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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. 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
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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

Fundamental	Credits	NLRD ID
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	
Core		
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	

Elective		
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)	4	12468
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
Core		
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	
Total Core			76
Elective			
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	
Total electives (minimum)			344
Total for qualification			141

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

Fundamental	Credits	NLRD ID
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
Total fundamental		35
Core		
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
Total Core		84

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

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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.

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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.

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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.

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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

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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.

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Moderation options

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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

Fundamental	Credits	NLRD ID
Use mathematical and statistical techniques effectively	20	12432
Use communication techniques effectively	8	12433
Total fundamental		28
Core		
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
Elective		
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