No. 990 **19 September 2008**

SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)

In accordance with Regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Task Team for

Electronics

registered by Organising Field 10, Physical, Mathematical, Computer and Life Sciences, publishes the following Qualification and Unit Standards for public comment.

This notice contains the title, field, sub-field, NQF level, credits, and purpose of the Qualification and Unit Standards. 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, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the Qualification and Unit Standards should reach SAQA at the address below and ***no later than 22 October 2008.*** All correspondence should be marked **Standards Setting – SGB for Electronics** and addressed to

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SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
Further Education and Training Certificate: Electronics

SAQA QUAL ID	*QUALIFICATION TITLE*		
63849	Further Education and Training Certificate: Electronics		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
Further Ed and Training Cert	10 - Physical, Mathematical, Computer and Life Sciences	Information Technology and Computer Sciences	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	122	Level 4	Regular-Unit Stds Based

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

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

This Qualification is intended for persons who are working or intending to study in the electronics field as Electronics Technicians. Learners accessing this Qualification will be provided with knowledge, skills and attitudes that will enable them to diagnose faults, repair and maintain electronics equipment. Learners will be able to interpret electronic circuits in order to do component level repairs. This Qualification comprise of Unit Standards that will serve as the building blocks towards progression to a NQF Level 5 Qualification in Electronics as part of career advancement.

It will also provide opportunities for those persons who do not have formal education in electronics currently working in the field of electronics for formal recognition of work experience through Recognition of Prior Learning.

Rationale:

Currently the electronics industry is proliferated with individuals who are trained on the job without formal Qualification. Hence the need for a formal Qualification at this level that is targeted for people who wish to join the electronics field or those that are working as general operators performing duties related to fault-finding, repair and maintenance of electronic equipment.

The general perception in the electronics field is that most general operators lack the necessary knowledge and technical skills to meet the global trends regarding repairing and maintaining of newly introduced electronic equipment due to the growing supply of advanced technology competencies that will enable such individuals to perform quality repair and maintenance work. Thus this Qualification will provide learners with the theoretical and practical experience related to electronic environment in order to satisfy client's needs and expectations.

Electronics plays an important role in the national economy in that the majority of industries in the country use technology in order to be productive to sustain economic growth. Therefore, this Qualification will create employment opportunities for general operators to deal with electronics

related matters. The Qualification represents the work based needs of employers within the electronics industry in order to develop a pool of qualified electronics operators who progress through learning towards a Qualification as Chief Engineering Technicians at NQF Level 6. This Qualification will facilitate articulation to other Qualifications which include amongst others, mechatronics and autotronics thus facilitating mobility and personal growth within the electronics field and improve productivity in general.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
Learners are assumed to be competent in:

> Communication skills at NQF Level 3, or equivalent.
> Mathematics at NQF Level 3, or equivalent.
> Computer literacy at NQF Level 3, or equivalent.

Access to the Qualification:

This Qualification is open to learners who have achieved a Qualification at NQF Level 3 or equivalent. Learners who demonstrated competence at NQF Level 3 through recognition of prior learning can also access this Qualification.

Recognition of Prior Learning (RPL):

This Qualification can be achieved wholly or in part through recognition of prior learning. Learners able to demonstrate competency through the formative and summative assessment processes attached to this Qualification will receive recognition of prior learning. It is assumed that candidates may have been performing duties that reflect competencies contained in this Qualification at the workplace any formal Qualification.

QUALIFICATION RULES
The Qualification consists of a Fundamental, a Core and an Elective Component.

To be awarded the Qualification learners are required to obtain a minimum of 122 credits as detailed below.

Fundamental Component:

The Fundamental Component consists of Unit Standards in:

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

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

All Unit Standards in the Fundamental Component are compulsory.

Core Component:

The Core Component consists of Unit Standards to the value of 56 credits all of which are compulsory.

Elective Component:

The Elective Component consists of a number of specializations each with its own set of Unit Standards. Learners are to choose a specialization area and must choose Elective Unit Standards to the value of 10 credits from the Unit standards listed under that specialization so as to attain a minimum of 122 credits.

Electrical Cluster:

> ID 115242: Draw and interpret electrical diagram.
> ID 119256: Inspect and test electrical circuit.
> ID 115245: Fabricate aircraft electrical harnesses and looms.
> ID 14057: Demonstrate knowledge and understanding of electrical systems and related concepts.

Mechanical Cluster:

> ID 244663: Conduct advanced tests on electro-mechanical components.

Electronic Cluster:

> ID 259163: Use software to design and simulate electronics circuits.
> ID 120228: Demonstrate an understanding of the process of design.

Telecommunication Cluster:

> ID 246680: Demonstrate an understanding of Telecommunications Transport concepts and principles.
> ID 246665: Perform operational activities on digital microwave radio systems.
> ID 246670: Demonstrate an understanding of the value added services platforms used in a telecommunications environment.
> ID 246656: Demonstrate an understanding of the basic equipment and components used in a telecommunications environment.

Automotive Cluster:

> ID 12229: Fit and wire up auxiliary auto-electrical equipment.
> ID 259144: Perform industrial repair inspections.

Generic Cluster:

> ID 9532: Demonstrate basic knowledge of computers.
> ID 117499: Demonstrate entrepreneurial competence.
> ID 114598: Demonstrate an understanding of entrepreneurial profile.
> ID 259138: Apply soldering techniques for thru-hole and surface mount technologies.

EXIT LEVEL OUTCOMES

1. Communicate in a variety of ways to achieve personal and workplace objectives.

2. Apply mathematics and physics principles to determine the specific values in electronics circuits.

3. Operate electronics equipment and instruments.

4. Apply knowledge and understanding of the principles and concepts of electronics circuits.

5. Rework and repair electronic circuits and systems.

6. Demonstrate entrepreneurial skills in the electronics environment.

Critical Cross-Field Outcomes (CCFOs):

This Qualification promotes, in particular, the following Critical Cross-Field Outcomes:

Unit standard CCFO Identifying:

> Identifying and solving problems related to damages and malfunctioning of the electronics equipment by using relevant test instruments for repair purposes in order meet the Occupational Health and Safety regulations.

Unit standard CCFO Working:

> Working effectively with others by coordinating activities pertaining to the repair work and when referring repaired equipment for quality assurance purposes.

Unit standard CCFO Organising:

> Planning and preparing oneself by organising time and resources needed to be used for repairing electronic equipment.

Unit Standard CCFO Science:

> Using science and technology effectively and critically, showing responsibility towards the environment and others by understanding the role of technology in society and using technology appropriately to retrieve, manage information and solve problems as well as facilitating communication.

Unit standard CCFO Understanding the world as a set of related systems:

> Recognise that problem-solving contexts do not exist in isolation by using electrical, mechanical and electronics knowledge and skills to repair electronic equipment.

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

1.1 Verbal and non-verbal communication skills are applied when interacting with team members, supervisors and clients in the working environment.
1.2 The role of feedback is explained in terms of its effect on the team members and the client.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Calculations are performed in order to determine specific unknown values.
2.2 Laws of Physics are applied in order to determine specific values in electronics circuits.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Different equipments are identified and explained in term their uses for measuring, power supply and signal injection.

> Range: Different equipment included but is not limited to oscilloscope, multi meter, logic probe, function generator, RF generator, spectrum analyser, logic analyser, a.c and d.c variable power supply.
3.2 Measuring results are explained in terms of their impact in fault-finding activities.

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 Circuits and diagrams are reproduced in accordance with design standards.
4.2 Values of components in circuits are determined to ensure operation.
4.3 The operation of circuits is explained in terms of specific functions.

Associated Assessment Criteria for Exit Level Outcome 5:

5.1 Trouble-shooting of circuits is performed safely and in accordance with manufacturer's specifications.
5.2 Faulty components are replaced without damage to the PC Board and adjacent components according to soldering and de-soldering procedures.
5.3 PC boards are checked for short/open circuits to ensure that repairs are done in accordance with design specifications.
5.4 Standard maintenance procedures are followed in order to determine the functioning of the system.
5.5 Calibration is carried out on systems in order to ensure the functioning of the system.

Associated Assessment Criteria for Exit Level Outcome 6:

6.1 The importance for creating a business venture in the electronics environment is explained with examples.
6.2 The need to develop, interpret and utilise a business plan is explained for the purpose of starting a new business venture.
6.3 The need to conduct a business analysis in order to establish the viability of a market of electronics products and services is explained with examples.
6.4 The process of managing and controlling stock activities is explained to ensure compliance with procedures.
6.5 The importance of developing a business promotion plan is explained with examples.
6.6 The characteristics of a successful entrepreneur are identified and explained in the context of skills, personality and values.
6.7 The strategies required for a successful entrepreneurship is explained in order to identify strengths, weaknesses and ways to improve.

Integrated Assessment:

Assessment should be focused on the candidate's ability to apply their theoretical knowledge and understanding in authentic contexts. Assessors should use a range of strategies, which will allow candidates to demonstrate applied competence. Applied competence (practical, foundational and reflective) competencies regarding electronics knowledge and skills will be achieved if a candidate can integrate the various outcomes of the Unit Standards of this Qualification. Assessment strategies and procedures should be aligned with the purpose and exist level outcomes of the Qualification. They should consists of projects, written assignment, tests and examinations and also include a variety of problem solving assignments, portfolios of learning, materials and projects. The Qualification should be assessed on the basis of evidence of demonstrated performance in the workplace or in simulated work situations designed to draw upon similar performance to that required at the workplace.

All Exit Level Outcomes, Critical Cross-Field Outcomes, and Essential Embedded Knowledge required by the component Unit Standards are to be assessed. Evidence of the achievement of

the Critical Cross-Field Outcomes should be found both in performance and in explaining and applying the essential embedded knowledge.

INTERNATIONAL COMPARABILITY

The electronics industry is a highly recognized sector in that the modern world relies on electrical and electronics devices which impact considerably on the domestic and business world. Due to the fact that the electrical and electronic engineering field is broad and vibrant and interfacing with physics, computer science and engineering, the comparison was made on Qualifications that deal with basic electronics and electrical engineering, which include electronic components.

The leaders in the field for this subject field in terms of Qualifications and provision are Japan, United States of America (USA) and Germany. In addition, other countries such as New Zealand, United Kingdom, Australia, India, China and Southern African Developing Countries (SADC) regions also offer short courses in this field. Countries such as China and India are considered to be leading in electronics products, but unfortunately such information could not be accessed. The research revealed that most countries offered qualifications in engineering qualifications of which electronics forms part, and they were pitched at a Degree, Honours and Masters including PhDs levels. Although the USA, Japan and Germany were recommended to be the leading countries in electronics, unfortunately such information was not accessible.

United States of America (USA):

The Institute of Electrical and Electronics Engineers -USA (IEEE-USA) is an organisational unit of the Institute of Electrical and Electronics Engineers international, Inc., that is created to promote the careers and public policy interests of the more than 235 000 electrical, electronics, computer and software engineers including the promotion of engineering awareness and encouraging technological literacy reaching out to two different segments of the public - from nine-13 year-olds and to adults. The IEEE-USA produces a range of distance-learning packs for training and educational use in the electrical engineering, electronics, and manufacturing and computer software industries. However, most of the Qualifications accessed that are recognized by the IEEE in the USA are predominantly offered at a degree level thus making it difficult to find compare with the South African Qualification at NQF Level 3.

Electronics Supply Centre, USA:

Basic Electronics for schools:

The search has identified a certificate course that compares favourably with the South African Qualification as it provides basic knowledge packaged for beginners in the electronics field. The course is divided into four modules comprised of different lessons in each module. These modules can be benchmarked against the Unit Standards contained in the South African Qualification that provides learners with key competencies contained in the lessons provided in each module. The modules are depicted as follows:

Basic Electronics DC (direct Current):

> Lesson 1: Basic electronics theories and principles.
> Lesson 2: Series Circuits.
> Lesson 3: Parallel Circuits.
> Lesson 4: Combination Circuits.
> Lesson 5: Rheostats, symbols of variables and potentiometers.

Basic Electronics AC (Alternating Current):

> Lesson 1: Magnetism.

> Lesson 2: Sine Wave Voltages.
> Lesson 3: Basic principles of Capacitors.
> Lesson 4: Capacitors (reactance and various types of capacitors).
> Lesson 5: Inductors (self induced voltages and calculation of inductors in series).
> Lesson 6: Inductors (Autotransformers).
> Lesson 7: RLC Circuits.

Basic Electronics (Semiconductors):

> Lesson 1: The Atom.
> Lesson 2: Diodes.
> Lesson 3: Bipolar Junction Transistors (NPN and PNP).
> Lesson 4: Field Effect Transistors.
> Lesson 5: Specialty Devices (Semiconductor devices).

Basic Electronics (Power Supplies):

> Lesson 1: Rectifying circuits.
> Lesson 2: Filtering.
> Lesson 3: Regulators (I.C Regulator circuits, switch mode regulators).
> Lesson 4: UPS System (uninterruptible power supplies).

Skagit Valley College, USA:

Short Courses:

> Electronics Fundamentals I [5 credits]:
> Departmental standards on laboratory conduct, reporting, and safety.
> Ohm's law.
> Watt's law.
> Series circuits.
> Parallel circuits.
> Series-parallel circuits.
> Computer solutions.
> Voltage and current dividers.
> Resistance, voltage and current meters.
> Conductors and insulators.
> Kirchoff's voltage law.
> Kirchoff's current law.
> Network theorems.

> Electronic Fundamentals II [5 credits]:
> Organisational standards on laboratory conduct, reporting and safety.
> Review of DC concepts.
> Introduction to AC Theory.
> Inductors and Capacitors.
> Reactance and Impedance.
> RL, RC and RLC circuit analysis and characteristics.

Penn Foster Career College, USA:

Electronics Technician Certificate:

This course is a distance learning course which provides skills and techniques needed to begin a career as an Electronics Technician. Due to the fact that this course is distance learning, it

may be completed between a few months or two years depending of the choice and circumstances of the learner. Learners completing this course will be able to:

> Work as a service technician in the growing field of computers and office machinery.
> Work for an existing electronics services business, or begin one of your own.

The course content includes:

Instruction Set 1:
> Learning Strategies.
> Introduction to Electronics.

Instruction Set 2:
> Nature of Electricity.
> Practical Exercise 1.

Instruction Set 3:
> Conductors, Insulators, and Batteries.
> Circuit Analysis and Ohms Law.
> Multi-meter Usage Manual.
> Practical Exercise 2.

Instruction Set 4:
> Basic Measuring Instruments.
> Electronics Hardware.
> Switches.
> Practical Exercise 3.

Instruction Set 5:
> Magnetism and Electromagnetism.
> Capacitors and Inductors.
> Basic Semiconductor Components: Diodes.
> Basic Semiconductor Components: Transistors.
> Practical Exercise: 4.

Instruction Set 6:
> Alternating Current.
> Capacitors in AC Circuits.
> Inductors in AC Circuits.
> Transformers.
> Practical Exercise 5.

Instruction Set 7:
> Reactance and Impedance.
> Resonant Circuits.
> Applications of Resonant Circuits.
> Practical Exercise 6.

Instruction Set 8:
> Rectifiers and Power Supplies.
> Amplifiers.
> Oscillators.
> Fiber Optic and Optoelectronic Components.
> Practical Exercise 7.

Instruction Set 9:
> Electronic Sensors.
> Modulation and Detection Circuits.
> Electronic Devices and Amplifiers.
> Using Basic Oscilloscopes.
> Practical Exercise 8.

Instruction Set 10:
> Audio and RF Circuits.
> Oscillator and Feedback Waveforms.
> Electronic Power Supplies.
> Practical Exercise 9.

Instruction Set 11:
> Resonant Circuits.
> Applications of Resonant Circuits.
> Pulse Generators and Techniques.
> Waveshaping Circuits.
> Timing and Synchronization.
> Pulse Circuit Applications.
> Troubleshooting Pulse Circuits.

Instruction Set 12:
> Logic Circuit Fundamentals.
> Introduction to Number Systems.
> Logic Devices and Diagrams.
> Logic Families.
> Applications of Logic Circuits.
> Troubleshooting Logic Circuits.

Instruction Set 13:
> Linear and Digital Integrated Circuits.
> Integrated Circuit Techniques.
> Linear Integrated Circuits.
> Digital Integrated Circuits.
> Linear and Digital Principles.
> Integrated Circuit Logic Systems.
> Troubleshooting Linear and Digital IC Systems.

Instruction Set 14:
> Experiments with Pulse Circuits.
> Experiments with Logic Circuits.
> Experiments with Linear Integrated Circuits.

Instruction Set 15:
> Industrial Computer Fundamentals.
> Digital and Analogy Systems.
> Software and Programming Systems.
> Computer Aided Control.
> Interfacing Principles.

Canada, Toronto:

George Brown College:

Electronics Technician Certificate:

George Brown College offers the Electronics Technician Certificate programme that is targeting technicians who work in the field of consumer, commercial and industrial electronics. Many schools and organisations, which have adopted it as part of their training programmes, use the programme. People who intend to work within the electronics environment thus preparing them for employment can also access the programme. The programme offered on a modular basis with at least 23 Modules and most of the Modules offered here above are comparing favourably with the South African Qualification. The duration of the programme is 32 weeks. The Modules are as follows:

> Introduction to Electronics.
> Current, Voltage and Resistance.
> Ohm's Law, Power and Energy.
> Series Circuits.
> Parallel Circuits.
> Series Parallel Circuits.
> DC Measuring Instruments.
> Network Theorems.
> Magnetism.
> Magnetic Circuits.
> Alternating Voltage and Current.
> Digital Electronics.
> AC Measuring Instruments.
> Capacitance and Capacitors.
> Inductance and Inductors.
> Transformers.
> Alternating Current Circuits.
> Resonance.
> Semiconductor Fundamentals.
> Coupling and Filter Circuits.
> Transistors and Thyristors.
> Amplifier Circuits.
> Integrated Circuits.

Fiji Islands - South Pacific:

Fiji Institute of Technology: School of Electrical and Electronic Engineering:

Trade Certificate in Electronics Engineering:

Fiji is a highly recognized institution that is registered as an Academy that offers very dynamic comprehensive programmes to school leavers who wish to pursue training in electrical and electronics engineering and their allied industries. The above programme compare favourably with the South African Qualification (Introductory Electronics, NQF Level 3) in terms of the units offered except Applied Mathematics unit although the level of the Qualification is not known. The certificate is comprised of the following units:

> Basic electronics.
> Applied Mathematics.
> Electrical Principles.
> Electronics fundamentals.
> Electrical Measurements.
> Occupational Health and Safety.
> Digital Electronics.

> Analogue Electronics.
> Components and Measurements.
> Computer Applications.
> Technical communication.
> Workshop Practice.
> Electronics Project.

Japan (Japan Qualifications Authority):

Tasmanian Secondary Assessment Board:

The following programme is offered:

> EL772 C, EL770 B: Introduction to Electronics.

The syllabuses are designed particularly for students with an interest in Electronics. The opportunity to develop a knowledge and understanding of Electronics through practical experience is offered. Syllabus is designed to be taught and assessed as either a 150 hour 'C' Course or a two 100 hours 'B' Courses.

Learners who complete the course are able to:

> Understand and apply fundamental concepts of electronics.
> Plan, construct and test circuits.
> Undertake electrical measurements.
> Demonstrate safe working practices.
> Research, record and recall information.
> Solve problems.
> Communicate ideas and information in a variety of ways.

The course outline is as follows:

> Electrical Safety.
> Fundamental Aspects.
> Basic Electrical Concepts.
> Transistors as Switches.
> Transistors as Amplifiers.
> Timing Circuits.
> Switching Circuits.
> Audio/Radio.
> Power Supplies.
> Semiconductor Logic Circuits.
> Combination of Gates.
> Introduction to the 555 Timer.
> Negotiated Project (possibly related to the 555 Timer).

United Kingdom (UK):

The comparison was done using the National Database of Accredited Qualifications (Qualification and Curriculum Authority) in which electronics related Qualifications found were at NVQ Level.

Edexcel: BTEC National Certificate in Electrical/Electronic Engineering (4322):

Edexcel is known to be the largest awarding body in the United Kingdom, which develops a diverse range of vocational and academic Qualifications including courses. The 'BTEC National Certificate in Electrical/Electronic Engineering is at the UK NQF Level 3, which has an equivalence level between our NQF Levels 4 and 5. The comparison was done focusing on the level, content and outcomes of the Qualification that is equivalent to our Level 3 Qualification. Although this is a 12-unit Qualification which is made up of six core Unit Standards and six specialist Unit Standards which compare slightly with few of our Unit Standards as follows:

> Electrical and Electronic principles.
> Digital electronics.
> Analogue electronics.
> Electronic fault finding.
> Further Electrical Principles.
> Health, Safety and Welfare.

New Zealand:

Electro Technology Industry Training Organisation: National Certificate in Electronics Technology (Level 3):

This Qualification is designed for people who are interested in electronics who may wish to pursue further training and employment in this field. The Qualification has been developed for people interested in electronics who may wish to pursue further raining and employment in this field and is offered in high schools. Some of the units standards contained in this Qualification compares favourably with the South African Qualification as it addresses basic knowledge and skills of electronics although it is comprised of 43 credits as follows:

> Demonstrate and apply knowledge of basic semiconductor devices.
> Demonstrate basic knowledge of basic digital and analogue electronic concepts.
> Describe the development of a new electronic product.
> Demonstrate basic knowledge of signals and the transmission of information.
> Demonstrate basic knowledge of electronic product quality and reliability.
> Demonstrate and apply basic knowledge of microcontrollers.

In addition, there are Unit Standards identified which do not form part of any Qualification within the New Zealand Qualifications Framework, pegged at level 3 which are core electronics for electronics technicians that compare favourably with the South African Qualification. These are:

> Demonstrate and apply introductory knowledge of d.c. principles for electronics technicians.
> Demonstrate and apply introductory knowledge of a.c. principles for electronics technicians.
> Demonstrate and apply introductory knowledge of digital electronics for electronics technicians.
> Demonstrate and apply introductory knowledge of analogue electronics for electronics technicians.

Universal College of Learning, New Zealand:

Certificate in Electronics and Electrical Technology, Level 3:

This programme is designed to provide new entrants with knowledge and skills in the field of electronics. The programme is targeting individuals who are interested in a career in the electrical and electronics industries as well as offering the stepping-stone to gain broad education and training in this field. The programme compares favourably with our Qualification in terms of the content, duration and level as well as covering the fundamental component in relation to mathematical and communication literacy, including computer skills. The course content is as follows:

> Communication.
> Digital electronics.
> Introduction to measurement and fault diagnosis.
> Introductory physics.
> Electronics theory.
> Electrical theory.

Zimbabwe:

In relation to South African developing countries (SADC), it has been discovered that countries in the SADC region tend to benchmark their Qualifications against the South African Qualifications. The only country found to provide a programme in the subject field is Zimbabwe through SIRDC (Electronics and Communications Institute) which offers technology transfer and training services in specialized areas of electronics, electronics circuit design and electronic instrumentation which does not compare fairly well with the standards offered by the South African Qualification in that the content/modules of their programme that is partly relevant to our Qualification but not addressed at this level are:

> Electronic circuit design fundamentals.
> Electronic instrumentation and control.

Conclusion:

The South African Qualification compares with the aspects of other qualifications identified but not in heir entirety. Our Qualification falls well within the occupational profiles and training standards of the other relevant countries that we have investigated.

ARTICULATION OPTIONS
This Qualification articulates horizontally with the following registered Qualifications:

> ID 48978: Further Education and Training Certificate: Electrical Network Control, NQF Level 4.
> Certificate: Electrical Engineering, NQF Level 4.
> National Certificate: Electrical Technology: FET Phase, NQF Level 4.
> ID 48978: Further Education and Training Certificate: Electrical Network Control, NQF Level 4.
> ID 58861: Further Education and Training Certificate: Electro-Mechanical Winding, NQF Level 4.
> ID 59731: Further Education and Training Certificate: Automotive Repair and Maintenance, NQF Level 4.

This Qualification articulates vertically with the following Qualification:

> National Certificate: Electronics Engineering Technology, NQF Level 5.

MODERATION OPTIONS
Moderation must include both internal and external moderation of assessments. Moderation of assessments will be overseen by the relevant ETQA according to the moderation guidelines and agreed ETQA procedures. This Qualification can be internally assessed by assessors of the provider and moderated by a moderator registered with the relevant ETQA. Moderation shall comply with SAQA requirements.

CRITERIA FOR THE REGISTRATION OF ASSESSORS
Assessors for this Qualification will hold a NQF Level 5 Qualification in Electronics or equivalent Qualification in related disciplines within the field of electronics, or will be competent in the outcomes of this Qualification and have at least two years experience in the field. The Assessor must include both internal and external moderation of assessments.

Anyone assessing a learner or moderating the assessment of a learner against this Qualification or its Unit Standards must be a constituent registered assessor with the relevant accredited ETQA or an ETQA that has a Memorandum of Understanding with the relevant accredited ETQA.

NOTES

Knowledge of basic computer is essential therefore it is encouraged that learners must choose from the elective components any Unit Standards together with a computer unit standard.

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Fundamental	9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	Level 4	6
Fundamental	119462	Engage in sustained oral/signed communication and evaluate spoken/signed texts	Level 4	5
Fundamental	119469	Read/view, analyse and respond to a variety of texts	Level 4	5
Fundamental	9016	Represent analyse and calculate shape and motion in 2- and 3-dimensional space in different contexts	Level 4	4
Fundamental	119471	Use language and communication in occupational learning programmes	Level 4	5
Fundamental	7468	Use mathematics to investigate and monitor the financial aspects of personal, business, national and international issues	Level 4	6
Fundamental	119459	Write/present/sign for a wide range of contexts	Level 4	5
Core	253094	Perform electronic fault-finding	Level 3	3
Core	14939	Assemble a personal computer or handheld computer and peripherals from modules	Level 4	7
Core	246659	Demonstrate an Understanding of basic electrical and electronic principles	Level 4	5
Core	259139	Demonstrate and apply knowledge of basic digital electronic principles	Level 4	10
Core	259142	Demonstrate knowledge of applied communications technology	Level 4	8
Core	259170	Operate electronic test instruments	Level 4	5
Core	113873	Understand basic electrical and mechanical engineering principles	Level 4	8
Core	259137	Analyse fault reports and make decisions according to work policies and procedures	Level 5	5
Core	259169	Construct DC power supplies	Level 5	5
Elective	246680	Demonstrate an understanding of Telecommunications Transport concepts and principles	Level 3	8
Elective	120228	Demonstrate an understanding of the process of design	Level 3	3
Elective	9532	Demonstrate basic knowledge of computers	Level 3	6
Elective	115242	Draw and interpret electrical diagrams	Level 3	3
Elective	115245	Fabricate aircraft electrical looms and harnesses	Level 3	10
Elective	259138	Apply soldering techniques for thru-hole and surface mount technologies	Level 4	10
Elective	244663	Conduct advanced tests on electro-mechanical components	Level 4	10
Elective	114598	Demonstrate an understanding of an entrepreneurial profile	Level 4	5
Elective	246656	Demonstrate an understanding of the basic equipment and components used in a telecommunications environment	Level 4	5

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	246670	Demonstrate an understanding of the value added services platforms used in a telecommunications environment	Level 4	2
Elective	117499	Demonstrate entrepreneurial competence	Level 4	12
Elective	14057	Demonstrate knowledge and understanding of electrical systems and related concepts	Level 4	6
Elective	12229	Fit and wire up auxiliary auto-electrical equipment	Level 4	12
Elective	119256	Inspect and test electrical circuits	Level 4	6
Elective	259144	Perform industrial repair inspection for quality control	Level 4	2
Elective	246665	Perform operational activities on-Digital Microwave Radio systems	Level 4	15
Elective	259163	Use software to develop and simulate electronic circuit	Level 4	4
Elective	259168	Inspect and design of looms and harnesses	Level 5	10
Elective	259166	Rework and repair electronics assemblies	Level 5	15

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Analyse fault reports and make decisions according to work policies and procedures

SAQA US ID	*UNIT STANDARD TITLE*		
259137	Analyse fault reports and make decisions according to work policies and procedures		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 5	5

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

SPECIFIC OUTCOME 1
Demonstrate knowledge of the various electronic systems in accordance with manufacturer's specifications.

SPECIFIC OUTCOME 2
Interpret fault-finding report for decision-making.

SPECIFIC OUTCOME 3
Interpret electronic circuit diagram.

SPECIFIC OUTCOME 4
Repair components in accordance with manufacture's specifications standard.

SPECIFIC OUTCOME 5
Test the repaired equipment for functionality.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	63849	Further Education and Training Certificate: Electronics	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Apply soldering techniques for thru-hole and surface mount technologies

SAQA US ID	*UNIT STANDARD TITLE*		
259138	Apply soldering techniques for thru-hole and surface mount technologies		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	10

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

SPECIFIC OUTCOME 1
Prepare for soldering.

SPECIFIC OUTCOME 2
Identify and place components on the PC board.

SPECIFIC OUTCOME 3
Perform soldering.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	63849	Further Education and Training Certificate: Electronics	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Demonstrate and apply knowledge of basic digital electronic principles

SAQA US ID	*UNIT STANDARD TITLE*		
259139	Demonstrate and apply knowledge of basic digital electronic principles		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	10

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

SPECIFIC OUTCOME 1
Demonstrate knowledge of microprocessor and microcontroller systems.

SPECIFIC OUTCOME 2
Programme and test a microprocessor or microcontroller application.

SPECIFIC OUTCOME 3
Demonstrate knowledge of external serial bus systems to enable expansion.

SPECIFIC OUTCOME 4
Demonstrate knowledge of analogue-to-digital and digital-to-analogue conversion within the controller.

SPECIFIC OUTCOME 5
Test analogue-to-digital and digital-to-analogue converters.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	63849	Further Education and Training Certificate: Electronics	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Demonstrate knowledge of applied communications technology

SAQA US ID	*UNIT STANDARD TITLE*		
259142	Demonstrate knowledge of applied communications technology		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	8

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

SPECIFIC OUTCOME 1
Identify and discuss the different kinds of communications technology and their application.

SPECIFIC OUTCOME 2
Demonstrate knowledge of hardware and/or software installation.

SPECIFIC OUTCOME 3
Demonstrate knowledge of the use of communications software and hardware.

SPECIFIC OUTCOME 4
Interface different kinds of communications technology.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	63849	Further Education and Training Certificate: Electronics	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Perform industrial repair inspection for quality control

SAQA US ID	*UNIT STANDARD TITLE*		
259144	Perform industrial repair inspection for quality control		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	2

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

SPECIFIC OUTCOME 1
Plan workflow.

SPECIFIC OUTCOME 2
Interpret fault -finding report for decision-making.

SPECIFIC OUTCOME 3
Interpret electronic circuit diagram.

SPECIFIC OUTCOME 4
Repair components in accordance with manufacture's specifications standard.

SPECIFIC OUTCOME 5
Test the repaired equipment for functionality.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	63849	Further Education and Training Certificate: Electronics	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Use software to develop and simulate electronic circuit

SAQA US ID	*UNIT STANDARD TITLE*		
259163	Use software to develop and simulate electronic circuit		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	4

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

SPECIFIC OUTCOME 1
Obtain, update and use component libraries.

SPECIFIC OUTCOME 2
Use components libraries to draw a circuit diagram.

SPECIFIC OUTCOME 3
Create a useable paper result.

SPECIFIC OUTCOME 4
Apply design rule check.

SPECIFIC OUTCOME 5
Use a circuit analysis programme to analyse the circuit behaviour.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	63849	Further Education and Training Certificate: Electronics	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Rework and repair electronics assemblies

SAQA US ID	*UNIT STANDARD TITLE*		
259166	Rework and repair electronics assemblies		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 5	15

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

SPECIFIC OUTCOME 1
Set up work area for repairing and reworking electronic assemblies.

SPECIFIC OUTCOME 2
Remove components from the PC boards.

SPECIFIC OUTCOME 3
Repair damaged PC boards.

SPECIFIC OUTCOME 4
Replace components on PC board.

SPECIFIC OUTCOME 5
Remove coatings and encapsulations.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	63849	Further Education and Training Certificate: Electronics	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Inspect and design of looms and harnesses

SAQA US ID	*UNIT STANDARD TITLE*		
259168	Inspect and design of looms and harnesses		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 5	10

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

SPECIFIC OUTCOME 1
Demonstrate knowledge of and analyse the IPC/WHMA-A-620 standards.

SPECIFIC OUTCOME 2
Prepare the inspection workstation.

SPECIFIC OUTCOME 3
Conduct inspection according to IPC/WHMA-A-620 standards.

SPECIFIC OUTCOME 4
Interpret product documentation.

SPECIFIC OUTCOME 5
Design cable and harness system according to IPC/WHMA-A-620 standards and customer specifications.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	63849	Further Education and Training Certificate: Electronics	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Construct DC power supplies

SAQA US ID	*UNIT STANDARD TITLE*		
259169	Construct DC power supplies		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 5	5

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

SPECIFIC OUTCOME 1
Describe and use basic DC power supplies.

SPECIFIC OUTCOME 2
Build DC power supply.

SPECIFIC OUTCOME 3
Perform fault finding.

SPECIFIC OUTCOME 4
Measure regulation and ripple of the power supply.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	63849	Further Education and Training Certificate: Electronics	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Operate electronic test instruments

SAQA US ID	*UNIT STANDARD TITLE*		
259170	Operate electronic test instruments		
ORIGINATOR		*PROVIDER*	
SGB Electronics			
FIELD		*SUBFIELD*	
10 - Physical, Mathematical, Computer and Life Sciences		Information Technology and Computer Sciences	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	5

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

SPECIFIC OUTCOME 1
Demonstrate knowledge of test instruments.

SPECIFIC OUTCOME 2
Set up electronic instruments.

SPECIFIC OUTCOME 3
Demonstrate knowledge of measuring techniques.

SPECIFIC OUTCOME 4
Interpret the results of the readings.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	63849	Further Education and Training Certificate: Electronics	Level 4