

- Title 1:** Produce components by performing engineering milling operations
- Title 2:** Produce components by performing engineering turning operations
- Title 3:** Produce components by performing engineering grinding operations
- Title 4:** Grind tools and drill bits
- Title 5:** Maintain bearings in machines and equipment
- Title 6:** Maintain pumps
- Title 7:** Maintain heat exchangers and pressure vessels
- Title 8:** Maintain direct drives
- Title 9:** Maintain dynamic seals in machines and / or equipment
- Title 10:** Maintain brakes and clutches
- Title 11:** Maintain lubricating systems

**ELECTIVE**

- Title 12:** Maintain conveyor systems
- Title 13:** Perform heat treatment processes on engineering metals
- Title 14:** Perform non-destructive tests on metal parts and components
- Title 15:** Test the physical properties of engineering metals
- Title 16:** Produce detailed engineering drawings

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN  
NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING AND MACHINING) NQF LEVEL 3**

- Title 1: Produce components by performing engineering milling operations**
- Specific outcome 1.1: Prepare for work activity
- Specific outcome 1.2: Set milling machine
- Specific outcome 1.3: Perform milling operations
- Specific outcome 1.4: Apply quality checks on machined component
- Specific outcome 1.5: Recognise and report problems, changes and/or malfunctions while operating
- Specific outcome 1.6: Record information on work done
- Specific outcome 1.7: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment



**Title 2: Produce components by performing engineering turning operations**

- Specific outcome 2.1: Prepare for work activity
- Specific outcome 2.2: Set lathe
- Specific outcome 2.3: Perform turning operations
- Specific outcome 2.4: Apply quality checks on machined component

**Title 3: Produce components by performing engineering grinding operations**

- Specific outcome 3.1: Prepare for work activity
- Specific outcome 3.2: Set grinding machine
- Specific outcome 3.3: Perform grinding operations
- Specific outcome 3.4: Apply quality checks on machined component

**Title 4: Grind tools and drill bits**

- Specific outcome 4.1: Plan and prepare for tool grinding
- Specific outcome 4.2: Prepare site and equipment
- Specific outcome 4.3: Inspect and assess tool condition
- Specific outcome 4.4: Grind tool

**Title 5: Maintain bearings in machines and equipment**

- Specific outcome 5.1: Plan and prepare for bearing replacement
- Specific outcome 5.2: Prepare site and equipment for bearing replacement
- Specific outcome 5.3: Check bearings in situ
- Specific outcome 5.4: Remove and inspect bearings
- Specific outcome 5.5: Install bearings to machines and equipment
- Specific outcome 5.6: Check installation for compliance with operational requirements

**Title 6: Maintain pumps**

- Specific outcome 6.1: Plan and prepare for pump maintenance
- Specific outcome 6.2: Prepare site and equipment
- Specific outcome 6.3: Inspect and assess pump condition
- Specific outcome 6.4: Maintain pump
- Specific outcome 6.5: Check pump for compliance with operational requirements
- Specific outcome 6.6: Care for and store system maintenance tools and equipment

**Title 7: Maintain heat exchangers and pressure vessels**

- Specific outcome 7.1: Plan and prepare for heat exchanger and pressure vessel maintenance / pressure



testing

- Specific outcome 7.2: Prepare site and equipment
- Specific outcome 7.3: Inspect and assess heat exchanger / pressure vessel condition
- Specific outcome 7.4: Maintain heat exchanger and pressure vessels
- Specific outcome 7.5: Conduct pressure test
- Specific outcome 7.6: Check heat exchanger for compliance with operational requirements

**Title 8: Maintain direct drives**

- Specific outcome 8.1: Plan and prepare for direct drive maintenance
- Specific outcome 8.2: Prepare site and equipment for direct drive maintenance
- Specific outcome 8.3: Maintain direct drive
- Specific outcome 8.4: Align direct drives
- Specific outcome 8.5: Apply quality checks on completed work
- Specific outcome 8.6: Conduct post-maintenance activities

**Title 9: Maintain dynamic seals in machines and / or equipment**

- Specific outcome 9.1: Plan and prepare for seal replacement
- Specific outcome 9.2: Prepare site and equipment for seal replacement
- Specific outcome 9.3: Maintain dynamic seals
- Specific outcome 9.4: Check equipment for compliance with operational requirements

**Title 10: Maintain brakes and clutches**

- Specific outcome 10.1: Plan and prepare for brake and clutch maintenance
- Specific outcome 10.2: Prepare site and equipment for brake and clutch maintenance
- Specific outcome 10.3: Check brakes and clutches in situ
- Specific outcome 10.4: Install brakes and clutches to machines and equipment

**Title 11: Maintain lubricating systems**

- Specific outcome 11.1: Plan and prepare for repairs to lubricating system
- Specific outcome 11.2: Prepare site and equipment
- Specific outcome 11.3: Inspect and assess lubricating system functioning
- Specific outcome 11.4: Rectify lubrication system faults

**Title 12: Maintain conveyor systems**

- Specific outcome 12.1: Plan and prepare for conveyor system maintenance
- Specific outcome 12.2: Prepare site and equipment



Specific outcome 12.3: Inspect and assess conveyor system

Specific outcome 12.4: Maintain conveyor system

**Title 13: Perform heat treatment processes on engineering metals**

Specific outcome 13.1: Discuss and explain the heat treatment of metals

Specific outcome 13.2: Determine heat treatment requirements

Specific outcome 13.3: Prepare materials and equipment for heat treatment process

Specific outcome 13.4: Complete heat treatment of metals

**Title 14: Perform non-destructive tests on metal parts and components**

Specific outcome 14.1: Receive samples and check against documentation

Specific outcome 14.2: Carry out testing using ultrasonic methods

Specific outcome 14.3: Test parts for surface defects using magnetic particle inspection

Specific outcome 14.4: Recognise and report problems, changes and/or malfunctions while working

**Title 15: Test the physical properties of engineering metals**

Specific outcome 15.1: Receive samples and check against documentation

Specific outcome 15.2: Prepare for tests

Specific outcome 15.3: Complete tests and interpret and record results

Specific outcome 15.4: Store samples

Specific outcome 15.5: Care for test equipment

**Title 16: Produce detailed engineering drawings**

Specific outcome 16.1: Determine drawing requirements

Specific outcome 16.2: Perform calculations to produce drawing

Specific outcome 16.3: Produce drawings



**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING AND MACHINING) NQF LEVEL 4****UNIT STANDARDS ON NQF LEVEL 4****CORE**

- Title 1:** Produce complex components using milling machines
- Title 2:** Produce complex components using lathes
- Title 3:** Maintain gearboxes
- Title 4:** Maintain compressors
- Title 5:** Maintain fluid power / pneumatic systems
- Title 6:** Diagnose and repair faults on equipment and machinery during production/operation
- Title 7:** Align machines and equipment using laser technology

**ELECTIVE**

- Title 8:** Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine
- Title 9:** Grind tools and cutters used in engineering machining operations
- Title 10:** Produce complex components by performing internal and external grinding operations
- Title 11:** Produce components by performing horizontal boring operations
- Title 12:** Produce components by performing vertical boring operations
- Title 13:** Set automatic production lathes
- Title 14:** Produce components using wire cutting operations
- Title 15:** Maintain safety valves
- Title 16:** Stopple operational pipelines
- Title 17:** Refurbish machines
- Title 18:** Commission assembly / machine
- Title 19:** Produce complex engineering drawings

**UNIT STANDARDS ON NQF LEVEL 5****ELECTIVE**

- Title 20:** Write computer numerical controlled (CNC) programmes for CNC machining centres using proprietary software

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN****NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (FITTING AND MACHINING) NQF LEVEL 4**



- Specific outcome 10.3: Perform universal grinding operations  
Specific outcome 10.4: Apply quality checks on machined component

**Title 11: Produce components by performing horizontal boring operations**

- Specific outcome 11.1: Prepare for work activity  
Specific outcome 11.2: Set horizontal boring machine  
Specific outcome 11.3: Perform horizontal boring operations  
Specific outcome 11.4: Clean machine

**Title 12: Produce components by performing vertical boring operations**

- Specific outcome 12.1: Prepare for work activity  
Specific outcome 12.2: Set vertical boring machine  
Specific outcome 12.3: Perform vertical boring operations  
Specific outcome 12.4: Apply quality checks on machined component

**Title 13: Set automatic production lathes**

- Specific outcome 13.1: Prepare for machine set up  
Specific outcome 13.2: Set machine  
Specific outcome 13.3: Produce sample component  
Specific outcome 13.4: Monitor machine setting

**Title 14: Produce components using wire cutting operations**

- Specific outcome 14.1: Prepare for work activity  
Specific outcome 14.2: Set up wire cutting machine for operation  
Specific outcome 14.3: Perform wire cutting operations  
Specific outcome 14.4: Apply quality checks on component

**Title 15: Maintain safety valves**

- Specific outcome 15.1: Plan and prepare for safety valve maintenance  
Specific outcome 15.2: Prepare site and equipment  
Specific outcome 15.3: Inspect and assess safety valve maintenance requirements  
Specific outcome 15.4: Maintain safety valve

**Title 16: Stopple operational pipelines**

- Specific outcome 16.1: Plan and prepare for work activity  
Specific outcome 16.2: Prepare site and equipment for drilling into and plugging the operational pipe line  
Specific outcome 16.3: Drill into the operational pipeline, tap the fitting and install the pipeline plug



Specific outcome 16.4: Check stoppling process for conformance to specifications

Specific outcome 16.5: Identify non-conforming components, changes and / or malfunctions and take appropriate corrective action

**Title 17: Refurbish machines**

Specific outcome 17.1: Plan and prepare for refurbishment

Specific outcome 17.2: Prepare site and equipment

Specific outcome 17.3: Carry out fault diagnosis on machines

Specific outcome 17.4: Refurbish machines

Specific outcome 17.5: Recognise and report problems or changes while working

Specific outcome 17.6: Record information on work done

Specific outcome 17.7: Discuss and explain incidents and problems related to refurbishment activity

**Title 18: Commission assembly / machine**

Specific outcome 18.1: Plan and prepare for commissioning

Specific outcome 18.2: Commission machine / assembly

Specific outcome 18.3: Identify non-conformances, diagnose faults and take corrective action

Specific outcome 18.4: Complete commissioning activity

**Title 19: Produce complex engineering drawings**

Specific outcome 19.1: Determine drawing requirements

Specific outcome 19.2: Perform calculations to produce drawing

Specific outcome 19.3: Produce drawings

Specific outcome 19.4: Record information on work done

**Title 20: Write computer numerical controlled (CNC) programmes for CNC machining centres using proprietary software**

Specific outcome 20.1: Prepare to write programme

Specific outcome 20.2: Write programme

Specific outcome 20.3: Verify programme

Specific outcome 20.4: Recognise and report problems and changes while programming



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Fitting) NQF Level 3**

**Field:** Manufacturing, Engineering and Technology- NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 3

**Credit:** 133

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of mechanical engineering (fitting) is characterized by the provision of engineering maintenance, repair and installation services and support in a variety of industries. The equipment requiring such service and support ranges from sophisticated equipment to antiquated single station machines. People working in the mechanical engineering field require specialized technical skills and knowledge, as well as highly developed hand skills in order to meet the mechanical engineering requirements of diverse industries.

This is the second qualification in a series for learners who want to follow a career in the field of mechanical engineering (fitting).

It also provides learners who have gained relevant experience in the workplace with an opportunity to obtain credits through an RPL process.

The qualification also forms the basis for further learning in field of mechanical engineering where learners will engage in more complex maintenance and repair activities.



**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of mechanical engineering skills and meet the challenges of such an environment.

The primary skills that are recognised in this qualification are the ability to fault find, dismantle, maintain, repair and install a variety of assemblies. These capabilities require an understanding of advanced mechanical theory and detailed engineering drawings as well as a familiarity with the equipment and processes within the environment in which the learner is working. Hand skills play a large role in this qualification.

Qualifying learners will also be able to relate what they are doing to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

What learners achieve in this qualification will also serve as a basis for further learning where they will engage in more complex maintenance and repair activities.

**Access to the Qualification:**

Open access.

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

This qualification assumes learners have a national certificate in mechanical engineering (fitting) level 2.



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

- Language and maths beyond basic literacy and numeracy
- Basic concepts of science and technology related to mechanical engineering, engineering materials and tools used in the maintenance process
- An ability to apply basic mechanical assembly, maintenance and repair fundamentals to recognise and respond to equipment component defects.
- Concepts of organising factors in labour, business and the economy
- Role and purpose of procedures related to workplace relationships, roles and responsibilities

#### **Exit Level Outcomes and Assessment Criteria:**

##### **Exit level outcome 1:**

Demonstrate an understanding of and an ability to fault find, dismantle, maintain, assemble and install a variety of mechanical assemblies and make close tolerance adjustments to equipment and process, meeting output requirements and working safely with due care for fellow workers and the environment

##### **Associated Assessment Criteria**

- Condition of equipment and machinery is monitored
- Faults in equipment and machinery are diagnosed.
- Equipment and machinery are maintained to required standards and overhauled at required intervals
- Dismantling sequence of assemblies meets specifications
- Assemblies and installations meet specifications
- Safe working practices are adhered to

##### **Exit level outcome 2**

Demonstrate an understanding of lubrication systems and an ability to maintain such systems

##### **Associated Assessment Criteria**

- Lubrication systems are maintained to specifications
- Can respond to questions and discuss issues related to the lubrication systems of equipment and machinery within the plant

##### **Exit level outcome 3**

Select appropriate procedures to solve familiar problems within a mechanical engineering environment and operate within clearly defined contexts, with some scope for personal decision-making and responsibility



**Associated Assessment Criteria**

- Appropriate procedures are selected to solve problems in an efficient and effective manner
- Unfamiliar problems are accurately reported to appropriate personnel
- Can respond to questions and discuss issues related to familiar problems in mechanical engineering (fitting)

**Exit level outcome 4**

Communicate with peers, production personnel and members of supervisory/management levels by demonstrating the ability to gather and summarise information from a range of sources and produce coherent presentations in a prescribed format

**Associated Assessment Criteria**

- Information is gathered from a range of sources and accurately summarised into a prescribed format.
- Information is clear and accurate and presented in a timely manner in the required format to appropriate parties.
- Relationships with peers, production personnel and supervisory/management levels are established and functioning

**Exit level outcome 5**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability**

This qualification was compared to other, similar outcomes- based qualifications, certifications or skills standards in New Zealand, Australia and the United Kingdom.

**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.



Some assessment aspects will demand practical demonstration while others may not. In some case inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It will be 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.

**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 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.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the MERS ETQA or any other relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the MERS ETQA or any other relevant ETQA
- Moderation of assessment should be overseen by the MERS ETQA or any other relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA procedures

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of mechanical engineering (fitting) – with a minimum of 3 years' experience working in the field. The subject matter experience of the assessor can be established by recognition of prior learning.



2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



## National Certificate in Mechanical Engineering (Fitting) NQF Level 3

Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
8968	Accommodate audience and context needs in oral communication	3	5
8969	Interpret and use information from texts	3	5
8970	Write texts for a range of communicative contexts	3	5
9529	Compile feasibility and commissioning reports	3	3
9528	Communicate with clients	3	3
	<b>Mathematics</b>		
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	3	2
9014	Use mathematics to investigate and monitor the financial aspects of personal and business issues	3	5
9012	Investigate life-related problems using data and probabilities	3	5
9013	Measure, estimate and calculate physical quantities and explore, describe and represent, interpret and justify geometrical relationships in two and three dimensional space relevant to the life or workplace of the community	3	4
	<b>Working with information</b>		
9357	Develop and use keyboard skills to enter text	1	3
7572	Demonstrate a knowledge of and produce computer spreadsheets using basic functions	2	3
Core			
NLRD	Title	Level	Credits
	<b>Tools, equipment and machines</b>		
	Grind tools and drill bits	3	4



	<b>Maintain and repair</b>		
	Maintain bearings in machines and equipment	3	8
	Maintain pumps	3	24
	Maintain heat exchangers and pressure vessels	3	8
	Maintain direct drives	3	6
	Maintain dynamic seals in machines and equipment	3	3
	Maintain brakes and clutches	3	6
	Maintain lubricating systems	3	4
	<b>Safety, Health &amp; Environment</b>		
	Apply safety, health and environmental protection procedures	3	6
	<b>Business Relations</b>		
9526	Manage basic business finance	3	6
9530	Manage work time effectively	3	3
<b>Elective</b>			
<b>NLRD</b>	<b>Titles</b>		<b>Credits</b>
	<b>Maintain and repair</b>		
	Maintain conveyor systems	3	6
	<b>Materials</b>		
	Perform heat treatment processes on engineering metals	3	8
	Perform non-destructive tests on metal parts and components	3	4
	Test the physical properties of engineering metals	3	6
	<b>Drawings and design</b>		
	Produce detailed engineering drawings	3	6
	<b>Suggested additional learning</b>		



8038	Operate lift trucks	3	6
8039	Operate cranes	3	10
	<b>Minimum elective credits required</b>		<b>12</b>



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Fitting) NQF Level 4**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 4

**Credit:** 135

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of mechanical engineering (fitting) is characterized by the provision of engineering maintenance, repair and installation services and support in a variety of industries. The production equipment requiring such service and support ranges from sophisticated equipment to antiquated single station machines. People working in the mechanical engineering field require specialized technical skills and knowledge, as well as highly developed hand skills in order to meet the mechanical engineering requirements of such diverse industries.

This is the third qualification in a series for learners who want to follow a career in the field of mechanical engineering (fitting).

It also provides learners who have gained relevant experience in the workplace with an opportunity to obtain credits through an RPL process.



	Monitor the application of safety, health and environmental protection procedures	4	4
	<b>Business Relations</b>		
	Contribute to the implementation and maintenance of business processes	4	10
<b>Elective</b>			
<b>NLRD</b>	<b>Titles</b>		<b>Credits</b>
	<b>Maintain and repair</b>		
	Maintain safety valves	4	4
	Stopple operational pipelines	4	16
	Refurbish machines	4	24
	Commission assembly/machine	4	8
	<b>Drawings and design</b>		
	Produce complex engineering drawings	4	6
	<b>Minimum elective credits required</b>		<b>12</b>



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Machining) NQF Level 2**

**Field:** Manufacturing, Engineering and Technology- NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 2

**Credit:** 151

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of engineering machining is characterized by work-to-order, low volume manufacture of components using different machining methods for use in a variety of industries including the automotive, metal, appliance manufacturing, plastic, tyre and rubber industries. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured.

This is the first qualification in a series for learners who want to follow a career in the field of engineering machining. This qualification focuses on developing skills and knowledge necessary to begin such a career.

It also provides learners who have gained relevant experience in the workplace with an opportunity to obtain credits through an RPL process.



The qualification also forms the basis for further learning in field of engineering and machining where the learner will be able to specialize in engineering machining or tooling manufacture.

**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of engineering fitting and machining skills and to meet the challenges of such an environment.

The primary skills that are recognised in this qualification are the ability to machine simple components using a variety of machining methods and the ability to apply basic mechanical assembly, maintenance and repair fundamentals to recognise and respond to equipment component defects. These capabilities require an understanding of basic machining theory, machinery functioning and maintenance, engineering materials and tools and concepts of measurement, and basic engineering drawings. Hand skills play a large role in this qualification.

Qualified learners will also understand:

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

With this understanding learners will be able to participate in workplace activities.

**Access to the Qualification:**

Open access.

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**



This qualification assumes learners have a General Education and Training Certificate at NQF level 1, or alternatively, an ABET level 4 qualification.

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

- Literacy and numeracy
- Basic concepts of science and technology

#### **Exit Level Outcomes and Assessment Criteria:**

##### **Exit level outcome 1**

Demonstrate an understanding of a variety of machining methods and an ability to produce simple components that meet quality and output requirements, working safely and in an environmentally aware manner.

##### **Associated Assessment Criteria**

- Output and quality requirements are met
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of machining, the various machining methods and the functioning of machinery.

##### **Exit level outcome 2**

Identify engineering materials used in the machining process and describe their characteristics and applications.

##### **Associated Assessment Criteria**

- Engineering materials are identified and their physical properties described
- Can respond to questions and discuss issues related to the common applications and methods of processing and manufacturing using engineering materials

##### **Exit level outcome 3**

Demonstrate an ability to read, interpret and produce basic engineering drawings.

##### **Associated Assessment Criteria**

- Components to be machined are identified and requirements interpreted from engineering drawing
- Engineering drawing produced meets job requirements
- Can respond to questions and discuss issues related to engineering drawing concepts and material lists



not too onerous as to prevent learners from taking up the RPL option towards gaining a qualification.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the MERS ETQA or any other relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the MERS ETQA or any other relevant ETQA
- Moderation of assessment should be overseen by the MERS ETQA or any other relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA procedures

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of mechanical engineering (machining) – with a minimum of 3 years' experience working in the field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



# **National Certificate in Mechanical Engineering (Machining) NQF Level 2**

<b>Fundamental</b>			
<b>NLRD</b>	<b>Title</b>	<b>Level</b>	<b>Credits</b>
	<b>Communication</b>		
8962	Maintain and adapt oral communication	2	5
8963	Access and use information from texts	2	5
8964	Write for a defined context	2	5
	Communicate at work	2	5
	<b>Mathematics</b>		
8982	Demonstrate an understanding of rational and irrational numbers and number systems within the context of relevant calculations	2	3
8983	Use mathematics to investigate and monitor the financial aspects of personal and community life	2	2
9009	Apply basic knowledge of statistics and probability in order to investigate life and work related problems	2	3
9008	Measure, estimate and calculate physical quantities and explore, describe and represent geometrical relationships in two dimensions in different life or workplace contexts	2	3
9007	Work with a range of patterns and basic functions to solve related problems	2	5
<b>Core</b>			
<b>NLRD</b>	<b>Title</b>	<b>Level</b>	<b>Credits</b>
	<b>Materials</b>		
	Identify engineering materials, their characteristics and applications, and common metal tests and treatments used in engineering	2	4
	<b>Tools, equipment and machines</b>		



Select, use and care for engineering measuring equipment	2	4
Select, use and care for engineering power tools	2	6
Select, use and care for engineering hand tools	2	8
Perform basic welding / joining of metals	2	8
Mark off basic engineering shapes	2	2
Perform routine maintenance	2	8
<b>Drawings and design</b>		
Read, interpret and produce basic engineering drawings	2	6
<b>Machining</b>		
Operate and monitor a drilling machine to produce simple components	2	6
Operate and monitor a surface grinding machine to produce simple components	2	8
Operate and monitor a milling machine to produce simple components	2	12
Operate and monitor a lathe to produce simple components	2	12
<b>Safety, Health &amp; Environment</b>		
Keep the work area safe and productive	2	8
<b>Business Relations</b>		
Explain the individual's role within business	2	4
<b>People interacting, leading and developing</b>		
Develop a learning plan and a portfolio for assessment	2	6
Understand and deal with HIV / Aids	2	3



Elective			
NLRD	<b>Tooling manufacture</b>		
	Manufacture basic tooling (requirement for learners wanting to embark on a career path in tooling manufacture)	2	24
	<b>Safety, Health &amp; Environment</b>		
	Perform basic first aid	2	4
	Perform basic fire fighting	2	2
	<b>Information technology</b>		
7547	Operate a personal computer system	2	6
7548	Use a personal computer operating system	2	3
	<b>Suggested additional learning</b>		
9268	Manage basic personal finance	2	6
	<b>Minimum elective credits required</b>		10



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Machining) NQF Level 3**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 3

**Credit:** 126

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of engineering machining is characterized by work-to-order, low volume manufacture of components using different machining methods for use in a variety of industries including the automotive, metal, appliance manufacturing, plastic, tyre and rubber industries. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured.

This is a second qualification in a series for learners who want to follow a career in the field of engineering machining, specialising in engineering machining skills.

It also provides learners who have gained relevant experience in the workplace with an opportunity to obtain credits through an RPL process.

The qualification also forms the basis for further learning in field of engineering and machining where the learner will be able to further specialize at NQF level 4.



**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of engineering machining skills to meet the challenges of such an environment.

The primary skill that is recognised in this qualification is the ability to produce components of some complexity using a variety of machining methods. This capability requires an understanding of advanced machining theory, detailed engineering drawings and a variety of tests and treatments used on engineering metals. Hand skills play a large role in this qualification.

Qualifying learners will also be able to relate what they are doing to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

**Access to the Qualification:**

Open access.

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

T This qualification assumes learners have a national certificate in engineering machining level 2.

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

- Language and maths beyond basic literacy and numeracy
- Basic concepts of science and technology related to machining methods, engineering materials and tools used in the machining process
- An ability to produce simple components using a variety of machining methods



- Concepts of organising factors in labour, business and the economy
- Role and purpose of procedures related to workplace relationships, roles and responsibilities

**Exit Level Outcomes and Assessment Criteria:****Exit level outcome 1**

Demonstrate an ability to produce components of some complexity using a variety of machining methods and operations, meeting output requirements and working safely with due care for fellow workers and the environment

**Associated Assessment Criteria**

- Output and quality requirements are met
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of machining and the various machining methods and their respective operations at this level

**Exit level outcome 2**

Demonstrate an ability to select and apply appropriate inspection methods to determine component compliance with specifications

**Associated Assessment Criteria**

- Appropriate inspection methods are chosen and applied
- Can respond to questions and discuss issues related to various inspection methods and procedures and the principles underpinning such methods

**Exit level outcome 3**

Demonstrate an ability to read and interpret detailed engineering drawings.

**Associated Assessment Criteria**

- Components and assemblies to be machined are identified and requirements interpreted from engineering drawing
- Machined components and assemblies meet drawing specifications

**Exit level outcome 4**

Select appropriate procedures to solve familiar problems within an engineering machining environment and operate within clearly defined contexts, with some scope for personal decision-making and responsibility

**Associated Assessment Criteria**

- Appropriate procedures are selected to solve problems in an efficient and effective manner
- Unfamiliar problems are accurately reported to appropriate personnel



- Can respond to questions and discuss issues related to familiar problems in the machining of components and assemblies

**Exit level outcome 5**

Communicate with peers, customers and members of supervisory/management levels by demonstrating the ability to gather and summarise information from a range of sources and produce coherent presentations in a prescribed format

**Associated Assessment Criteria**

- Information is gathered from a range of sources and accurately summarised into a prescribed format.
- Information is clear and accurate and presented in a timely manner in the required format to appropriate parties.
- Relationships with peers and supervisory./management levels are established and functioning

**Exit level outcome 6**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability**

As a starting point, the series of qualifications in the field of mechanical engineering covering machining, fitting, fitting and machining, and tooling manufacture specialisations, of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in New Zealand and Australia. It was found to be difficult to compare the New Zealand and Australian narrow focus qualifications with these broad-based qualifications that also include fundamentals and generic core standards. It was further difficult to undertake such comparisons given that the New Zealand and Australian qualifications, although they are in the same field of mechanical engineering and cover the same areas of specialisation (thus containing a large degree of similar content) are conceptualized as three year qualifications without exit level outcomes at the intermediate levels (NQF levels 2 and 3). This notwithstanding, the technical content of this series of qualifications for mechanical engineering (with the various specialisations) of which the highest qualification is at level 4 does correspond with the equivalent level of qualification in mechanical engineering (with the various specialisations) in Australia and New Zealand.



**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.

Some assessment aspects will demand practical demonstration while others may not. In some case inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It will be 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.

**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 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.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the MERS ETQA or any other relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the MERS ETQA or any other relevant ETQA



- Moderation of assessment should be overseen by the MERS ETQA or any other relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA procedures

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of mechanical engineering (machining) – with a minimum of 3 years' experience working in the field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
8968	Accommodate audience and context needs in oral communication	3	5
8969	Interpret and use information from texts	3	5
8970	Write texts for a range of communicative contexts	3	5
9529	Compile feasibility and commissioning reports	3	3
9528	Communicate with clients	3	3
	<b>Mathematics</b>		
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	3	2
9014	Use mathematics to investigate and monitor the financial aspects of personal and business issues	3	5
9012	Investigate life-related problems using data and probabilities	3	5
9013	Measure, estimate and calculate physical quantities and explore, describe and represent, interpret and justify geometrical relationships in two and three dimensional space relevant to the life or workplace of the community	3	4
Core			
NLRD	Title	Level	Credits
	<b>Machining</b>		
	Produce components by performing engineering milling operations	3	20
	Produce components by performing engineering turning operations	3	20
	Produce components by performing engineering grinding operations	3	12
	<b>Business Relations</b>		
9526	Manage basic business finance	3	6
9530	Manage work time effectively	3	3



	<b>People interacting, leading and developing</b>		
	Develop learning strategies and techniques	3	3
<b>Elective</b>			
<b>NLRD</b>	<b>Titles</b>		<b>Credits</b>
	<b>Materials</b>		
	Perform heat treatment processes on engineering metals	3	8
	Perform non-destructive tests on metal parts and components	3	4
	Test the physical properties of engineering metals	3	6
	<b>Drawings and design</b>		
	Produce detailed engineering drawings	3	6
	<b>Suggested additional learning</b>		
8038	Operate lift trucks	3	6
8039	Operate cranes	3	10
	<b>Minimum elective credits required</b>		<b>25</b>



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Machining) NQF Level 4**

**Field:** Manufacturing, Engineering and Technology- NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 4

**Credit:** 129

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of engineering machining is characterized by work-to-order, low volume manufacture of components using different machining methods for use in a variety of industries including the automotive, metal, appliance manufacturing, plastic, tyre and rubber industries. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured.

This is a third qualification in a series for learners who want to follow a career in the field of engineering machining, specialising in engineering machining skills.

It also provides learners who have gained relevant experience in the workplace to gain credits through an RPL process.



The qualification also forms the basis for further learning in field of engineering within the higher education and training band.

**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of engineering machining skills and meet the challenges of such an environment.

The primary skill that is recognised in this qualification is the ability to produce complex components to precision specifications using a variety of machining methods. This capability requires an understanding of advanced machining theory and complex engineering drawings. The learner must furthermore choose from a number of elective unit standards for various machining methods and for computer numerical controlled (CNC) programming, setting and operation. Although the CNC unit standards are elective at present, it is recommended that learners choose these standards. Hand skills play a large role in this qualification.

Qualified learners will also understand:

- How to plan, schedule and evaluate own work
- How to interact with team leaders and develop the capacity of team members to maintain and support quality, safety and health systems.

With this understanding learners will be able to participate in workplace activities.

Qualifying learners will also be able to relate what they see and experience to scientific and technological principles and concepts.

**Access to the Qualification:**

Open access.

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

This qualification assumes learners have a national certificate in engineering machining (machining specialisation) level 3.



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

- Language and maths related to organising and controlling their environment
- Maths and applicable scientific and technological concepts related to machining of components
- An ability to produce components of some complexity using a variety of machining methods
- Concepts of contributing factors in labour, business and the economy
- Role and purpose of systems which support workplace relationships, procedures, roles and responsibilities

#### **Exit Level Outcomes and Assessment Criteria:**

##### **Exit level outcome 1**

Demonstrate an ability to produce complex components using a variety of machining methods and operations, meeting output requirements and working safely with due care for fellow workers and the environment

##### **Associated Assessment Criteria**

- Output and quality requirements are met
- Machining time limits are adhered to
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of machining and the various machining methods and their respective operations at this level

##### **Exit level outcome 2**

Demonstrate an understanding of quality specifications and an ability to interpret these and evaluate components machined to determine compliance

##### **Associated Assessment Criteria**

- Quality specifications interpreted and applied to machined component and compliance determined and reported
- Can respond to questions and discuss issues related to quality specifications and the principles underpinning such specifications

##### **Exit level outcome 3**

Demonstrate an ability to read and interpret complex engineering drawings.

##### **Associated Assessment Criteria**

- Components and assemblies to be machined identified and requirements interpreted from engineering drawing
- Machined components and assemblies meet drawing specifications



**Exit level outcome 4**

Maintain and support procedures to solve a variety of problems, both familiar and unfamiliar, within an engineering machining context and operate within familiar and new situations, taking responsibility and making decisions

**Associated Assessment Criteria**

- Solutions to machining problems are based on a clear analysis of information gathered through diagnostic procedures.
- Procedures are modified to respond to unfamiliar problems where appropriate.
- Can respond to questions and discuss issues related to familiar and unfamiliar problems arising in the machining of complex components
- All actions related to problem solving are accurately recorded for future reference

**Exit level outcome 5**

Communicate and present information clearly and reliably and demonstrate the ability to analyse information to identify problems and determine trends

**Associated Assessment Criteria**

- Conditions, evidence and incidences are reported accurately in a timely manner and discussed with peers and management
- Data gathered through diagnostic procedures is examined systematically and analysis is repeated until problem is solved.
- Records are available for scrutiny and future reference

**Exit level outcome 6**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability**

This qualification was compared to other, similar outcomes- based qualifications, certifications or skills standards in New Zealand, Australia and the United Kingdom.



**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.

Some assessment aspects will demand practical demonstration while others may not. In some case inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It will be 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.

**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 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.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the MERS ETQA or any other relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the MERS ETQA or any other relevant ETQA
- Moderation of assessment should be overseen by the MERS ETQA or any other relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA procedures



**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of mechanical engineering (machining) – with a minimum of 3 years' experience working in the field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



## National Certificate in Mechanical Engineering (Machining) NQF Level 4

Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
8968	Engage in sustained oral communication and evaluate spoken texts	4	5
8969	Read, analyse and respond to a variety of texts	4	5
8970	Write for a wide range of contexts	4	5
9529	Write a technical report	4	4
9528	Communicate in an assertive manner with clients and fellow workers	4	4
	<b>Mathematics</b>		
9014	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	4	4
9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	4	6
9016	Measure, estimate and calculate physical quantities and explore, critique and prove geometrical relationships in two and three dimensional space in the life and workplace of the adult with increasing responsibilities	4	6
Core			
NLRD	Title	Level	Credits
	<b>Machining</b>		
	Produce complex components using milling machines	4	20
	Produce complex components using lathes	4	20
	<b>People interacting, leading and developing</b>		
	Develop the skills of a workgroup	5	10
	<b>Business Relations</b>		
	Contribute to the implementation and maintenance of business processes	4	10



Elective			
NLRD	Titles	Level	Credits
	<b>Machining</b>		
	Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine	4	24
	Grind tools and cutters used in engineering machining operations	4	8
	Produce complex components by performing internal and external grinding operations	4	12
	Produce components by performing horizontal boring operations	4	12
	Produce components by performing vertical boring operations	4	8
	Set automatic production lathes	4	10
	Write programmes for CNC machining centres using proprietary software	5	30
	<b>Drawings and design</b>		
	Produce complex engineering drawings	4	6
	<b>Life Skills</b>		
	Develop a personal financial plan	4	2



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Tooling Manufacture) NQF Level 3**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 3

**Credit:** 169

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of engineering machining is characterized by work-to-order, low volume manufacture of components using different machining methods for use in a variety of industries including the automotive, metal, appliance manufacturing, plastic, tyre and rubber industries. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured.

This is a second qualification in a series for learners who want to follow a career in the field of engineering machining, specialising in tooling manufacture. This qualification applies to the manufacture of tools, jigs, dies and fixtures and plastic injection moulds. The learner must demonstrate competence in either of the two skills areas to receive credits for this qualification.

It also provides learners who have gained relevant experience in the workplace to gain credits through an RPL process.



The qualification also forms the basis for further learning in field of engineering and machining where the learner will be able to further specialize at NQF level 4.

**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of tooling manufacturing skills and meet the challenges of such an environment.

The underpinning skill that is recognised in this qualification is the ability to produce components of some complexity using a variety of machining methods. The primary skill that is recognised in this qualification is the ability to use this underpinning skill to manufacture and repair production tooling. These capabilities require an understanding of advanced machining theory, detailed engineering drawings and a variety of tests and treatments used on engineering metals. Hand skills play a large role in this qualification.

Qualifying learners will also be able to relate what they are doing to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

**Access to the Qualification:**

Open access.

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

T This qualification assumes learners have a national certificate in engineering machining level 2.



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

- Language and maths beyond basic literacy and numeracy
- Basic concepts of science and technology related to machining methods, engineering materials and tools used in the machining process
- An ability to produce simple components using a variety of machining methods
- An ability to manufacture basic tooling
- Concepts of organising factors in labour, business and the economy
- Role and purpose of procedures related to workplace relationships, roles and responsibilities

#### **Exit Level Outcomes and Assessment Criteria:**

##### **Exit level outcome 1**

Demonstrate an ability to produce components of some complexity using a variety of machining methods and operations, meeting output requirements and working safely with due care for fellow workers and the environment

##### **Associated Assessment Criteria**

- Output and quality requirements are met
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of machining and the various machining methods and their respective operations at this level

##### **Exit level outcome 2**

Demonstrate an understanding of and an ability to manufacture and maintain production tooling

##### **Associated Assessment Criteria**

- Output and quality requirements are met
- Time frames for manufacturing tooling are adhered to
- Production tooling is maintained and repaired to job specifications
- Safe working practices are adhered to

Can respond to questions and discuss issues related to the theoretical principles underpinning tooling manufacture

##### **Exit level outcome 3**

Demonstrate an ability to select and apply appropriate inspection methods to determine component compliance with specifications

##### **Associated Assessment Criteria**

- Appropriate inspection methods are chosen and applied



- Can respond to questions and discuss issues related to various inspection methods and procedures and the principles underpinning such methods

**Exit level outcome 4**

Demonstrate an ability to read and interpret detailed engineering drawings.

**Associated Assessment Criteria**

- Tooling to be manufactured is identified and requirements interpreted from engineering drawing
- Manufactured tooling meets drawing specifications

**Exit level outcome 5**

Select appropriate procedures to solve familiar problems within an engineering machining environment and operate within clearly defined contexts, with some scope for personal decision-making and responsibility

**Associated Assessment Criteria**

- Appropriate procedures are selected to solve problems in an efficient and effective manner
- Unfamiliar problems are accurately reported to appropriate personnel
- Can respond to questions and discuss issues related to familiar problems in the machining of components and assemblies

**Exit level outcome 6**

Communicate with peers, customers and members of supervisory/management levels by demonstrating the ability to gather and summarise information from a range of sources and produce coherent presentations in a prescribed format

**Associated Assessment Criteria**

- Information is gathered from a range of sources and accurately summarised into a prescribed format.
- Information is clear and accurate and presented in a timely manner in the required format to appropriate parties.
- Relationships with peers and supervisory./management levels are established and functioning

**Exit level outcome 7**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning



**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability**

As a starting point, the series of qualifications in the field of mechanical engineering covering machining, fitting, fitting and machining, and tooling manufacture specialisations, of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in New Zealand and Australia. It was found to be difficult to compare the New Zealand and Australian narrow focus qualifications with these broad-based qualifications that also include fundamentals and generic core standards. It was further difficult to undertake such comparisons given that the New Zealand and Australian qualifications, although they are in the same field of mechanical engineering and cover the same areas of specialisation (thus containing a large degree of similar content) are conceptualized as three year qualifications without exit level outcomes at the intermediate levels (NQF levels 2 and 3). This notwithstanding, the technical content of this series of qualifications for mechanical engineering (with the various specialisations) of which the highest qualification is at level 4 does correspond with the equivalent level of qualification in mechanical engineering (with the various specialisations) in Australia and New Zealand.

**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.

Some assessment aspects will demand practical demonstration while others may not. In some case inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It will be 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.



**Recognition of prior learning:**

This qualification may be obtained through RPL. The learner should be thoroughly briefed on the mechanism to be used and support and guidance should be provided. Care should be taken that the mechanism used provides the learner with an opportunity to demonstrate competence and is not too onerous as to prevent learners from taking up the RPL option towards gaining a qualification.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the MERS ETQA or any other relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the MERS ETQA or any other relevant ETQA
- Moderation of assessment should be overseen by the MERS ETQA or any other relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA procedures

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of mechanical engineering (tooling manufacture) – with a minimum of 3 years' experience working in the field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other relevant ETQA



## National Certificate in Mechanical Engineering (Tooling Manufacture) NQF Level 3

Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
8968	Accommodate audience and context needs in oral communication	3	5
8969	Interpret and use information from texts	3	5
8970	Write texts for a range of communicative contexts	3	5
9529	Compile feasibility and commissioning reports	3	3
9528	Communicate with clients	3	3
	<b>Mathematics</b>		
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	3	2
9014	Use mathematics to investigate and monitor the financial aspects of personal and business issues	3	5
9012	Investigate life-related problems using data and probabilities	3	5
9013	Measure, estimate and calculate physical quantities and explore, describe and represent, interpret and justify geometrical relationships in two and three dimensional space relevant to the life or workplace of the community	3	4



Core			
NLRD	Title	Level	Credits
	<b>Machining</b>		
	Produce components by performing engineering milling operations	3	20
	Produce components by performing engineering turning operations	3	20
	Produce components by performing engineering grinding operations	3	12
	<b>Tooling manufacture</b>		
	Manufacture production tooling to drawing or sample part	3	36
	Maintain and repair production tooling	3	20
	<b>Business Relations</b>		
9526	Manage basic business finance	3	6
9530	Manage work time effectively	3	3
	<b>People interacting, leading and developing</b>		
	Develop learning strategies and techniques	3	3
Elective			
NLRD	Titles		Credits
	<b>Tooling manufacture</b>		
	Produce components by spark eroding machining operations	3	8
	<b>Materials</b>		
	Perform heat treatment processes on engineering metals	3	8
	Perform non-destructive tests on metal parts and components	3	4
	Test the physical properties of engineering metals	3	6
	<b>Drawings and design</b>		



	Produce detailed engineering drawings	3	6
	<b>Suggested additional learning</b>		
8038	Operate lift trucks	3	6
8039	Operate cranes	3	10
	<b>Minimum elective credits required</b>		<b>12</b>



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechanical Engineering (Tooling Manufacture) NQF Level 4**

**Field:** Manufacturing, Engineering and Technology- NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 4

**Credit:** 183

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The field of engineering machining is characterized by work-to-order, low volume manufacture of components using different machining methods for use in a variety of industries including the automotive, metal, appliance manufacturing, plastic, tyre and rubber industries. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured.

This is a third qualification in a series for learners who want to follow a career in the field of engineering machining, specialising in tooling manufacture. This qualification applies to the manufacture of tools, jigs, dies and fixtures and plastic injection moulds. The learner must demonstrate competence in either of the two skills areas to receive credits for this qualification.

It also provides learners who have gained relevant experience in the workplace to gain credits through an RPL process.



The qualification also forms the basis for further learning in field of engineering within the higher education and training band.

**Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of tooling manufacturing skills and meet the challenges of such an environment.

The underpinning skill that is recognised in this qualification is the ability to produce components using a variety of machining methods. The primary skill that is recognised in this qualification is the ability to use this underpinning skill to manufacture complex tooling and to diagnose and repair faults on tooling during the production run. These capabilities require an understanding of advanced machining theory and complex engineering drawings. Hand skills play a large role in this qualification.

The learner may also choose from a number of elective unit standards for various machining methods and for computer numerical controlled (CNC) programming, setting and operation. Although the CNC unit standards are elective at present, it is recommended that learners choose these standards.

Qualified learners will also understand:

- How to plan, schedule and evaluate own work
- How to interact with team leaders and develop the capacity of team members to maintain and support quality, safety and health systems.

With this understanding learners will be able to participate in workplace activities.

Qualifying learners will also be able to relate what they see and experience to scientific and technological principles and concepts.

**Access to the Qualification:**

Open access.

This qualification series recognises skills, knowledge and values relevant to a workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge gained to activities 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.

**Learning assumed to be in place:**

This qualification assumes learners have a national certificate in engineering machining (machining specialisation) level 3.

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

- Language and maths related to organising and controlling their environment
- Maths and applicable scientific and technological concepts related to the manufacturing of production tooling and the machining of components
- An ability to produce components of some complexity using a variety of machining methods
- An ability to manufacture and maintain production tooling
- Concepts of contributing factors in labour, business and the economy
- Role and purpose of systems which support workplace relationships, procedures, roles and responsibilities

**Exit Level Outcomes and Assessment Criteria:****Exit level outcome 1**

Demonstrate an understanding of and an ability to manufacture complex tooling

**Associated Assessment Criteria**

- Output and quality requirements met
- Time frames for manufacturing tooling are adhered to
- Safe working practices are adhered to

**Exit level outcome 2**

Demonstrate an understanding of and an ability to diagnose and repair faults on tooling during the production run

**Associated Assessment Criteria**

- Recurrent tooling faults and their root causes identified
- Minor repairs on line performed
- Tooling requiring major repair dismantled and dispatched to workshop
- Potential production and maintenance problems are identified



**Exit level outcome 3**

Demonstrate an understanding of quality specifications and an ability to interpret these and evaluate tooling manufactured to determine compliance

**Associated Assessment Criteria**

- Quality specifications interpreted and applied to manufactured tooling and compliance determined and reported
- Can respond to questions and discuss issues related to quality specifications and the principles underpinning such specifications

**Exit level outcome 4**

Demonstrate an ability to read and interpret complex engineering drawings.

**Associated Assessment Criteria**

- Tooling to be manufactured is identified and requirements interpreted from engineering drawing
- Manufactured tooling meets drawing specifications

**Exit level outcome 5**

Maintain and support procedures to solve a variety of problems, both familiar and unfamiliar, within an engineering machining context and operate within familiar and new situations, taking responsibility and making decisions

**Associated Assessment Criteria**

- Solutions to machining problems are based on a clear analysis of information gathered through diagnostic procedures.
- Procedures are modified to respond to unfamiliar problems where appropriate
- Can respond to questions and discuss issues related to familiar and unfamiliar problems arising in the machining of complex components
- All actions related to problem solving are accurately recorded for future reference

**Exit level outcome 6**

Communicate and present information clearly and reliably and demonstrate the ability to analyse information to identify problems and determine trends

**Associated Assessment Criteria**

- Conditions, evidence and incidences are reported accurately in a timely manner and discussed with peers and management
- Data gathered through diagnostic procedures is examined systematically and analysis is repeated until problem is solved.



- Records are available for scrutiny and future reference

**Exit level outcome 7**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability**

As a starting point, the series of qualifications in the field of mechanical engineering covering machining, fitting, fitting and machining, and tooling manufacture specialisations, of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in New Zealand and Australia. It was found to be difficult to compare the New Zealand and Australian narrow focus qualifications with these broad-based qualifications that also include fundamentals and generic core standards. It was further difficult to undertake such comparisons given that the New Zealand and Australian qualifications, although they are in the same field of mechanical engineering and cover the same areas of specialisation (thus containing a large degree of similar content) are conceptualized as three year qualifications without exit level outcomes at the intermediate levels (NQF levels 2 and 3). This notwithstanding, the technical content of this series of qualifications for mechanical engineering (with the various specialisations) of which the highest qualification is at level 4 does correspond with the equivalent level of qualification in mechanical engineering (with the various specialisations) in Australia and New Zealand.

**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.

Some assessment aspects will demand practical demonstration while others may not. In some case inference will be necessary to determine competence depending on the nature and context within which performance takes place.



## National Certificate in Mechanical Engineering (Tooling Manufacture) NQF Level 4

Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
8968	Engage in sustained oral communication and evaluate spoken texts	4	5
8969	Read, analyse and respond to a variety of texts	4	5
8970	Write for a wide range of contexts	4	5
9529	Write a technical report	4	4
9528	Communicate in an assertive manner with clients and fellow workers	4	4
	<b>Mathematics</b>		
9014	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	4	4
9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	4	6
9016	Measure, estimate and calculate physical quantities and explore, critique and prove geometrical relationships in two and three dimensional space in the life and workplace of the adult with increasing responsibilities	4	6
Core			
NLRD	Title	Level	Credits
	<b>Machining</b>		
	Produce complex components using milling machines	4	20
	Produce complex components using lathes	4	20
	<b>Tooling Manufacture</b>		
	Manufacture complex tooling		48
	Diagnose and repair faults on tooling during the production run		24
	<b>People interacting, leading and developing</b>		



	Develop the skills of a workgroup	5	10
	<b>Business Relations</b>		
	Contribute to the implementation and maintenance of business processes	4	10
<b>Elective</b>			
<b>NLRD</b>	<b>Titles</b>	<b>Level</b>	<b>Credits</b>
	<b>Tooling Manufacture</b>		
	Produce components using wire cutting operations	4	10
	<b>Machining</b>		
	Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine	4	24
	Grind tools and cutters used in engineering machining operations	4	8
	Produce complex components by performing internal and external grinding operations	4	12
	Produce components by performing horizontal boring operations	4	12
	Produce components by performing vertical boring operations	4	8
	Set automatic production lathes	4	10
	Write computer numerical controlled (CNC) programmes for CNC machining centres using proprietary software	4	30
	<b>Drawings and design</b>		
	Produce complex engineering drawings	4	6
	<b>People interacting, leading and developing</b>		
	<b>Life Skills</b>		
	Develop a personal financial plan	4	2



- Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
  5. Any other criteria required by the MERS ETQA or any other relevant ETQA



It will be 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.

**Recognition of prior learning:**

This qualification may be obtained through RPL. The learner should be thoroughly briefed of the mechanism to be used and support and guidance should be provided. Care should be taken that the mechanism used provides the learner with an opportunity to demonstrate competence and is not too onerous as to prevent learners from taking up the RPL option towards gaining a qualification.

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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:**

- Anyone assessing a learner against this qualification must be registered as an assessor with the MERS ETQA or any other relevant ETQA
- Any institution or learning provider offering learning towards the achievement of this qualification should be accredited as a provider with the MERS ETQA or any other relevant ETQA
- Moderation of assessment should be overseen by the MERS ETQA or any other relevant ETQA according to the moderation guidelines provided for in this qualification as well as the agreed ETQA procedures

**Criteria for registration of assessors**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of mechanical engineering (tooling manufacture) – with a minimum of 3 years' experience working in the field. The subject matter experience of the assessor can be established by recognition of prior learning.
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and the ability to balance the conflicting requirements of:



**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (MACHINING) – NQF LEVEL 2****UNIT STANDARDS ON NQF LEVEL 2****CORE**

- Title 1:** Identify engineering metals, their characteristics and applications and common metal tests and treatments used in engineering
- Title 2:** Select, use and care for engineering measuring equipment
- Title 3:** Select, use and care for engineering power tools
- Title 4:** Select, use and care for engineering hand tools
- Title 5:** Mark off basic engineering shapes
- Title 6:** Perform basic welding / joining of metals
- Title 7:** Perform routine maintenance
- Title 8:** Read, interpret and produce engineering drawings
- Title 9:** Operate and monitor a drilling machine to produce simple components
- Title 10:** Operate and monitor a surface grinding machine to produce simple components
- Title 11:** Operate and monitor a milling machine to produce simple components
- Title 12:** Operate and monitor a milling machine to produce simple components

**ELECTIVE**

- Title 13:** Manufacture basic tooling

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN  
NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (MACHINING) NQF LEVEL 2**

- Title 1: Identify engineering materials, their characteristics and applications and common metal tests and treatments used in engineering**
- Specific outcome 1.1: Identify materials used in common engineering applications
- Specific outcome 1.2: Discuss the physical properties of engineering materials used in common engineering applications
- Specific outcome 1.3: Explain the common applications and methods of processing and manufacturing using engineering materials
- Specific outcome 1.4: Demonstrate an understanding of the common metal tests used in engineering
- Specific outcome 1.5: Demonstrate an understanding of heat treatment processes
- Specific outcome 1.6: Explain the effects external factors have on engineering materials



**Title 2: Select, use and care for engineering measuring equipment**

- Specific outcome 2.1: Explain and discuss basic units of measure and symbols
- Specific outcome 2.2: Select and use engineering measuring equipment
- Specific outcome 2.3: Care for and maintain measuring equipment
- Specific outcome 2.4: Recognise and report problems, changes and/or malfunctions while working
- Specific outcome 2.5: Work safely with due care for self, fellow workers, equipment, materials and the environment

**Title 3: Select, use and care for engineering power tools**

- Specific outcome 3.1: Select and use engineering power tools
- Specific outcome 3.2: Care for and maintain engineering power tools
- Specific outcome 3.3: Check on power supply connections to equipment
- Specific outcome 3.4: Recognise and report problems, changes and/or malfunctions while working

**Title 4: Select, use and care for engineering hand tools**

- Specific outcome 4.1: Select and use engineering hand tools
- Specific outcome 4.2: Care for and maintain hand tools
- Specific outcome 4.3: Recognise and report problems, changes and/or malfunctions while working
- Specific outcome 4.4: Work safely with due care for self, fellow workers, equipment, materials and the environment

**Title 5: Perform basic welding / joining of metals**

- Specific outcome 5.1: Prepare for work activity
- Specific outcome 5.2: Weld/join metals
- Specific outcome 5.3: Apply quality checks on completed weld/joint
- Specific outcome 5.4: Perform finishing activities
- Specific outcome 5.5: Report out of compliance or unsafe conditions while working
- Specific outcome 5.6: Work safely with due care for self, fellow workers, equipment, materials and the environment

**Title 6: Mark off basic engineering shapes**

- Specific outcome 6.1: Plan and prepare materials for marking off
- Specific outcome 6.2: Mark off materials
- Specific outcome 6.3: Apply quality checks on completed work
- Specific outcome 6.4: Care for and store marking off equipment



**Title 7: Perform routine maintenance**

- Specific outcome 7.1: Plan and prepare for routine maintenance
- Specific outcome 7.2: Monitor the condition of machinery and equipment
- Specific outcome 7.3: Perform routine maintenance
- Specific outcome 7.4: Apply quality checks on completed work

**Title 8: Read, interpret and produce basic engineering drawings**

- Specific outcome 8.1: Discuss and explain basic engineering drawing concepts and material lists
- Specific outcome 8.2: Interpret basic engineering drawings
- Specific outcome 8.3: Produce drawing

**Title 9: Operate and monitor a drilling machine to produce simple components**

- Specific outcome 9.1: Prepare for work activity
- Specific outcome 9.2: Set drilling machine
- Specific outcome 9.3: Perform drilling operations
- Specific outcome 9.4: Apply quality checks on machined component

**Title 10: Operate and monitor a surface grinding machine to produce simple components**

- Specific outcome 9.1: Prepare for work activity
- Specific outcome 10.2: Set grinding machine
- Specific outcome 10.3: Set grinding machine
- Specific outcome 10.4: Apply quality checks on machined component

**Title 11: Operate and monitor a milling machine to produce simple components**

- Specific outcome 11.1: Prepare for work activity
- Specific outcome 11.2: Set milling machine
- Specific outcome 11.3: Perform milling operations
- Specific outcome 11.4: Apply quality checks on machined component

**Title 12: Operate and monitor a lathe to produce simple components**

- Specific outcome 12.1: Prepare for work activity
- Specific outcome 12.2: Set lathe
- Specific outcome 12.3: Perform turning operations
- Specific outcome 12.4: Apply quality checks on machined component
- Specific outcome 12.5: Recognise and report problems, changes and/or malfunctions while operating



**Title 13: Manufacture basic tooling**

Specific outcome 13.1: Plan and prepare for tooling manufacturing process

Specific outcome 13.2: Manufacture basic tooling

Specific outcome 13.3: Assemble tooling

Specific outcome 13.4: Perform sample part try-out

Specific outcome 13.5: Recognise and report problems, changes and/or malfunctions while working

Specific outcome 13.6: Record information on work done

Specific outcome 13.7: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment



**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (MACHINING) NQF LEVEL 3****UNIT STANDARDS ON NQF LEVEL 3****CORE**

- Title 1:** Produce components by performing engineering milling components  
**Title 2:** Produce components by performing engineering turning operations  
**Title 3:** Produce components by performing engineering grinding operations

**ELECTIVE**

- Title 4:** Perform heat treatment processes on engineering metals  
**Title 5:** Test the physical properties of engineering metals  
**Title 6:** Perform non-destructive tests on metal components  
**Title 7:** Produce detailed engineering drawings

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN  
NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (MACHINING) NQF LEVEL 3****Title 1: Produce components by performing engineering milling operations**

- Specific outcome 1.1: Prepare for work activity  
Specific outcome 1.2: Set milling machine  
Specific outcome 1.3: Perform milling operations  
Specific outcome 1.4: Apply quality checks on machined component  
Specific outcome 1.5: Recognise and report problems, changes and/or malfunctions while operating  
Specific outcome 1.6: Record information on work done  
Specific outcome 1.7: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 2: Produce components by performing engineering turning operations**

- Specific outcome 2.1: Prepare for work activity  
Specific outcome 2.2: Set lathe  
Specific outcome 2.3: Perform turning operations  
Specific outcome 2.4: Apply quality checks on machined component

**Title 3: Produce components by performing engineering grinding operations**

- Specific outcome 3.1: Prepare for work activity  
Specific outcome 3.2: Set grinding machine



- Specific outcome 3.3: Perform grinding operations  
Specific outcome 3.4: Apply quality checks on machined component

**Title 4: Perform heat treatment processes on engineering metals**

- Specific outcome 4.1: Discuss and explain the heat treatment of metals  
Specific outcome 4.2: Determine heat treatment requirements  
Specific outcome 4.3: Prepare materials and equipment for heat treatment process  
Specific outcome 4.4: Complete heat treatment of metals

**Title 5: Perform non-destructive tests on metal parts and components**

- Specific outcome 5.1: Receive samples and check against documentation  
Specific outcome 5.2: Carry out testing using ultrasonic methods  
Specific outcome 5.3: Test parts for surface defects using magnetic particle inspection  
Specific outcome 5.4: Recognise and report problems, changes and/or malfunctions while working

**Title 6: Test the physical properties of engineering metals**

- Specific outcome 6.1: Receive samples and check against documentation  
Specific outcome 6.2: Prepare for tests  
Specific outcome 6.3: Complete tests and interpret and record results  
Specific outcome 6.4: Store samples  
Specific outcome 6.5: Care for test equipment

**Title 7: Produce detailed engineering drawings**

- Specific outcome 7.1: Determine drawing requirements  
Specific outcome 7.2: Perform calculations to produce drawing  
Specific outcome 7.3: Produce drawings



**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (MACHINING) NQF LEVEL 4**  
**UNIT STANDARDS ON NQF LEVEL 4**

**CORE**

- Title 1:** Produce complex components using milling machines  
**Title 2:** Produce complex components using lathes

**ELECTIVE**

- Title 3:** Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine  
**Title 4:** Grind tools and cutters used in engineering machining operations  
**Title 5:** Produce complex components by performing internal and external grinding operations  
**Title 6:** Produce components by performing horizontal boring operations  
**Title 7:** Produce components by performing vertical boring operations  
**Title 8:** Set automatic production lathes  
**Title 9:** Produce complex engineering drawings

**UNIT STANDARDS ON NQF LEVEL 5**

**ELECTIVE**

- Title 10:** Write computer numerical controlled (CNC) programmes for CNC machining centers using proprietary software

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN**  
**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (MACHINING) NQF LEVEL 4**

**Title 1: Produce complex components using milling machines**

- Specific outcome 1.1: Prepare for work activity  
Specific outcome 1.2: Set milling machine  
Specific outcome 1.3: Perform milling operations  
Specific outcome 1.4: Apply quality checks on machined component  
Specific outcome 1.5: Recognise and report problems, changes and/or malfunctions while operating  
Specific outcome 1.6: Record information on work done  
Specific outcome 1.7: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 2: Produce complex components using lathes**

- Specific outcome 2.1: Prepare for work activity



- Specific outcome 2.2: Set lathe
- Specific outcome 2.3: Perform turning operations
- Specific outcome 2.4: Apply quality checks on machined component

**Title 3: Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine**

- Specific outcome 3.1: Prepare and write programme
- Specific outcome 3.2: Prepare to set machine
- Specific outcome 3.3: Set machine to perform the specified work
- Specific outcome 3.4: Produce sample component
- Specific outcome 3.5: Operate CNC machine

**Title 4: Grind tools and cutters used in engineering machining operations**

- Specific outcome 4.1: Prepare for work activity
- Specific outcome 4.2: Set grinding machine
- Specific outcome 4.3: Perform tool and cutter grinding operations
- Specific outcome 4.4: Apply quality checks on machined tool/cutter

**Title 5: Produce complex components by performing internal and external grinding operations**

- Specific outcome 5.1: Prepare for work activity
- Specific outcome 5.2: Set grinding machine
- Specific outcome 5.3: Perform universal grinding operations
- Specific outcome 5.4: Apply quality checks on machined component

**Title 6: Produce components by performing horizontal boring operations**

- Specific outcome 6.1: Prepare for work activity
- Specific outcome 6.2: Set horizontal boring machine
- Specific outcome 6.3: Perform horizontal boring operations
- Specific outcome 6.4: Clean machine

**Title 7: Produce components by performing vertical boring operations**

- Specific outcome 7.1: Prepare for work activity
- Specific outcome 7.2: Set vertical boring machine
- Specific outcome 7.3: Perform vertical boring operations
- Specific outcome 7.4: Apply quality checks on machined component



**Title 8: Set automatic production lathes**

- Specific outcome 8.1: Prepare for machine set up
- Specific outcome 8.2: Set machine
- Specific outcome 8.3: Produce sample component
- Specific outcome 8.4: Monitor machine setting

**Title 9: Produce complex engineering drawings**

- Specific outcome 9.1: Determine drawing requirements
- Specific outcome 9.2: Perform calculations to produce drawing
- Specific outcome 9.3: Produce drawings
- Specific outcome 9.4: Record information on work done

**Title 10: Write computer numerical controlled (CNC) programmes for CNC machining centres using proprietary software**

- Specific outcome 10.1: Prepare to write programme
- Specific outcome 10.2: Write programme
- Specific outcome 10.3: Verify programme
- Specific outcome 10.4: Recognise and report problems and changes while programming



**UNIT STANDARDS AND SPECIFIC OUTCOMES IN  
NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (TOOLING MANUFACTURE) NQF LEVEL 3**

**Title 1: Produce components by performing engineering milling operations**

- Specific outcome 1.1: Prepare for work activity
- Specific outcome 1.2: Set milling machine
- Specific outcome 1.3: Perform milling operations
- Specific outcome 1.4: Apply quality checks on machined component
- Specific outcome 1.5: Recognise and report problems, changes and/or malfunctions while operating
- Specific outcome 1.6: Record information on work done
- Specific outcome 1.7: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 2: Produce components by performing engineering turning operations**

- Specific outcome 2.1: Prepare for work activity
- Specific outcome 2.2: Set lathe
- Specific outcome 2.3: Perform turning operations
- Specific outcome 2.4: Apply quality checks on machined component

**Title 3: Produce components by performing engineering grinding operations**

- Specific outcome 3.1: Prepare for work activity
- Specific outcome 3.2: Set grinding machine
- Specific outcome 3.3: Perform grinding operations
- Specific outcome 3.4: Apply quality checks on machined component

**Title 4: Manufacture production tooling to drawing or sample part**

- Specific outcome 4.1: Plan and prepare for tooling manufacturing process
- Specific outcome 4.2: Manufacture production tooling
- Specific outcome 4.3: Assemble tooling
- Specific outcome 4.4: Perform sample part try-out
- Specific outcome 4.5: Recognise and report problems, changes and/or malfunctions while working

**Title 5: Maintain and repair production tooling**

- Specific outcome 5.1: Identify and analyse defects in tooling
- Specific outcome 5.2: Dismantle and assess tooling components
- Specific outcome 5.3: Manufacture and/or repair tooling components



Specific outcome 5.4: Assemble tooling components

Specific outcome 5.5: Reset tools into press and perform sample part try-out

**Title 6: Produce components by spark eroding machining operations**

Specific outcome 6.1: Manufacture electrode

Specific outcome 6.2: Prepare for spark eroding machining process

Specific outcome 6.3: Prepare spark eroding machine for operation

Specific outcome 6.4: Perform spark eroding operations

Specific outcome 6.5: Apply quality checks on component

Specific outcome 6.6: Recognise and report problems, changes and/or malfunctions while operating

Specific outcome 6.7: Record information on work done

**Title 13: Perform heat treatment processes on engineering metals**

Specific outcome 13.1: Discuss and explain the heat treatment of metals

Specific outcome 13.2: Determine heat treatment requirements

Specific outcome 13.3: Prepare materials and equipment for heat treatment process

Specific outcome 13.4: Complete heat treatment of metals

**Title 14: Perform non-destructive tests on metal parts and components**

Specific outcome 14.1: Receive samples and check against documentation

Specific outcome 14.2: Carry out testing using ultrasonic methods

Specific outcome 14.3: Test parts for surface defects using magnetic particle inspection

Specific outcome 14.4: Recognise and report problems, changes and/or malfunctions while working

**Title 15: Test the physical properties of engineering metals**

Specific outcome 15.1: Receive samples and check against documentation

Specific outcome 15.2: Prepare for tests

Specific outcome 15.3: Complete tests and interpret and record results

Specific outcome 15.4: Store samples

Specific outcome 15.5: Care for test equipment

**Title 16: Produce detailed engineering drawings**

Specific outcome 16.1: Determine drawing requirements

Specific outcome 16.2: Perform calculations to produce drawing

Specific outcome 16.3: Produce drawings



**NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (TOOLING MANUFACTURE) NQF LEVEL 4****UNIT STANDARDS ON NQF LEVEL 4****CORE**

- Title 1:** Produce complex components using milling machines  
**Title 2:** Produce complex components using lathes  
**Title 3:** Manufacture complex tooling  
**Title 4:** Diagnose and repair faults on tooling during the production run

**ELECTIVE**

- Title 5:** Produce components using wire cutting operations  
**Title 6:** Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine  
**Title 7:** Grind tools and cutters used in engineering machining operations  
**Title 8:** Produce complex components by performing internal and external grinding operations  
**Title 9:** Produce components by performing horizontal boring operations  
**Title 10:** Produce components by performing vertical boring operations  
**Title 11:** Set automatic production lathes

**UNIT STANDARDS ON NQF LEVEL 5****ELECTIVE**

- Title 12:** Write computer numerical controlled (CNC) programmes for CNC machining centres using proprietary software

**UNIT STANDARDS AND SPECIFIC OUTCOMES IN  
NATIONAL CERTIFICATE IN MECHANICAL ENGINEERING (TOOLING MANUFACTURE) NQF LEVEL 4**

- Title 1: Produce complex components using milling machines**  
Specific outcome 1.1: Prepare for work activity  
Specific outcome 1.2: Set milling machine  
Specific outcome 1.3: Perform milling operations  
Specific outcome 1.4: Apply quality checks on machined component  
Specific outcome 1.5: Recognise and report problems, changes and/or malfunctions while operating  
Specific outcome 1.6: Record information on work done  
Specific outcome 1.7: Work safely with due care for self, fellow workers, machines, equipment, materials



and the environment

**Title 2: Produce complex components using lathes**

- Specific outcome 2.1: Prepare for work activity
- Specific outcome 2.2: Set lathe
- Specific outcome 2.3: Perform turning operations
- Specific outcome 2.4: Apply quality checks on machined component

**Title 3: Manufacture complex tooling**

- Specific outcome 3.1: Plan and prepare for tooling manufacturing process
- Specific outcome 3.2: Manufacture complex tooling
- Specific outcome 3.3: Assemble tooling
- Specific outcome 3.4: Perform sample part try-out
- Specific outcome 3.5: Recognise and report problems, changes and/or malfunctions while working

**Title 4: Diagnose and repair faults on tooling during the production run**

- Specific outcome 4.1: Monitor the performance of tooling on the production run
- Specific outcome 4.2: Perform minor repairs on line
- Specific outcome 4.3: Record required major tooling repairs
- Specific outcome 4.4: Identify potential production and maintenance problems

**Title 5: Produce components using wire cutting operations**

- Specific outcome 5.1: Prepare for work activity
- Specific outcome 5.2: Set up wire cutting machine for operation
- Specific outcome 5.3: Perform wire cutting operations
- Specific outcome 5.4: Apply quality checks on component

**Title 6: Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine**

- Specific outcome 6.1: Prepare and write programme
- Specific outcome 6.2: Prepare to set machine
- Specific outcome 6.3: Set machine to perform the specified work
- Specific outcome 6.4: Produce sample component
- Specific outcome 6.5: Operate CNC machine



**Title 7: Grind tools and cutters used in engineering machining operations**

- Specific outcome 7.1: Prepare for work activity
- Specific outcome 7.2: Set grinding machine
- Specific outcome 7.3: Perform tool and cutter grinding operations
- Specific outcome 7.4: Apply quality checks on machined tool/cutter

**Title 8: Produce complex components by performing internal and external grinding operations**

- Specific outcome 8.1: Prepare for work activity
- Specific outcome 8.2: Set grinding machine
- Specific outcome 8.3: Perform universal grinding operations
- Specific outcome 8.4: Apply quality checks on machined component

**Title 9: Produce components by performing horizontal boring operations**

- Specific outcome 9.1: Prepare for work activity
- Specific outcome 9.2: Set horizontal boring machine
- Specific outcome 9.3: Perform horizontal boring operations
- Specific outcome 9.4: Clean machine

**Title 10: Produce components by performing vertical boring operations**

- Specific outcome 10.1: Prepare for work activity
- Specific outcome 10.2: Set vertical boring machine
- Specific outcome 10.3: Perform vertical boring operations
- Specific outcome 10.4: Apply quality checks on machined component

**Title 11: Set automatic production lathes**

- Specific outcome 11.1: Prepare for machine set up
- Specific outcome 11.2: Set machine
- Specific outcome 11.3: Produce sample component
- Specific outcome 11.4: Monitor machine setting

**Title 12: Write computer numerical controlled (CNC) programmes for CNC machining centres using proprietary software**

- Specific outcome 12.1: Prepare to write programme
- Specific outcome 12.2: Write programme
- Specific outcome 12.3: Verify programme
- Specific outcome 12.4: Recognise and report problems and changes while programming



No. 1186

20 September 2002

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

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

**Manufacturing and Assembly**

Registered by NSB 06, Manufacturing, Engineering and Technology, publishes the following qualifications and unit standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the qualification and unit standards upon which qualifications are based. The full qualification and unit standards can be accessed via the SAQA web-site at [www.saga.org.za](http://www.saga.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, 659 Pienaar street, Brooklyn, Pretoria.

Comment on the unit standards should reach SAQA at the address *below and no later than 21 October 2002* espondence should be marked **Standards Setting – SGB for Manufacturing and Assembly** and addressed to

The Director: Standards Setting and Development  
SAQA  
*Attention: Mr. D Mphuthing*  
Postnet Suite 248  
Private Bag X06  
Waterkloof  
0145  
or faxed to 012 – 482 0907



**SAMUEL B.A. ISAACS**  
EXECUTIVE OFFICER



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechatronics: NQF Level 2**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 2

**Credit:** 140

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The manufacturing industry is characterised by technologically sophisticated automation processes using Computerised Integrated Manufacturing systems (CIM) that integrate the fields of mechanical, electrical and electronic engineering and control and information technology. The field of mechatronics deals with the installation, maintenance and commissioning of such CIM systems that must conform to all safety aspects as per regulations and legislation. People working in the mechatronics field require specialised technical skills and knowledge as well as highly developed hand skills to enable them to install, maintain and commission mechatronic systems.



This is the first qualification in a series for learners who want to follow a career in mechatronics. This series reflects the skills, knowledge and understanding required to perform effectively in industry, whether in micro, small, medium or large enterprises.

For those who have been in the workplace for a long time, this qualification represents part of the RPL process that acknowledges workplace skills acquired without the benefit of formal education and training. For the new entrant, this qualification recognises the applied competence needed by a productive person in a structured workplace.

This qualification forms the basis for further learning in the field of mechatronics.

**Purpose of the qualification:**

The purpose of this qualification is to provide learners, education providers, training providers and employers with the standard and range of learning required to work effectively in the mechatronics environment and meet the challenges of such an environment.

The primary skills that are recognised by this qualification include the ability to:

- Construct simple parts within given tolerances
- Install, test and maintain basic electrical circuits
- Construct and test electronic circuits

These capabilities require an understanding of basic electrical and electronic theory, engineering drawings and electrical circuit diagrams and concepts of measurement, and an ability to join engineering materials, use tools and use a computer. Hand skills play a large role in this qualification.

Qualifying learners will be able to relate what they see and experience to science and technology principles and concepts.

What learners achieve in this qualification will also serve as a basis for further learning where they will engage more directly in the installation, maintenance and commissioning of mechatronic systems.



**Learning assumed to be in place:**

This qualification assumes learners have a GETC at NQF level 1 or alternatively, ABET qualifications.

The qualifications must include:

- Literacy
- Numeracy
- Basic concepts of science and technology

**Access to the qualification:**

Open access

This qualification series recognises skills, knowledge and values relevant to the workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge and skill gained to activities 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

**Exit level Outcomes:****Exit level outcome 1**

Demonstrate an understanding of basic mechanical engineering in the joining and assembly of parts and in mechanical installations meeting quality requirements and working safely and in environmentally aware manner

**Associated Assessment Criteria**

- Assemblies meet specifications.
- Safe working practices are adhered to.
- Working drawings and instructions are interpreted correctly.
- Appropriate materials and tools are selected.
- Tools, equipment and materials are correctly stored upon completion of assembly activity.



- Can respond to questions and discuss issues related to the assembly of mechanical components.

**Exit level outcome 2**

Demonstrate an understanding of basic electrical/electronic engineering theory and the ability to install electrical and electronic components in a circuit that meets quality requirements, working in a safe and environmentally aware manner.

**Associated Assessment Criteria**

- Appropriate components are selected
- Safe working practices are adhered to
- Cable installation meets quality standards
- Electrical safety practices are adhered to
- Testing and measurement procedures are followed correctly
- Electrical and electronic circuits function to specifications
- Can respond to questions and discuss issues related to the construction of electrical and electronic diagrams

**Exit level outcome 3**

Demonstrate an ability to generate and retrieve files and store information and an understanding of the logic of using different paths for retrieving files using personal computers.

**Associated Assessment Criteria**

- Can respond to questions and discuss issues related to computer hardware and software
- Can generate, save and retrieve documents within a computer system.

**Exit level outcome 4**

Recognise and respond to routine problems related to the assembly of components and the construction of circuits.

**Associated Assessment Criteria**

- Various options are considered before a solution is chosen
- Lessons learnt in previous performances are used
- Responses are appropriate to the nature of the problem



- Problems are accurately reported to relevant personnel in a timely manner
- Can respond to questions and discuss issues related to routine problems encountered while working

**Exit level outcome 5**

Communicate with peers and members of supervisory/management levels by demonstrating the ability to summarise information and express opinions on given information in spoken and written form

**Associated Assessment Criteria**

- Communication is regular and ongoing
- Information is clear and accurate and conveyed in a timely manner
- Relationships with peers and supervisory/management levels are established and functioning

**Exit level outcome 6**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability:**

As a starting point, the series of qualifications in the field of mechatronics of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in New Zealand and Australia. It was found to be difficult to compare the New Zealand and Australian narrow focus qualifications with these broad-based qualifications in the specialised field of mechatronics. Therefore, extensive reference was made to training materials from Germany and the United States when constructing these qualifications to ensure the relevance of the qualifications content and benchmarking with best practice world wide.



**Integrated Assessment:**

The integrated assessment must be based on a summative assessment guide. The guide must spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in primary activities as well as other interactions) or by relevant simulations
- Asking questions and initiating short discussions to test understanding
- Looking at records and reports

The learner may choose in which language s/he wants to be assessed. This should be established as part of a process or preparing the learner for assessment and familiarising the learner on 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 required of mechatronics. The assessment process should also establish how the critical outcomes have been advanced by the learning process

**Recognition of prior learning:**

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

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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 and have a qualification in engineering.

To assure the quality of the assessment process the moderation should cover one of the following:

- Assessor credentials
- The assessment instrument
- The assessment process

Where assessment and moderation are taking place in sectors other than the MERSETA, assessment and moderation should be in terms of a memorandum of understanding negotiated with the MERS ETQA

**Criteria for registration of assessors:**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of engineering- with a minimum of four years experience in the field of mechatronics. The subject matter experience of the assessor can be established by recognition of prior learning
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other ETQA



## NATIONAL CERTIFICATE IN MECHATRONICS: NQF LEVEL 2

Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
8962	Maintain and adapt oral communication	2	5
8963	Access and use information from texts	2	5
8964	Write for a defined context	2	5
	Communicate at work	2	5
	<b>Mathematics</b>		
8982	Demonstrate an understanding of rational and irrational numbers and number systems within the context of relevant calculations	2	3
8983	Use mathematics to investigate and monitor the financial aspects of personal and community life	2	2
9009	Apply basic knowledge of statistics and probability in order to investigate life and work related problems	2	3
9008	Measure, estimate and calculate physical quantities and explore, describe and represent geometrical relationships in two dimensions in different life or workplace contexts	2	3
9007	Work with a range of patterns and basic functions to solve related problems	2	5
	<b>Total fundamental</b>		<b>36</b>
Core			
NLRD	Title	Level	Credits
	<b>General</b>		
	Select, use and care for engineering hand tools	2	8
	Select, use and care for engineering power tools	2	6
	Select, use and care for engineering measuring equipment	2	4
	Mark off basic engineering shapes	2	2
	Perform basic welding / joining of metals	2	8
	Read, interpret and produce basic engineering drawings	2	6
	<b>Mechanical assembly</b>		
	Assemble mechanical components	2	12
	<b>Industrial Electronics:</b>		



	Construct and test basic electronic circuits	2	16
	<b>Electrical installations</b>		
	Install, test, maintain and commission basic electrical circuits	2	16
	<b>Safety, health &amp; environmental quality assurance</b>		
	Keep the work area safe and productive	2	8
	<b>Information Technology:</b>		
7547	Operate a personal computer system	2	6
	<b>Total Core</b>		<b>92</b>
<b>Elective</b>			
<b>NLRD</b>	<b>Safety, Health &amp; Environment</b>		
	Perform basic first aid	2	4
	Perform basic fire fighting	2	2
	<b>Business Relations</b>		
	Explain the individual's role within business	2	4
	<b>People: interacting, leading and developing</b>		
9322	Work in a team	2	3
	<b>Life Skills</b>		
9268	Manage basic personal finance	2	6
	Understand and deal with HIV/Aids	2	3
	Develop a learning plan and a portfolio for assessment	2	6
	<b>Information Technology:</b>		
7568	Demonstrate knowledge of and produce word processing documents using basic functions	2	3
	<b>Working with Information:</b>		
	Collect and use information	2	5
	<b>Minimum elective credits required for qualification</b>		<b>10</b>
	<b>Total for qualification</b>		<b>140</b>



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechatronics: NQF Level 3**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 3

**Credit:** 146

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The manufacturing industry is characterised by technologically sophisticated automation processes using Computerised Integrated Manufacturing systems (CIM) that integrate the fields of mechanical, electrical and electronic engineering and control and information technology. The field of mechatronics deals with the installation, maintenance and commissioning of such CIM systems that must conform to all safety aspects as per regulations and legislation. People working in the mechatronics field require specialised technical skills and knowledge as well as highly developed hand skills to enable them to install, maintain and commission mechatronic systems.



This is the second qualification in a series for learners who want to follow a career in mechatronics. This series reflects the skills, knowledge and understanding required to perform effectively in industry, whether in micro, small, medium or large operations.

For those who have been in the workplace for a long time, this qualification represents part of the RPL process that acknowledges workplace skills acquired without the benefit of formal education and training.

This qualification forms the basis for further learning in the field of mechatronics.

**Purpose of the qualification:**

The purpose of this qualification is to provide learners, education providers, training providers and employers with the standard and range of learning required to work effectively in the mechatronics environment and meet the challenges of such an environment.

The primary skills that are recognised by this qualification include the ability to:

- Installation, test and commission single phase AC/DC machines, control and switch gear
- Install, test and maintain basic pneumatic systems
- Install, test and maintain basic hydraulic systems
- Program, install and test basic PLC control systems

These capabilities require an understanding of mechanical, electrical and electronic theory, and circuit diagrams, and an ability to machine simple parts using milling machines or lathes. Hand skills play a large role in this qualification.

Qualifying learners will also be able to relate what they are doing to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.



What learners achieve in this qualification will also serve as a basis for further learning where they will engage further in the installation, maintenance and commissioning of mechatronic systems.

**Learning assumed to be in place:**

It is assumed that learners entering a programme towards this qualification have achieved a mechatronics NQF level 2 qualification or have the relevant experience.

**Access to the qualification:**

Open access.

This qualification series recognises skills, knowledge and values relevant to the workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge and skill gained to activities 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

**Exit level Outcomes:**

**Exit level outcome 1**

Demonstrate an understanding of a variety of machining methods and an ability to produce simple components that meet quality and output requirements, working safely and in an environmentally aware manner.

**Associated Assessment Criteria**

- Output and quality requirements are met
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the theoretical principles of machining, the various machining methods and the functioning of machinery.



**Exit level outcome 2**

Demonstrate the understanding of and an ability to install, test and commission basic hydraulic and pneumatic systems, working safely and in an environmentally aware manner.

**Associated Assessment Criteria**

- Hydraulic and pneumatic system installation, testing and commissioning meets specifications
- Safe working practices are adhered to.
- Can respond to questions and discuss issues related to pneumatic systems

**Exit level outcome 3**

Demonstrate an understanding of and an ability to install, test, maintain and programme programmable logic controllers (PLCs)

**Associated Assessment Criteria**

- PLC installation, testing and maintenance meets specifications
- PLC programming meets specifications
- Safe working practices are observed
- Can respond to questions and discuss issues related to PLCs

**Exit level outcome 4**

Demonstrate the ability to install and configure PC hardware and software

**Associated Assessment Criteria**

- Hardware and software interfaces and compatibility of hardware components and system requirements for software are checked
- System components are installed to specifications and hardware is configured.
- Software is installed and configured to software manufacturer's specifications
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to PC hardware and software installation and configuration.

**Exit level outcome 5**

Select appropriate procedures to solve familiar problems within a mechatronics environment and operate within clearly defined contexts, with some scope for personal decision-making and responsibility



**Associated Assessment Criteria**

- Appropriate procedures are selected to solve problems in an efficient and effective manner
- Unfamiliar problems are accurately reported to appropriate personnel
- Can respond to questions and discuss issues related to familiar problems in the mechatronics environment

**Exit level outcome 6**

Communicate with peers, customers and members of supervisory/management levels by demonstrating the ability to gather and summarise information from a range of sources and produce coherent presentations in a prescribed format

**Associated Assessment Criteria**

- Information is gathered from a range of sources and accurately summarised into a prescribed format.
- Information is clear and accurate and presented in a timely manner in the required format to appropriate parties.
- Relationships with peers and supervisory./management levels are established and functioning

**Exit level outcome 7**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability:**

As a starting point, the series of qualifications in the field of mechatronics of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in New Zealand and Australia. It was found to be difficult to compare the New Zealand and Australian narrow focus qualifications with these broad-based qualifications in the specialised field of mechatronics. Therefore, extensive reference was made to training materials from Germany and the United States



when constructing these qualifications to ensure the relevance of the qualifications content and benchmarking with best practice world wide.

**Integrated Assessment:**

The integrated assessment must be based on a summative assessment guide. The guide must spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in primary activities as well as other interactions) or by relevant simulations
- Asking questions and initiating short discussions to test understanding
- Looking at records and reports

The learner may choose in which language s/he wants to be assessed. This should be established as part of a process or preparing the learner for assessment and familiarising the learner on 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 which underpin the activities required of mechatronics. The assessment process should also establish how the critical outcomes have been advanced by the learning process

**Recognition of prior learning:**

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

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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 and have a qualification in engineering.

To assure the quality of the assessment process the moderation should cover one of the following:

- Assessor credentials
- The assessment instrument
- The assessment process

Where assessment and moderation are taking place in sectors other than the MERSETA, assessment and moderation should be in terms of a memorandum of understanding negotiated with the MERS ETQA

**Criteria for registration of assessors:**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of engineering- with a minimum of four years in a mechatronics environment. The subject matter experience of the assessor can be established by recognition of prior learning
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other ETQA



**NATIONAL CERTIFICATE IN MECHATRONICS: NQF LEVEL 3**

<b>Fundamental</b>			
<b>NLRD</b>	<b>Title</b>	<b>Level</b>	<b>Credits</b>
	<b>Communication</b>		
8968	Accommodate audience and context needs in oral communication	3	5
8969	Interpret and use information from texts	3	5
8970	Write texts for a range of communicative contexts	3	5
9529	Compile feasibility and commissioning reports	3	3
9528	Communicate with clients	3	3
	<b>Mathematics</b>		
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	3	2
9014	Use mathematics to investigate and monitor the financial aspects of personal and business issues	3	5
9012	Investigate life-related problems using data and probabilities	3	5
9013	Measure, estimate and calculate physical quantities and explore, describe and represent, interpret and justify geometrical relationships in two and three dimensional space relevant to the life or workplace of the community	3	4
	<b>Total fundamental</b>		<b>37</b>
<b>Core</b>			
<b>NLRD</b>	<b>Title</b>	<b>Level</b>	<b>Credits</b>
	<b>General</b>		
	Operate and monitor a milling machine to produce simple components	2	12
	Operate and monitor a lathe to produce simple components	2	12
	Identify engineering materials, their characteristics and applications and common metals tests and treatments used in engineering	2	4
	<b>Electrical</b>		
	Install, test and maintain single phase AC /DC machines and control gear	3	15
	<b>Hydraulics and Pneumatics</b>		
	Install, test and maintain a basic hydraulics system	3	10
	Install, test and maintain a basic pneumatic system	3	10
	<b>Programmable controllers</b>		
	Install and programme basic programmable logic controllers	3	20
	<b>Information technology</b>		
	Install, use and test hardware and software	3	6
	<b>Quality</b>		
	Apply quality procedures	3	8
	<b>Total Core</b>		<b>97</b>
<b>Elective</b>			
<b>NLRD</b>	<b>Titles</b>		<b>Credits</b>
	<b>General</b>		
8038	Operate a lift truck	3	6



8039	Operate a crane	3	10
	<b>Testing</b>		
	Test the physical properties of engineering metals	3	4
	Perform non-destructive tests on metal parts and components	3	6
	<b>Safety, health and environmental quality assurance</b>		
	Perform the role of a safety, health and environmental protection representative	3	4
	<b>People: interacting, leading, developing</b>		
	Explain and use organisational procedures	3	6
9531	Show understanding of diversity in the workplace	3	3
9533	Use communication skills to handle and resolve conflict in the workplace	3	3
	Develop a personal financial plan	3	2
	<b>Minimum elective credits required</b>		<b>12</b>
	<b>Total for qualification</b>		<b>146</b>



### National Diploma in Rubber Technology: NQF Level 5

Title	Level	Credits	NLRD ID
<b>Communication</b>			
Use communication techniques effectively	5	8	
<b>Mathematics</b>			
Use mathematical and statistical techniques effectively as a rubber technologist	5	34	
<b>Total fundamental</b>		<b>42</b>	

Title	Level	Credits	NLRD ID
<b>Rubber Technology</b>			
Test and analyse rubber materials, components and products	5	45	
Determine requirements for rubber applications	5	60	
Perform auditing activities	5	12	
<b>Business skills</b>			
Implement new projects in a rubber manufacturing and assembly process	5	30	
<b>Quality</b>			
Optimise the quality assurance system	5	6	
<b>Business relations</b>			
Maintain business processes	5	10	
<b>People interacting, leading and developing</b>			
Manage a team	5	4	9406
<b>Total Core</b>		<b>167</b>	
<b>Titles</b>		<b>Credits</b>	<b>NLRD ID</b>
Choice of a minimum of 30 elective credits to be drawn from the following learning areas:			
• Business management, e.g. purchasing, stock control, accounting			
• Technical drawing			
• Mercantile law			
• Physics			
<b>Minimum elective credits towards qualification</b>		<b>30</b>	
<b>Total for qualification</b>		<b>249</b>	



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechatronics: NQF Level 4**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 4

**Credit:** 151

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The manufacturing industry is characterised by technologically sophisticated automation processes using Computerised Integrated Manufacturing systems (CIM) that integrate the fields of mechanical, electrical and electronic engineering and control and information technology. The field of mechatronics deals with the installation, maintenance and commissioning of such CIM systems that must conform to all safety aspects as per regulations and legislation. People working in the mechatronics field require specialised technical skills and knowledge as well as highly developed hand skills to enable them to install, maintain and commission mechatronic systems.



This is the third qualification in a series for learners who want to follow a career in Mechatronics. This series reflects the skills, knowledge and understanding required to perform effectively in industry, whether in micro, small, medium or large operations.

For those who have been in the workplace for a long time, this qualification represents part of the RPL process that acknowledges workplace skills acquired without the benefit of formal education and training. For the new entrant, this qualification recognises the applied competence needed by a productive person in a structured workplace

This qualification forms the basis for further learning in the field of mechatronics within the higher education band.

**Purpose of the qualification:**

The purpose of this qualification is to provide learners, education providers, training providers and employers with the standard and range of learning required to work effectively in the mechatronics environment and meet the requirements of such an environment.

The primary skills that are recognised by this qualification include the ability to:

- Installation, test and commission three phase AC/DC machines, control and switch gear
- Use, operate and maintain an industrial robot system
- Install and programme variable speed control drives
- Install, test and maintain electro-pneumatic systems
- Install, test and maintain electro- hydraulic systems
- Install, test and configure bus systems
- Install and program industrial programmable logic controllers

Hand skills and advanced theoretical and analytical skills play a large role in this qualification.

Qualifying learners will also be able to relate what they see and experience to scientific and technological principles and concepts. They will also be able to maintain and



support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

What learners achieve in this qualification will also serve as a basis for further learning in the field of mechatronics within the higher education and training band.

**Learning assumed to be in place:**

This qualification assumes learners have attained a Mechatronics NQF level 3 qualification or have the relevant experience.

**Access to qualification:**

Open access

This qualification series recognises skills, knowledge and values relevant to the workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge and skill gained to activities 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

**Exit level Outcomes:**

**Exit level outcome 1**

Demonstrate an understanding of and an ability to install, commission, test and maintain three phase AC/DC machines, control and switch gear, working safely and in an environmentally aware manner.

**Associated Assessment Criteria**

- AC/DC machine installation and commissioning meets specifications
- Testing and maintenance on AC/DC machines meets specifications
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to AC/DC machines



**Exit level outcome 2**

Demonstrate an understanding of power electronics technology and an ability to install, test and configure manual and software driven variable speed control drives, working safely and in an environmentally aware manner

**Associated Assessment Criteria**

- Power electronic circuits constructed and tested meet specifications and quality requirements
- Appropriate variable speed control components are selected
- Electrical and mechanical installation meets quality standards
- Software variable speed control drives correctly configured
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to power electronics technology and the installation, testing and configuration of variable speed control drives

**Exit level outcome 3**

Demonstrate the understanding and ability to install and configure local area network (LAN) and related bus systems

**Associated Assessment Criteria**

- Networked subsystems meet specifications
- Bus systems installed and configured to specifications
- Can respond to questions and discuss issues related to hardware and software

**Exit level outcome 4**

Demonstrate an understanding of and an ability to install and programme industrial programmable logic controllers (PLCs), working in a safe and environmentally aware manner

**Associated Assessment Criteria**

- PLC hardware, software and sensor/actuator addresses of a PLC are configured to specifications
- Advanced PLC control programmes are written to meet job specifications
- Advanced PLC circuits installation and programming meets specifications
- Programme and installations are tested and debugged according to requirements



- Can respond to questions and discuss issues related to industrial PLCs.

**Exit level outcome 5**

Demonstrate an understanding of and an ability to install and maintain electro-pneumatic and electro-hydraulic systems by interpreting circuit diagrams, performing the necessary tests and installing components, working safely and in an environmentally aware manner.

**Associated Assessment Criteria**

- Installation meets specifications
- Appropriate tests are performed and results recorded
- Integrated PLC controlled circuit programming meets specifications
- Can respond to questions and discuss issues related to electro-pneumatic and electro-hydraulic systems

**Exit level outcome 6**

Demonstrate an understanding and ability to programme and use an industrial robot system

**Associated Assessment Criteria**

- Robot programming meets job requirements and specifications
- Robot is used appropriately meeting quality and output requirements
- 
- Safe working practices are adhered to
- Can respond to questions and discuss issues related to the use and programming of industrial robots.

**Exit level outcome 7**

Maintain and support procedures to solve a variety of problems, both familiar and unfamiliar, within a mechatronics environment and operate within familiar and new situations, taking responsibility and making decisions

**Associated Assessment Criteria**

- Solutions to problems are based on a clear analysis of information gathered through diagnostic procedures.
- Procedures are modified to respond to unfamiliar problems where appropriate



- Can respond to questions and discuss issues related to familiar and unfamiliar problems arising in the mechatronics environment
- All actions related to problem solving are accurately recorded for future reference

**Exit level outcome 8**

Communicate and present information clearly and reliably and demonstrate the ability to analyse information to identify problems and determine trends

**Associated Assessment Criteria**

- Conditions, evidence and incidences are reported accurately in a timely manner and discussed with peers and management
- Data gathered through diagnostic procedures is examined systematically and analysis is repeated until problem is solved.
- Records are available for scrutiny and future reference

**Exit level outcome 9**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained.
- Learning plan is developed

**International comparability:**

As a starting point, the series of qualifications in the field of mechatronics of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in New Zealand and Australia. It was found to be difficult to compare the New Zealand and Australian narrow focus qualifications with these broad-based qualifications in the specialised field of mechatronics. Therefore, extensive reference was made to training materials from Germany and the United States when constructing these qualifications to ensure the relevance of the qualifications content and benchmarking with best practice world wide.



**Integrated Assessment:**

The integrated assessment must be based on a summative assessment guide. The guide must spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in primary activities as well as other interactions) or by relevant simulations
- Asking questions and initiating short discussions to test understanding
- Looking at records and reports

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 on 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 required of Mechatronics. The assessment process should also establish how the learning process has advanced the critical outcomes

**Recognition of prior learning:**

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

**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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 and have a qualification in engineering.

To assure the quality of the assessment process, the moderation should cover one of the following:

- Assessor credentials
- The assessment instrument
- The assessment process

Where assessment and moderation are taking place in sectors other than the MERSETA, assessment and moderation should be in terms of a memorandum of understanding negotiated with the MERS ETQA

**Criteria for registration of assessors:**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of engineering- with a minimum of four years in a mechatronics environment. The subject matter experience of the assessor can be established by recognition of prior learning
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other ETQA



## NATIONAL CERTIFICATE IN MECHATRONICS: NQF LEVEL 4

Fundamental			
NLRD	Title	Level	Credits
	<b>Communication</b>		
8968	Engage in sustained oral communication and evaluate spoken texts	4	5
8969	Read, analyse and respond to a variety of texts	4	5
8970	Write for a wide range of contexts	4	5
9529	Write a technical report	4	4
9528	Communicate in an assertive manner with clients and fellow workers	4	4
	<b>Mathematics</b>		
9014	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	4	4
9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	4	6
9016	Measure, estimate and calculate physical quantities and explore, critique and prove geometrical relationships in two and three dimensional space in the life and workplace of the adult with increasing responsibilities	4	6
	<b>Total fundamental</b>		<b>41</b>
Core			
NLRD	Title	Level	Credits
	<b>Electrical</b>		
	Install, test and maintain three phase AC/DC machines and control gear	4	10
	<b>Robot Technology</b>		
	Programme, use and maintain an industrial robot	4	10
	<b>Pneumatics and Hydraulics</b>		
	Install, test and maintain an electro-pneumatic system	4	20
	Install, test and maintain an electro-hydraulic system	4	15
	<b>Programmable Logic Controllers</b>		
	Install and programme advanced industrial programmable logic controllers	4	20
	<b>Power Electronics</b>		
	Install, test and configure variable speed control drives	4	10
	<b>Information Technology</b>		
	Install, test and configure Bus systems	4	10
	<b>Quality</b>		
	Maintain the quality assurance system	4	5
	<b>Total Core</b>		<b>100</b>



**SOUTH AFRICAN QUALIFICATIONS AUTHORITY****National Certificate in Mechatronics: NQF Level 5**

**Field:** Manufacturing, Engineering and Technology - NSB 06

**Sub-field:** Manufacturing & Assembly

**Level:** 5

**Credit:** 123

**Issue date:**

**Review date:**

**Rationale for the qualification:**

The manufacturing industry is characterised by technologically sophisticated automation processes using Computerised Integrated Manufacturing systems (CIM) that integrate the fields of mechanical, electrical and electronic engineering and control and information technology. The field of mechatronics deals with the installation, maintenance and commissioning of such CIM systems that must conform to all safety aspects as per regulations and legislation. People working in the mechatronics field require specialised technical skills and knowledge as well as highly developed hand skills to enable them to install, maintain and commission mechatronic systems.



This is the fourth qualification in the certificate series for learners who want to follow a career in mechatronics. This series will reflect the skills, knowledge and understanding required to perform effectively in industry, whether in micro, small, medium or large operations.

For those who have been in the workplace for a long time, this qualification represents part of the RPL process that acknowledges workplace skills acquired without the benefit of formal education and training. For the new entrant, this qualification recognises the applied competence needed by a productive person in a structured workplace.

This qualification forms the basis for further development in the higher education and training band in the field of engineering.

**Purpose of the qualification:**

The purpose of this qualification is to provide learners, education providers, training providers and employers with the standard and range of learning required to work effectively in the mechatronics environment and meet the requirements of such an environment.

The primary skills that are recognised by this qualification include the ability to:

- Install, maintain, commission and hand over a complex computer integrated manufacturing system
- Ensure optimum quality of production

Hand skills and advanced theoretical and analytical skills play a large role in this qualification.

Qualified learners will also understand:

- How to maintain and influence relationships in a complex production environment
- How to achieve change
- How to work with a range of information sources to optimise performance and quality

With this understanding learners will be able to participate in workplace activities.



Qualifying learners will also be able to relate what they see and experience to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

**Learning assumed to be in place:**

This qualification assumes learners have attained a Mechatronics NQF level 4 qualification or have the relevant experience.

**Access to the qualification:**

Open access

This qualification series recognises skills, knowledge and values relevant to the workplace. It is designed for learners who:

- Have attended courses and then apply the knowledge and skill gained to activities 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

**Exit level Outcomes:**

**Exit level outcome 1**

Install, test and commission a complex integrated computer manufacturing system

**Associated Assessment Criteria**

- System parameters are met
- Bus parameterisation is correctly done
- Software is installed and configured to specification
- PLC Programming of system meets specifications
- Can respond to questions and discuss issues related to the installation, testing and commissioning of a complex integrated computer manufacturing system

**Exit level outcome 2**

Demonstrate the ability to handover computer integrated systems to customers



**Associated Assessment Criteria**

- Appropriate communication procedures and internal communication systems are used to communicate operating instructions and demonstrate the use of product manuals
- System demonstrations and presentations on equipment are given

**Exit level outcome 3**

Demonstrate an understanding of how to maintain the efficiencies of an automotive manufacturing and assembly process and how to identify opportunities for optimising such a process

**Range:** Maintaining and optimising the process includes maintaining and optimising aspects of equipment operation, materials usage and inventory management, the utilisation of personnel, quality, safety, health, and environmental practices

**Associated Assessment Criteria**

- Production efficiencies are maintained.
- Performance and training issues affecting quality, safety, health, and the environment are identified and reported
- Process output is recorded and trends mapped
- Options to achieve process improvements are generated and tested and reflect a clear understanding of issues

**Exit level outcome 4**

Demonstrate an understanding of options for further learning in this or a related field of learning and preparation requirements for such learning

**Associated Assessment Criteria**

- Options are explained
- Preparation requirements are explained
- Learning plan is developed

**International comparability:**

As a starting point, the series of qualifications in the field of mechatronics of which this qualification forms a part, was compared to other, similar outcomes-based qualifications, certifications or skills standards in New Zealand and Australia. It was found to be difficult to compare the New Zealand and Australian narrow focus qualifications with



these broad-based qualifications in the specialised field of mechatronics. Therefore, extensive reference was made to training materials from Germany and the United States when constructing these qualifications to ensure the relevance of the qualifications content and benchmarking with best practice world wide.

**Integrated Assessment:**

The integrated assessment must be based on a summative assessment guide. The guide must spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in primary activities as well as other interactions) or by relevant simulations
- Asking questions and initiating short discussions to test understanding
- Looking at records and reports

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 on 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 required of Mechatronics. The assessment process should also establish how the learning process has advanced the critical outcomes.

**Recognition of prior learning:**

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



**Articulation possibilities:**

The qualification has been designed and structured so that qualifying learners can move from one context to another. Employers or institutions should be able to evaluate the outcomes of this qualification against the needs of their 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 and have a qualification in engineering.

To assure the quality of the assessment process the moderation should cover one of the following:

- Assessor credentials
- The assessment instrument
- The assessment process

Where assessment and moderation are taking place in sectors other than the MERSETA, assessment and moderation should be in terms of a memorandum of understanding negotiated with the MERS ETQA

**Criteria for registration of assessors:**

The following criteria should be applied by the relevant ETQA:

1. Appropriate qualification in the field of engineering- with a minimum of four years in a mechatronics environment. The subject matter experience of the assessor can be established by recognition of prior learning
2. Appropriate experience and understanding of assessment theory, processes and practices
3. Good interpersonal skills and ability to balance the conflicting requirements of:
  - Maintaining national standards
  - The interests of the learner
  - The need for transformation and redressing the legacies of the past
  - The cultural background and language of the learner
4. Registration as an assessor with the MERS ETQA or any other relevant ETQA
5. Any other criteria required by the MERS ETQA or any other ETQA



**NATIONAL CERTIFICATE IN MECHATRONICS: NQF LEVEL 5**

<b>Fundamental</b>			
<b>NLRD</b>	<b>Title</b>	<b>Level</b>	<b>Credits</b>
	<b>Communication</b>		
	Use communication techniques effectively	5	8
	<b>Mathematics</b>		
	Use mathematical and statistical techniques effectively	5	20
	<b>Total fundamental</b>		<b>28</b>
<b>Core</b>			
<b>NLRD</b>	<b>Title</b>	<b>Level</b>	<b>Credits</b>
	<b>General</b>		
	Optimise the production process	5	24
	<b>Computer Integrated Manufacturing System</b>		
	Install, test and maintain a complex integrated manufacturing system	5	20
	<b>Business Relations</b>		
	Maintain business processes	5	10
	<b>Quality</b>		
	Optimise the quality assurance system	5	6
	<b>Total core</b>		<b>60</b>



Elective			
NLRD	Titles	Level	Credits
	<b>Robot Technology</b>		
	Install, commission and maintain an industrial robot system	5	15
	<b>General</b>		
	Write computer numerical controlled (CNC) programmes for CNC machining centres using proprietary software	5	30
	<b>Safety, health &amp; environmental quality assurance</b>		
	Optimise the safety, health and environmental protection system	5	6
	<b>People: Interacting, leading developing</b>		
9406	Manage a team	5	4
	Develop the skills of the work group	5	10
	<b>Working with information</b>		
9405	Analyse work requirements and plan ahead	5	4
	<b>Minimum elective credits towards qualification</b>		<b>35</b>
	<b>Total for qualification</b>		<b>123</b>



**NATIONAL CERTIFICATE IN MECHATRONICS – NQF LEVEL 2****UNIT STANDARDS ON NQF LEVEL 2****CORE**

**Title 1:** Construct and test basic electronic circuits

**Title 2:** Install, test, maintain and commission basic electrical circuits

**UNIT STANDARDS AND SPECIFIC OUTCOMES FOR THE NATIONAL CERTIFICATE IN  
MECHATRONICS – NQF LEVEL 2****Title 1: Construct and test basic electronic circuits**

- Specific outcome 1.1: Discuss and explain the principles of electronics
- Specific outcome 1.2: Demonstrate an understanding of the operation of basic electronic circuits
- Specific outcome 1.3: Read and interpret basic electronic circuit diagrams
- Specific outcome 1.4: Select electronic and related components for circuit construction
- Explain the functions of electronic and related components
- Specific outcome 1.5: Test electronic and related components for short circuit and open circuit conditions
- Use appropriate measuring equipment
- Specific outcome 1.6: Construct basic electronic circuits
- Diagnose electronic faults

**Title 2: Install, test, maintain and commission basic electrical circuits**

- Specific outcome 2.1: Read and interpret basic electric circuit diagrams and select electrical components
- Specific outcome 2.2: Select, terminate and join electric cables
- Specific outcome 2.3: Install wire-ways
- Specific outcome 2.4: Install basic electrical circuits in accordance with relevant regulations
- Specific outcome 2.5: Maintain electrical installations
- Specific outcome 2.6: Apply relevant safety practices and procedures when working with electrical equipment
- Specific outcome 2.7: Discuss and report incidents and problems related to electrical work



**NATIONAL CERTIFICATE IN MECHATRONICS – NQF LEVEL 3****UNIT STANDARDS ON NQF LEVEL 3****CORE**

- Title 1:** Install, test and maintain single phase AC/DC machines and control gear
- Title 2:** Install, test and maintain a basic hydraulic system
- Title 3:** Install, test and maintain a basic pneumatic system
- Title 4:** Install and programme basic programmable logic controllers
- Title 5:** Install, use and test hardware and software

**UNIT STANDARDS AND SPECIFIC OUTCOMES FOR THE NATIONAL CERTIFICATE IN  
MECHATRONICS – NQF LEVEL 3****Title 1: Install, test and maintain single phase AC/DC machines and control gear**

- Specific outcome 1.1: Select and install single phase AC/DC machines
- Specific outcome 1.2: Test and maintain machines
- Specific outcome 1.3: Install control gear
- Specific outcome 1.4: Test and maintain control gear
- Specific outcome 1.5: Connect machine and switch gear
- Specific outcome 1.6: Record information on work done
- Specific outcome 1.7: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 2: Install, test and maintain a basic hydraulic system**

- Specific outcome 2.1: Read and interpret basic hydraulic circuit diagrams and related component symbols
- Specific outcome 2.2: Identify and select hydraulic components
- Specific outcome 2.3: Install basic hydraulic circuits
- Specific outcome 2.4: Test basic hydraulic circuits and record results
- Specific outcome 2.5: Maintain basic hydraulic circuits
- Specific outcome 2.6: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment



**Title 3: Install, test and maintain a basic pneumatic system**

- Specific outcome 3.1: Read and interpret basic pneumatic circuit diagrams and related component symbols
- Specific outcome 3.2: Identify and select pneumatic components
- Specific outcome 3.3: Install basic pneumatic circuits
- Specific outcome 3.4: Maintain basic pneumatic circuits
- Specific outcome 3.5: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 4: Install and programme basic programmable logic controllers**

- Specific outcome 4.1: Identify and explain the function of PLC input devices (sensors) and output devices (actuators)
- Specific outcome 4.2: Design basic PLC sequential control programmes
- Specific outcome 4.3: Install basic PLC circuits
- Specific outcome 4.4: Configure inputs/outputs and test and run the PLC programme
- Specific outcome 4.5: Record information on work done
- Specific outcome 4.6: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 5: Install, use and test hardware and software**

- Specific outcome 5.1: Discuss and explain the installation, use and testing of hardware and software within the context of mechatronics
- Specific outcome 5.2: Install and configure hardware and software
- Specific outcome 5.3: Check hardware and software interfaces
- Specific outcome 5.4: Check compatibility of hardware components and system requirements
- Specific outcome 5.5: Carry out required changes to hardware and software
- Specific outcome 5.6: Document changes made



**NATIONAL CERTIFICATE IN MECHATRONICS – NQF LEVEL 4****UNIT STANDARDS ON NQF LEVEL 4****CORE**

- Title 1:** Install, test and maintain three phase AC/DC machines and control gear
- Title 2:** Programme, use and maintain an industrial robot
- Title 3:** Install, test and maintain an electro-pneumatic system
- Title 4:** Install, test and maintain an electro-hydraulic system
- Title 5:** Install and programme advanced industrial programmable logic controllers
- Title 6:** Install, test and configure variable speed control drives
- Title 7:** Install, test and configure Bus systems

**UNIT STANDARDS AND SPECIFIC OUTCOMES FOR THE NATIONAL CERTIFICATE IN  
MECHATRONICS – NQF LEVEL 4****Title 1: Install, test and maintain three phase AC/DC machines and control gear**

- Specific outcome 1.1:** Select and install three phase AC/DC machines
- Specific outcome 1.2:** Test and maintain machines
- Specific outcome 1.3:** Install control gear
- Specific outcome 1.4:** Test and maintain control gear
- Specific outcome 1.5:** Connect machine and switch gear
- Specific outcome 1.6:** Record information on work done
- Specific outcome 1.7:** Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 2: Programme, use and maintain an industrial robot system**

- Specific outcome 2.1:** Demonstrate an understanding of and an ability to apply the relevant robot safety
- Specific outcome 2.2:** Identify and explain the function of the various parts of an industrial robot
- Specific outcome 2.3:** Demonstrate an understanding of and an ability to use the handheld teach pendant
- Specific outcome 2.4:** Demonstrate an understanding of and an ability to maintain the manipulator
- Specific outcome 2.5:** Remove and install in-line wrist, toothed belts and motor units
- Specific outcome 2.6:** Programme the industrial robot using simple motion programmes
- Specific outcome 2.7:** Run and test industrial robot motion programmes



**Title 3: Install, test and maintain an electro-pneumatic system**

- Specific outcome 3.1: Read and interpret electro-pneumatic circuit diagrams and related component symbols
- Specific outcome 3.2: Identify and select electro-pneumatic components
- Specific outcome 3.3: Install manual electro- pneumatic circuits
- Specific outcome 3.4: Construct and programme an integrated PLC controlled electro-pneumatic circuit
- Specific outcome 3.5: Maintain electro-pneumatic circuits
- Specific outcome 3.6: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment

**Title 4: Install, test and maintain an electro-hydraulic system**

- Specific outcome 4.1: Read, interpret electro- hydraulic circuit diagrams and related component symbols
- Specific outcome 4.2: Identify and select electro-hydraulic components
- Specific outcome 4.3: Install electro- hydraulic circuits
- Specific outcome 4.4: Test electro-hydraulic circuits and record results
- Specific outcome 4.5: Construct and programme an integrated PC controlled electro-pneumatic circuit
- Specific outcome 4.6: Maintain electro-hydraulic circuits

**Title 5: Install and programme advanced industrial programmable logic controllers**

- Specific outcome 5.1: Identify and explain the function of PLC sensors/actuators
- Specific outcome 5.2: Configure PLC hardware and software
- Specific outcome 5.3: Design advanced PLC control programmes
- Specific outcome 5.4: Install and programme advanced PLC circuits
- Specific outcome 5.5: Test and run advanced PLC programmes

**Title 6: Install, test and maintain variable speed control drives**

- Specific outcome 6.1: Read and interpret power electronic circuit diagrams
- Specific outcome 6.2: Build power electronic circuits
- Specific outcome 6.3: Install industrial variable speed control units
- Specific outcome 6.4: Maintain installations

**Title 7: Install, test and configure Bus systems**

- Specific outcome 7.1: Install Local Area Networks and bus systems
- Specific outcome 7.2: Install Bus hardware
- Specific outcome 7.3: Configure Bus software
- Specific outcome 7.4: Install input/output units
- Specific outcome 7.5: Record information on work done



**NATIONAL CERTIFICATE IN MECHATRONICS – NQF LEVEL 5****UNIT STANDARDS ON NQF LEVEL 5****CORE**

**Title 1:** Optimise the production process

**Title 2:** Install, test and maintain a complex computer integrated manufacturing system

**ELECTIVE**

**Title 3:** Install, commission and maintain an industrial robot system

**UNIT STANDARDS AND SPECIFIC OUTCOMES FOR THE NATIONAL CERTIFICATE IN  
MECHATRONICS – NQF LEVEL 5****Title 1: Optimise the production process**

Specific outcome 1.1: Analyse data to identify opportunities for improvement

Specific outcome 1.2: Generate and test options to achieve improvement

Specific outcome 1.3: Generate plan for optimisation

- Make recommendations in a way that draws support for process improvement

Specific outcome 1.4: Implement improved recommendations

- Ensure all stakeholders understand their role in process improvement

Specific outcome 1.5: Adjust and update operating procedures

Specific outcome 1.6: Explain and discuss optimising issues with workgroup and other partners

Specific outcome 1.7: Understand the impact and the interrelationship of changes on production quality and output and production costs

**Title 2: Install, test and maintain a complex computer integrated manufacturing system**

Specific outcome 2.1: Read and interpret CIM system installation diagrams

Specific outcome 2.2: Identify, select, install and integrate CIM sub-systems

Specific outcome 2.3: Test, measure and record information

Specific outcome 2.4: Programme CIM systems

Specific outcome 2.5: Maintain complex CIM systems

Specific outcome 2.6: Work safely with due care for self, fellow workers, machines, equipment, materials and the environment



---

**Title 3: Install, commission and maintain and industrial robot system**

- Specific outcome 3.1: Demonstrate an understanding of and an ability to install an industrial robot system and peripherals
- Specific outcome 3.2: Demonstrate an understanding of commissioning and an ability to commission an industrial robot system
- Configure software
- Specific outcome 3.3: Demonstrate an understanding of and an ability to maintain the industrial controller
- Read and interpret controller circuit diagrams
  - Perform fault analysis
- Specific outcome 3.4: Record information on work done
-



**Dog ate your Gazette?  
... read it online**



**www.SA Gazettes.co.za**  
.....

**A new information Portal keeping you up to date with news, legislation, the Parliamentary programme and which is the largest pool of SA Gazette information available on the Web.**

- Easily accessible through the www!
  - Government Gazettes - from January 1994
  - Compilations of all Indexes pertaining to the past week's Government Gazettes
  - All Provincial Gazettes - from September 1995
  - Parliamentary Bills - as of January 1999
- Available in full-text, with keyword searching
- Sabinet Online scans, formats, edits and organize information for you. Diagrams and forms included as images.
- No stacks of printed gazettes - all on computer. Think of the storage space you save.
- Offers Bill Tracker - complementing the SA Gazettes products.

**For easy electronic access to full-text gazette info, subscribe to the SA Gazettes from Sabinet Online. Please visit us at [www.sagazettes.co.za](http://www.sagazettes.co.za)**

**Sabinet**  
*Online*





*Looking for back copies and out of print issues of  
the Government Gazette and Provincial Gazettes?*

## The National Library of SA has them!

Let us make your day with the information you need ...

National Library of SA, Pretoria Division

PO Box 397

0001 PRETORIA

Tel.:(012) 321-8931, Fax: (012) 325-5984

E-mail: [infodesk@nlsa.ac.za](mailto:infodesk@nlsa.ac.za)



*Soek u ou kopieë en uit druk uitgawes van die  
Staatskoerant en Provinsiale Koerante?*

## Die Nasionale Biblioteek van SA het hulle!

Met ons hoef u nie te sukkel om inligting te bekom nie ...

Nasionale Biblioteek van SA, Pretoria Divisie

Posbus 397

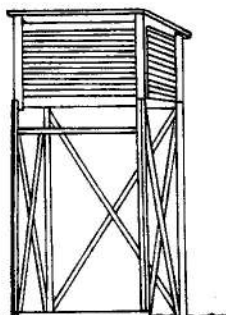
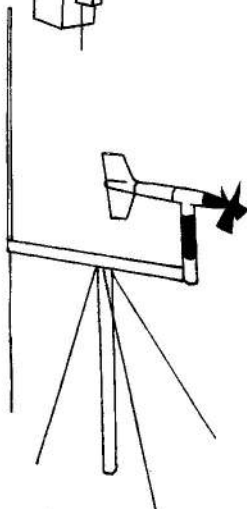
0001 PRETORIA

Tel.:(012) 321-8931, Faks: (012) 325-5984

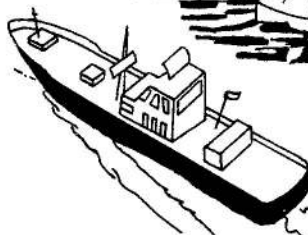
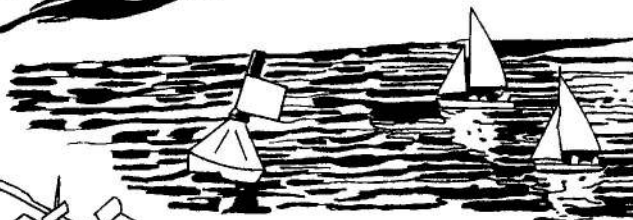
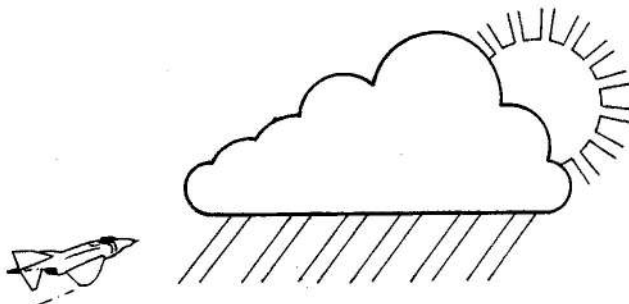
E-pos: [infodesk@nlsa.ac.za](mailto:infodesk@nlsa.ac.za)



# SA WEATHER BUREAU SA WEERBURO



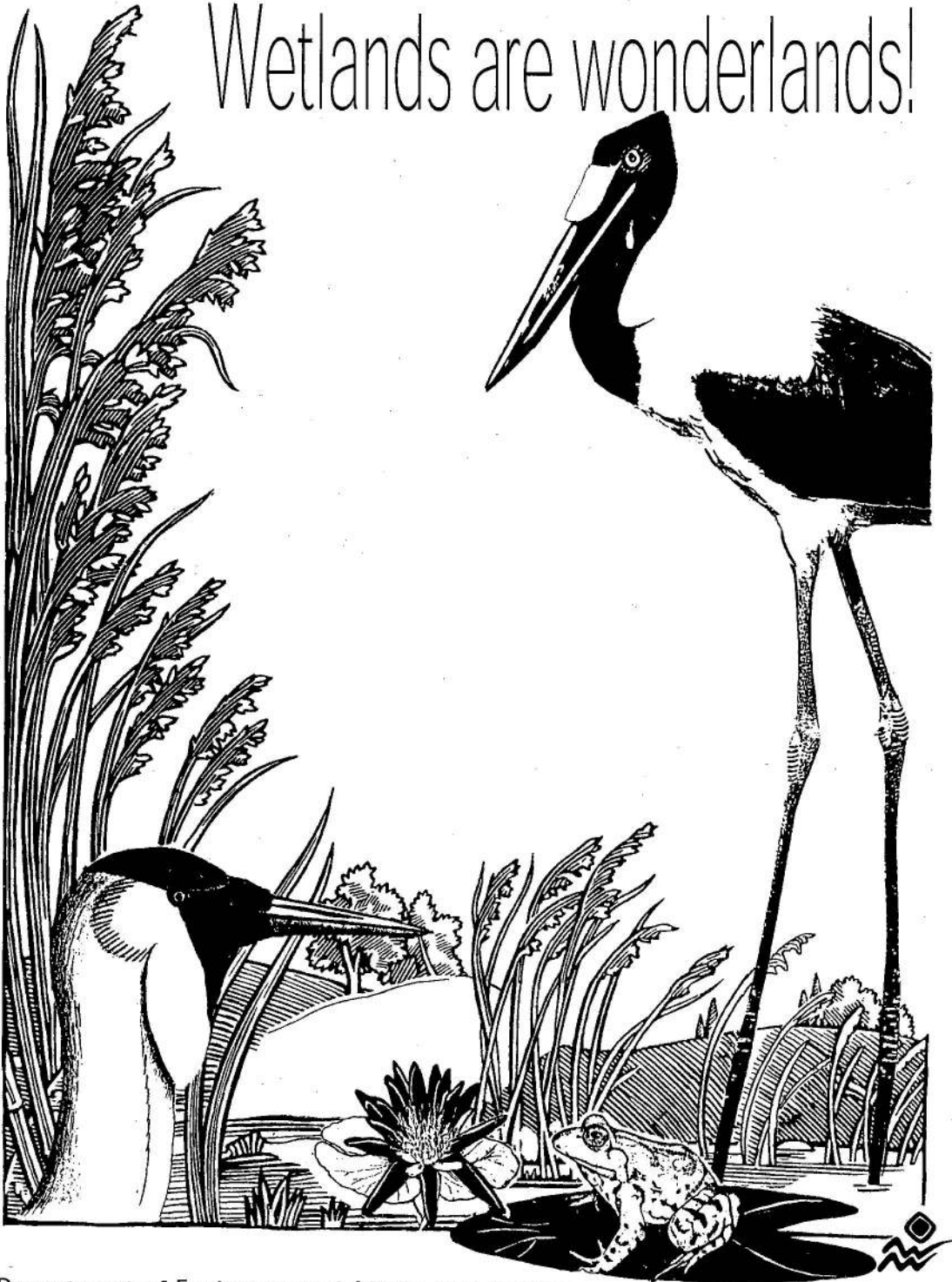
**W  
E  
A  
T  
H  
E  
R  
·  
S  
E  
R  
V  
I  
C  
E  
S  
·  
W  
E  
E  
R  
D  
I  
E  
N  
S  
T  
E**



DEPT. OF ENVIRONMENTAL AFFAIRS AND TOURISM · DEPT. VAN OMGEWINGSAKE EN TOERISME



Wetlands are wonderlands!



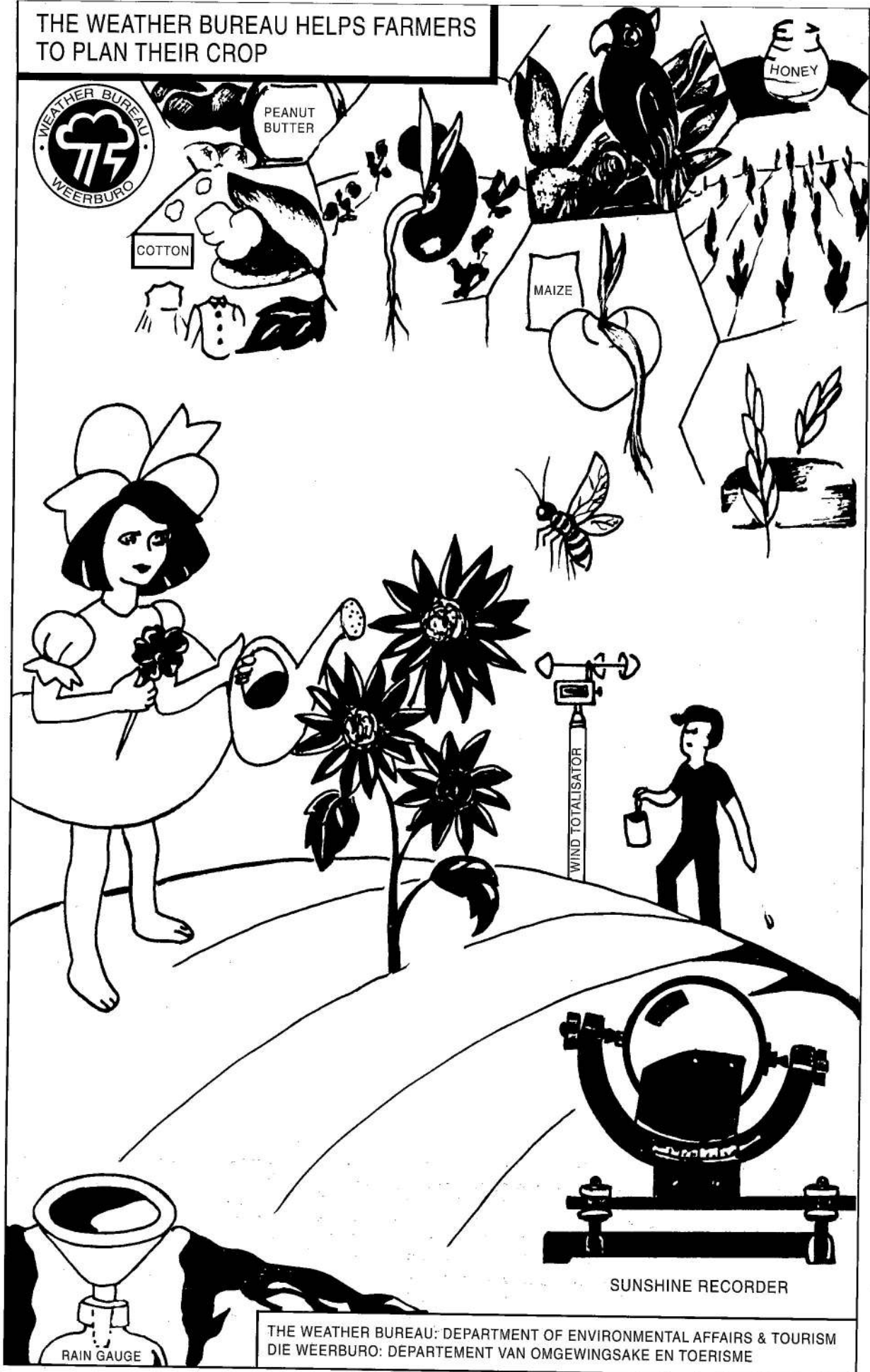
Department of Environmental Affairs and Tourism







# THE WEATHER BUREAU HELPS FARMERS TO PLAN THEIR CROP



THE WEATHER BUREAU: DEPARTMENT OF ENVIRONMENTAL AFFAIRS & TOURISM  
DIE WEERBURU: DEPARTEMENT VAN OMGEWINGSAKE EN TOERISME



Printed by and obtainable from the Government Printer, Bosman Street, Private Bag X85, Pretoria, 0001  
Publications: Tel: (012) 334-4508, 334-4509, 334-4510  
Advertisements: Tel: (012) 334-4673, 334-4674, 334-4504  
Subscriptions: Tel: (012) 334-4735, 334-4736, 334-4737  
Cape Town Branch: Tel: (021) 465-7531

Gedruk deur en verkrygbaar by die Staatsdrukker, Bosmanstraat, Privaatsak X85, Pretoria, 0001  
Publikasies: Tel: (012) 334-4508, 334-4509, 334-4510  
Advertensies: Tel: (012) 334-4673, 334-4674, 334-4504  
Subskripsies: Tel: (012) 334-4735, 334-4736, 334-4737  
Kaapstad-tak: Tel: (021) 465-7531