No. 127 **11 February 2009**

SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)

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

Air-conditioning, Refrigeration and Ventilation

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

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

Comment on the Qualifications and Unit Standards should reach SAQA at the addr and ***no later than 11 March 2009.*** All correspondence should be marked **Standards SGB for Air-conditiong, Refrigeration and Ventilation** and addressed to

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SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
National Certificate: Air-conditioning, Refrigeration and Ventilation

SAQA QUAL ID	*QUALIFICATION TITLE*		
65449	National Certificate: Air-conditioning, Refrigeration and Ventilation		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
National Certificate	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	133	Level 2	Regular-Unit Stds Based

This qualification replaces:

Qual ID	Qualification Title	NQF Level	Min Credits	Replacement Status
48959	National Certificate: Air-conditioning, Refrigeration and Ventilation	Level 2	147	Will occur as soon as 65449 is registered

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

The air conditioning, refrigeration and ventilation industry provides a service to many sectors of the country`s economy such as food processing and warehousing, food transportation, distribution and retailing, deep level mining and industrial process, high rise and retail property, specialized medical care, automotive and mass transport, tourism and hospitality.

This qualification enables a competent learner at NQF Level 2, under supervision, to demonstrate a basic ability to install, service, repair and operate mechanical equipment that is used in the air conditioning, refrigeration and ventilation industry.

The current rate of urban development, the advance in technology and development of tourism creates an ever-increasing demand for air conditioning, refrigeration and ventilation equipment and systems and therefore a corresponding demand for technicians to repair, maintain, install and manufacture such equipment and systems.

The technical skills required for this purpose are scarce and there is a growing demand for technicians skilled in the mechanical, electrical and thermal sciences. These qualifications are ideally suited to school-leavers (male and female) who have an interest in the engineering sciences and have practical skills. This series of qualifications also equips the learner with entrepreneurial skills which would lead to self employment in the SMME field (Most businesses in the field of air conditioning, refrigeration, and ventilation are in fact SMME`s).

South African trained technicians are the obvious choice for work in this field, in many African countries. We also see an untapped potential for work and learning in this field, in many parts of Africa.

This qualification specifically suits learners who have an interest in science and mathematics as well as manual dexterity (ability to use tools) and a consciousness of personal and environmental safety.

Learners credited with this Qualification will be able to:

> Identify and handle refrigerants.
> Identify and use basic tools.
> Identify and work with component parts for air-conditioning, refrigeration and ventilation equipment.
> Understand the basic operation of air-conditioning, refrigeration and ventilation systems.
> Work safely and responsibly in the plant environment.

Rationale:

Air conditioning, refrigeration and ventilation are subfields of specialized engineering which account for the design, manufacture, installation, maintenance, and repair of systems which provide artificial cooling for the environment and the processing and preservation of foodstuffs. The development of the urban lifestyle with its concentration of population into centralized areas, the food chain from producer to consumer as well as the working environment and medical care would not be possible without these specialized engineering services.

This is the first qualification in a series of qualifications which will lead to a learner acquiring all the skills required to work in the industry in the repair, maintenance, installation, manufacture and ultimately design of the mechanical/electrical systems which provide temperature control for environmental or process needs. By qualifying at this level, a learner will achieve the status of an Assistant Mechanic. The broader framework of qualifications (2008) is demonstrated by the following hierarchy of qualifications:

> Assistant Mechanic - Level 2 (Technical competence - Has a basic understanding of equipment and is able to carry out technical work under supervision).
> Mechanic - Level 3, - (Technical competence - Has a knowledge of equipment and systems and is able to carry out technical work without supervision).
> Artisan - Level 4, - (Technical competence - Has an advanced knowledge of systems and equipment and is able to work without supervision and to supervise a team).
> Technician/Project Leader - Level 5, - (Has knowledge of system design, selection and engineering and has management skills).

The learner will be required to reach competence in the advanced skills of the servicing, repair and commissioning of systems and the selection of components and to understand and operate supervisory control systems. He will be required to supervise work teams and communicate at all levels in the workplace and with customers.

There are many applications of air conditioning, refrigeration and ventilation which relate directly to the tourism and hospitality industry:

> Air conditioning of hotels, restaurants and recreation areas.
> Air conditioning of luxury buses, automobiles and other transport modes.
> Refrigeration related to the food chain (producers, processors, warehouses, transport, and retailing).

Relevant future socio-economic developments, for example, the increase in level of tourism will create further demand for the services of trained technicians to install, service and repair cooling equipment at all skills levels.

RECOGNIZE PREVIOUS LEARNING?

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LEARNING ASSUMED IN PLACE
This qualification assumes that the candidate has already achieved a General Education and Training Certificate at NQF Level 1 or ABET Level 4 or Grade 9 school level.

Recognition of Prior Learning:

This qualification may be achieved in part (or whole) through the recognition of relevant prior knowledge and/or experience. The learner must be able to demonstrate competence in the knowledge, skills, values and attitudes implicit in this qualification. As part of the provision of recognition of prior learning providers are required to develop a structured means for the assessment of individual learners against the Unit Standards of the Qualification on a case-by-case basis. A range of assessment tools and techniques during formative and summative assessment procedures should be used which have been jointly decided upon by the learner and the assessor. Such procedures, and the assessment of individual cases, are subject to moderation by independent assessors. The same principles that apply to assessment of this qualification also apply to recognition of prior learning.

Learners may provide evidence of prior learning for which they may receive credit towards the Unit Standards and/or the qualification by means of portfolios or other forms of appropriate evidence as agreed to between the relevant provider and relevant ETQA or ETQA that has a Memorandum of Understanding in place with the relevant ETQA.

RPL is particularly important, as there are people in the metal production sector with a variety of skills and competencies of differing quality and scope. It is important that an RPL process be available to assist in making sense of existing competencies and skills, and helping to standardise these competencies and skills towards a common standard.

QUALIFICATION RULES
> Fundamental component: 36 credits.

> Core component: 78 credits.

> A minimum total of 19 credits is required in the elective component. A learner may select any combination of credits adding up to a minimum of 19 credits.

EXIT LEVEL OUTCOMES
1. Identify and handle refrigerants.

2. Identify and use basic tools.

3. Identify and work with component parts for air-conditioning, refrigeration and ventilation equipment.

4. Understand the basic operation of air-conditioning, refrigeration and ventilation systems.

5. Work safely and responsibly in the plant environment.

Critical Cross-field outcomes:

This Qualification addresses the following Critical-Cross Field Outcomes:

Identifying and solving problems in which responses display that responsible decisions using thinking have been made when:

> Identifying, using and handling equipment in the air conditioning, refrigeration and ventilation industry.

Working effectively with others as a member of a team, group, organization and community when:
> Maintaining safety standards in handling air conditioning and refrigeration equipment.

Organising and managing oneself and one's activities responsibly and effectively when:
> Identifying tools, equipments and instruments.
> Sequencing installation of parts and components.

Communicate effectively using visual, mathematical and/or language in the modes of oral and/or written persuasion when:
> Explaining basic tools.
> Explaining sequence of installing component parts.
> Explaining the functions of components.
> Explaining refrigeration, air conditioning and ventilation systems.

Use science and technology effectively and critically, showing responsibility towards the environment and health of others when:
> How the various components are aligned and integrated into the bigger whole.

Demonstrate understanding of the world as a set of related systems by recognizing the complex and dynamic nature of the various systems, system components and the inter-relationships that exist between systems when:
> Interpreting air conditioning, refrigeration and ventilation plant layout and component and systems.
> Handling refrigerants responsibly.

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

> Types of refrigerants are identified as required.
> Procedures for the handling of refrigerants are demonstrated in line with specifications.
> Procedures for the handling of refrigerants are demonstrated in line with occupational safety norms and standards.

Associated Assessment Criteria for Exit Level Outcome 2:

> Types of basic tools are identified.
> Procedures and sequences for the use of basic tools are followed and demonstrated in line with manufacturer's specifications.
> Basic tools are handled in line with occupational safety norms and standards.

Associated Assessment Criteria for Exit Level Outcome 3:

> Component parts for air-conditioning, refrigeration and ventilation equipment are identified.
> Component parts for air-conditioning, refrigeration and ventilation equipment are used as required and in line with manufacturer's specifications.
> Component parts for air-conditioning, refrigeration and ventilation equipment are handled in line with occupational safety norms and standards.
> Consequences of defective assembly are explained in terms of safety, legal and contractual considerations.
> Standards for control of quality are explained and their application is discussed.

Associated Assessment Criteria for Exit Level Outcome 4:

> Components of air-conditioning, refrigeration and ventilation systems are identified.
> How air-conditioning, refrigeration and ventilation systems operate are explained in terms of procedure.
> The functioning of the devices and systems are explained by means of control and wiring diagrams.
> The need for control devices and systems is explained.

Associated Assessment Criteria for Exit Level Outcome 5:

> The required installation methods or application are discussed and safety precautions noted.
> Safety requirements for the plant environment are described.
> The operation of different systems and refrigerants is explained and reasons for their selection is given.

Integrated Assessment:

Integrated assessment at the level of this qualification will evaluate the learner's capacity to integrate engineering principles, processes and behaviour across a range of workplace domains and thus be able to carry out maintenance, repair and installation work under supervision for the benefit of his employer.

Integrated assessment must specifically evaluate the learner's ability to:

> Understand and apply mathematics literacy, communicate and behave appropriately.
> Understand and use tools, instruments and equipment safely and purposefully.
> Understand and apply the engineering principles and safety considerations related to the specific workplace tasks and environment.

This will require assessment methodologies which will include demonstration, oral and written responses, both summative and formative, and evidence of these in the form of portfolios or projects. Since this is a basic qualification, the learner must show sufficient evidence of ability to understand engineering principles and workplace behaviour and procedures. Such ability may be obtained in a formal learnership, by practice gained in the workplace (RPL) or by a combination of formal learning and practice in the workplace. The assessment must also ensure that learners have achieved the critical outcomes.

INTERNATIONAL COMPARABILITY
European Union:

Through the European Federation of National Refrigeration and Air Conditioning Associations (ERA. comprising 21 EU states), there is a move towards the harmonisation of EU refrigeration training and certification.

This stems from the current lack of a singular reference point in respect of competence levels and a resulting measurement of compliance to EU refrigeration codes. For example, there is an EU legislative requirement (EC842-2006 for F Gas handling) which requires refrigeration workers to achieve certification in the handling of gases. This can be achieved through (City & Guild 2078) or CITB. The handling of ammonia is dealt with at Level 2 and at subsequent levels in our system.

Great Britain:

Equivalent qualifications-to the South African Qualifications-in Britain include the 6087 series, that is:

> Level 2: Small commercial air conditioning systems below 10kw.
> Level 3: Commercial and industrial non ammonia refrigeration systems above 10kw.
> Level 3: Ammonia refrigeration system.

South African air conditioning, refrigeration and ventilation Qualifications at NQF Levels 2-4 are equivalent to the expansive NVQ (UK) and SVQ's (Scottish) Levels1, 2, 3 and some elements of their Level 4.

On the other hand, the City and Guilds equivalents are found in the following range: 207- Level 2 (refrigeration and air conditioning craft certificate); 207- Level 3 refrigeration and air conditioning advanced certificate and 257 technician certificate).

Commonalities between the SA (NQF Level 2, 3 and 4) and UK Qualifications 6087 NVQ in Refrigeration and Air Conditioning Levels 2, 3 and 4) are as follows:

The core competence areas under which there is commonality across the four levels are from simple to complex systems, as follows:

> People skills range: Maintaining effective work relationships, diversity and supervision.
> Safety and compliance range: Health, safety and regulatory requirements in respect of national, international codes of practice and applicable legislation.
> Commissioning and decommissioning of refrigeration and air conditioning systems: range: Planning and factoring of tools, requirements, process and use.
> Service and repair: Installation, maintenance, diagnosis and fault finding.

In both jurisdictions the various levels have the following similarities:

> Level 2: Basic safety, the handling of ammonia and the installation of simple systems.
> Level 3: Relevant safety area, assembling, design and sketching of a complex system.
> Level 4: Maintenance, fault finding / diagnosis, repair of a complex system, measurements of air flow, supervision, determining evaluation parameters and servicing.

Operatives

The operatives (SA) in the air conditioning, refrigeration and ventilation field are: Assistant mechanic at Level 2, who carries out technical work under supervision; the mechanic (without supervision) at Level 3; the Technician/Protect Leader at Level 4 whose role is supervisory and is able to deal with complex systems.

In the UK Level 2 is for the Trainee, Level 3 is for the craftsperson and Level 4 is for the Specialist/Supervisor and Team leader.

An example from British Columbia:

For illustration, a specific Heating, Ventilation an Air-conditioning Technician course from British Columbia Institute of Technology (BCIT) in Canada. In it there is consistency with the SA and UK qualifications in the core/main elements, though with some minor differences of terminology, duration and qualification pegging.

BCIT Qualification:

It is noted that the BCIT qualification has been made up of 3 separate levels of Unit Standards that make up the total Credit of 125. The South African equivalent qualifications have three qualifications that span three Levels, that is, Levels 2-4 with credits as follows: (Level 2; 133, Level 3: 122 and Level 4 at 156 credits).

The Table below illustrates the difference in the BCIT Credit Level 1 Unit Standards and the South African Qualification Unit standard Level 2 Qualification and their respective Credits.

Level 1; Unit Standards; Credits:

> HVAC 1095; Apply Effective Learning Technique; 0.5.
> HVAC 1100; Apply Trade Safety Practices; 2.0.
> HVAC 1101; Process Technical Information; 2.5.
> HVAC 1103; Apply Trade Tools and Fastener; 4.0.
> HVAC 1104; Apply Fundamental of Refrigeration; 8.5.
> HVAC 1105; Proper Service Procedures; 5.5.
> HVAC 1106; Apply Electrical Fundamentals; 5.5.
> HVAC 1107; Interpret Electrical Diagrams; 3.0.
> HVAC 1108; Apply Electrical Test Equipment; 2.0.
> HVAC 1109; Install Electrical Devices; 4.0.
> HVAC 1111; Install Refrigeration Project; 2.0.
> HVAC 1112; Prepare for Employment; 0.5.
> HVAC 1990; Co-op 1; 22.0.

An example from British Columbia:

It should be noted that the international standard is arguably set higher than the South African standards based on the reason listed below. A BCIT qualified graduate at level two is expected to be able to Design Refrigeration Systems, Describe Basic HVAC Systems, Air Distribution Arrangement for HVAC, Air Properties and Measurement, Explain HVAC Control Loops, Maintain Heat Pump Systems, whereas our graduate is only expected to demonstrate understanding of the basic understanding of mechanical/technical equipment and carry out technical work and understand principles of Air-Conditioning, refrigeration and ventilation and demonstrate a b. The BCIT graduate would have learned all the South African NQF Level 2 core unit standards in his/her Level 1.

Learning assumed to be in place

South African Qualification requires that the candidate learner must have achieved a National Certificate at NQF Level 1, Abet Level 4 or Grade 9 school Level. BCIT requires that the candidate must have completed High school graduation or any if the following: English 12, Communications 12, English-language proficiency, Academic Math 11 (C) Applicants must pass a BCIT Mechanical Reasoning test.

New Zealand:

South African Level 3 and 4 qualifications compare relatively favourably with those of New Zealand (Level 3: 1415, Level 4:1416; Level 4: 0124; Level 4: 0130). It is note that the New Zealand Qualifications Authority allows for specialization in the following areas:

Automotive Heating etc. Automotive machining, Diesel Fuel injection and Motorsport. The New Zealand Qualification Authority (NZQA) has listed an equivalent qualification as a Heating, Ventilation an Air-conditioning (HVAC) qualification which would be a component of an Engineering Qualification (e.g. Mechanical Engineering, Motor Industry Engineering or Building maintenance).

SADC and beyond:

Many SADC countries are still in the early stages of developing their NQF's. Equivalents for the qualifications under review were not found.

Summary:

The International comparability exercise has revealed the following:

New Zealand, Great Britain, and EU qualifications have a number of occupational streams and learning pathways within the domestic, commercial/industrial and auto applications of heating, ventilation and air conditioning. It was also observed that the South African air conditioning unit standards within the NQF Level range 2-4 overlaps the international equivalent at Levels 1-6, in the various countries. Other countries make provision for school based vocational education at level 1 equivalent, for example, the United States of America.

In line with the international experience, South African Qualifications seek comply with the requirements of safety, national standards and the handling of dangerous substances.

ARTICULATION OPTIONS
This Qualification allows for both horizontal and vertical articulation.

Horizontal Articulation:

ID: 58860: National Certificate: Electro-Mechanical Winding, Level 2.

Vertical Articulation:

ID: 49056, National Certificate: Domestic Appliance Repair, Level 3.

MODERATION OPTIONS
> Anyone assessing a learner or moderating the assessment of a learner against the qualification must be registered as an assessor with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

> Any institution offering learning that will enable the achievement of this qualification must be accredited as a provider with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

> Assessment and moderation of assessment will be overseen by the relevant Education, Training, Quality, Assurance (ETQA) Body, or by an ETQA that has a Memorandum of Understanding with the relevant ETQA, according to the ETQA`s policies and guidelines for assessment and moderation.

> Moderation must include both internal and external moderation of assessments, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described in the associated unit standards.

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

CRITERIA FOR THE REGISTRATION OF ASSESSORS
> Anyone assessing a learner against this qualification must be registered with the relevant ETQA as an assessor.

> Any institution offering learning that will enable the achievement this qualification must be accredited as a provider with the relevant ETQA. Assessment will be overseen by the relevant ETQA according to the policies and guidelines for assessment of that ETQA, in terms of

agreements reached around assessment and between various ETQA's (including professional bodies).

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

> The options as listed above provide the opportunity to ensure that assessment and moderation can be transparent, affordable, valid reliable and non-discriminatory.
> For an applicant to register as an assessor or moderator of this qualification, the applicant should be registered as an assessor with the relevant ETQA.
> In possession of the relevant qualification.
> Have sufficient relevant experience.
> Have the appropriate qualification to assess communication and mathematical literacy.

NOTES
This qualification replaces qualification, 48959, "National Certificate in Air Conditioning, Refrigeration and Ventilation", Level 2, 147 credits.

The assessment criteria for each unit standard are to be used by the assessor as the basis for assessment judgments, first in relation to each unit standard, and then in relation to integration at exit outcome level.

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119463	Access and use information from texts	Level 2	5
Fundamental	7480	Demonstrate understanding of rational and irrational numbers and number systems	Level 2	3
Fundamental	9008	Identify, describe, compare, classify, explore shape and motion in 2-and 3-dimensional shapes in different contexts	Level 2	3
Fundamental	12444	Measure, estimate and calculate physical quantities and explore, describe and represent geometrical relationships in 2-dimensions in different life or workplace contexts	Level 2	3
Fundamental	119455	Respond to selected literary texts	Level 2	5
Fundamental	119460	Use language and communication in occupational learning programmes	Level 2	5
Fundamental	7469	Use mathematics to investigate and monitor the financial aspects of personal and community life	Level 2	2
Fundamental	9007	Work with a range of patterns and functions and solve problems	Level 2	5
Fundamental	119456	Write/present for a defined context	Level 2	5
Core	116236	Define and explain the principles of thermodynamics and carry out basic calculations involving heat	Level 2	5
Core	116223	Demonstrate knowledge of the OHS Act as it applies to employees in the air-conditioning, refrigeration and ventilation industries	Level 2	3
Core	116232	Demonstrate understanding of fundamentals of electricity and its application in air conditioning, refrigeration and ventilation equipment	Level 2	4
Core	262177	Explain the basic vapour compression cycle, the components, the handing and storage of refrigerants	Level 2	8
Core	116355	Handle refrigerant containers and transfer refrigerants into service cylinders	Level 2	3
Core	116230	Identify materials, piping, fitting, jointing methods and insulation materials used for air-conditioning and refrigeration installations	Level 2	4
Core	116334	Identify refrigerant containers, explain handling procedures and discuss the use of refrigerants	Level 2	3
Core	116239	Identify, use and maintain hand tools and measuring instruments used in the air-conditioning, refrigeration and ventilation trades	Level 2	12

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Core	116335	Identify, use and maintain refrigeration trade specific tools and instruments	Level 2	8
Core	116229	Join and install refrigerant piping	Level 2	9
Core	116241	Work Safely and use safety equipment when carrying out mechanical or electrical work on air conditioning, refrigeration and ventilation installations	Level 2	7
Core	9322	Work in a team	Level 2	3
Core	116700	Maintain safety in the handling group 1 and 2 refrigerants	Level 3	9
Elective	13202	Apply study and learning techniques	Level 2	3
Elective	116246	Behave in the proper manner under working conditions	Level 2	4
Elective	116238	Clean air-conditioning, refrigeration and ventilation plants, components and work sites	Level 2	4
Elective	116234	Identify and apply fixing methods for piping, ducting and equipment used in the trade of air-conditioning, refrigeration and ventilation	Level 2	6
Elective	116233	Identify and state application of belt drives, couplings, gearboxes and bearings used on air-conditioning, refrigeration and ventilation plants and recognize misaligned, mismatched and worn components	Level 2	6
Elective	244564	Identify causes of stress in own life and indicate techniques to manage it	Level 2	2
Elective	9266	Install self propelled transport refrigeration systems	Level 2	4
Elective	116243	Install, connect and maintain electrical cables and conductors as applied in air conditioning, refrigeration and ventilation installations	Level 2	6
Elective	116245	Perform basic arc welding of metals as applicable to air-conditioning, refrigeration and ventilation installations	Level 2	4
Elective	116244	Sketch and construct electrical circuits applicable to single-phase air conditioning, refrigeration and ventilation installations	Level 2	9
Elective	116704	Maintain safety in the handling of ammonia refrigerant	Level 3	9
Elective	261802	Perform maintenance and repair on non-specialised marine refrigerated containers	Level 3	8
Elective	262161	Set instrumentation and perform inspections on marine refrigerated containers	Level 3	8

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
National Certificate: Air-Conditioning, Refrigeration and Ventilation

SAQA QUAL ID	*QUALIFICATION TITLE*		
65489	National Certificate: Air-Conditioning, Refrigeration and Ventilation		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
National Certificate	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	122	Level 3	Regular-Unit Stds Based

This qualification replaces:

Qual ID	Qualification Title	NQF Level	Min Credits	Replacement Status
48963	National Certificate: Air-Conditioning, Refrigeration and Ventilation	Level 3	186	Will occur as soon as 65489 is registered

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

The air conditioning, refrigeration and ventilation industry provides a service to many sectors of the country`s economy such as food processing and warehousing; food transportation, distribution and retailing; deep level mining and industrial process; high rise and retail property; specialized medical care; automotive and mass transport; tourism and hospitality.

This qualification provides the learner with the skills required to service, repair, commission and operate mechanical/electrical equipment and systems in the air conditioning, refrigeration and ventilation sub-field in a variety of applications, and to supervise work teams.

The current rate of urban development, the advance in technology and development of tourism creates an ever-increasing demand for air conditioning, refrigeration and ventilation equipment and systems and therefore a corresponding demand for technicians to repair, maintain, install and manufacture such equipment and systems.

The technical skills required for this purpose are scarce and there is a growing demand for technicians skilled in the mechanical, electrical and thermal sciences. These qualifications are ideally suited to school-leavers (male and female) who have an interest in the engineering sciences and have practical skills. This series of qualifications also equips the learner with entrepreneurial skills which would lead to self employment in the SMME field (Most businesses in the field of air conditioning, refrigeration, and ventilation are in fact SMME`s).

South African trained technicians are the obvious choice for work in this field, in many African countries. We also see an untapped potential for work and learning in this field, in many parts of Africa.

This qualification specifically suits learners who have an interest in science and mathematics as well as manual dexterity (ability to use tools) and a consciousness of personal and environmental safety. It is also suitable for workers who have some practical and technical experience working in the air conditioning, refrigeration and ventilation industry but lack the formal learning required in the qualification and who have a level to competence equivalent of the NQF Level 2 qualification in air conditioning, refrigeration and ventilation as determined in formal assessment by an assessor who meets the criteria for the registration of assessors.

To achieve competence in this qualification the learner must be able to:

> Use verbal and written practices to communicate in the workplace and apply mathematical processes to solve everyday numerical problems.
> Read and interpret drawings and diagrams related to his work as per industry standards.
> Use power tools, equipment and instruments, accurately and safely according to standard operating procedures.
> Adhere to health and safety regulations during installation, connection and maintenance of electrical cables and conductors in accordance with industry standards.
> Demonstrate knowledge of the operation of the vapour compression refrigeration system and its components, electrical and control devices and be able to repair/replace parts.
> Demonstrate knowledge of air-conditioning, refrigeration and ventilation plant layout and components drawings, sketches and specifications.

Rationale:

Air conditioning, refrigeration and ventilation are subfields of specialized engineering which account for the design, manufacture, installation, maintenance, and repair of systems which provide artificial cooling for the environment to improve comfort and productivity and the processing and preservation of foodstuffs. The development of the urban lifestyle with its concentration of population into centralized areas, the food chain from producer to consumer as well as the working environment and medical care would not be possible without these specialized engineering services.

This is the second qualification in a series of qualifications which will lead to a learner acquiring all the skills required to work in the industry in the repair, maintenance, installation, manufacture and ultimately design of the mechanical/electrical systems which provide temperature control for environmental or process needs.

The following represents a learning progression path:

> Assistant Mechanic, at NQF Level 2: Technical competence - Has a basic understanding of equipment and is able to carry out technical work under supervision.
> Mechanic, at NQF Level 3: Technical competence - Has a knowledge of equipment and systems and is able to carry out technical work without supervision.
> Artisan, at NQF Level 4: Technical competence - Has an advanced knowledge of systems and equipment and is able to work without supervision and to supervise a team.
> Technician/Project Leader, at NQF Level 5: Has knowledge of system design, selection and engineering and has management skills.

The learner will be required to reach competence in the advanced skills of the use of tools of the trade, practice of workplace safety, repair of mechanical and electrical plant faults, installation and dismantling of plants, reading and interpretation of drawings and diagrams. He will be required to work in a team and communicate at all levels in the workplace.

There are many applications of air conditioning, refrigeration and ventilation which relate directly to the tourism and hospitality industry:

> Air conditioning of hotels, restaurants and recreation areas.
> Air conditioning of luxury buses, automobiles and other transport modes.
> Refrigeration related to the food chain (producers, processors, warehouses, transport, retailing).

Relevant future socio-economic developments, for example, the increase in level of tourism will create further demand for the services of trained technicians to install, service and repair cooling equipment at all skills levels.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
This qualification assumes that the candidate has already achieved one of more of the following:

> Communication and mathematical literacy at NQF Level 2 or an equivalent.
> ID 65449: National Certificate in Air conditioning, Refrigeration and Ventilation at NQF Level 2, and or an equivalent.

Recognition of Prior Learning:

Whether a candidate attends formal courses or acquires the required skills through informal means, the same standards apply as per the matrix of unit standards. The qualification and the standards have been written in such a way that the learning has to be assessed in an integrated way. Assessors will assess evidence to establish what the learners know and can do. Such evidence may be gathered through course related activities and/or through work related activities. In cases where candidates do not attend formal courses, assessors should seek work related evidence as far as possible.

Where courses are provided for learners, institutions can use the unit standards and this qualification to assess learning achievements.

For candidates who are not able to achieve the outcomes, providers can then use the standards and qualifications to determine a specific learning programme to suit the candidates learning needs.

QUALIFICATION RULES
Fundamental component: 36 credits as expressed by the following:

> Communication: 20 credits at the level of the qualification.
> Mathematical Literacy: 16 credits at the level of the qualification.

Core component: 67 credits.

A minimum total of 19 credits is required in the elective component. For this qualification, learners are required to include Unit Standards 116720, 9532 and 9533 in this combination.

EXIT LEVEL OUTCOMES
1. Use verbal and written practices to communicate in the workplace and apply mathematical processes to solve everyday numerical problems.

2. Read and interpret drawings and diagrams related to his work as per industry standards.

3. Use power tools, equipment and instruments, accurately and safely according to standard operating procedures.

4. Adhere to health and safety regulations during installation, connection and maintenance of electrical cables and conductors in accordance with industry standards.

5. Demonstrate knowledge of the operation of the vapour compression refrigeration system and its components, electrical and control devices.

6. Demonstrate knowledge of air-conditioning, refrigeration and ventilation plant layout and components drawings, sketches and specifications.

Critical Cross-field outcomes:

This Qualification addresses the following Critical-Cross Field Outcomes:

Identifying and solving problems in which responses display that responsible decisions using thinking have been made when:

> Identify, use and maintain power tools, equipment and instruments in the air conditioning, refrigeration and ventilation industry.
> Install, connect and maintain electrical cables.

Working effectively with others as a member of a team, group, organization and community when:

> Construct electrical circuits applicable to single-phase air-conditioning, refrigeration and ventilation installations.
> Dismantle and assemble air conditioning and refrigeration equipment.

Organising and managing oneself and one's activities responsibly and effectively when:

> Identify power tools, equipments and instruments.
> Sketch and construct electrical circuits applicable to a single phase air-conditioning, refrigeration and ventilation installations.

Communicate effectively using visual, mathematical and/or language in the modes of oral and/or written persuasion when:

> Explain the operation of control devices.
> Describe the air-conditioning, refrigeration and ventilation plant layout.
> Explain the functions of components.
> Explain the purpose of power tools and other installation equipment.
> Explain the consequences of unsafe procedures in handling refrigerants.
> Explain the safety precautions that are to be practiced in the identification process.

Use science and technology effectively and critically, showing responsibility towards the environment and health of others when:

> Analyse refrigeration sample oil and demonstrate how oil indicate the general condition of a refrigeration system.
> Construct single-phase electrical circuits.
> Analyse the nature of the electrical or mechanical fault is identified.

Demonstrate understanding of the world as a set of related systems by recognizing the complex and dynamic nature of the various systems, system components and the inter-relationships that exist between systems when:

> Interpret air conditioning, refrigeration and ventilation plant layout and component drawings, sketches and specifications.
> Handle refrigerants (groups 1 and 2) responsibly.

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

1.1 Information from texts, reports and standard operating procedures is identified and applied to explain the operation of control devices.
1.2 Information from texts, reports and standard operating procedures is applied to explain the refrigeration cycle and plant layout.
1.3 Information from texts, reports and standard operating procedures is used to explain the plant layout, components, sketches and specifications.
1.4 Information from texts, reports and standard operating procedures is applied to explain faults associated with air-conditioning, refrigeration or ventilation industries.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 The use of drawings, diagrams and specifications as a means of conveying detail instructions is explained.
2.2 On-Off control devices are identified from diagrams and their use in the air-conditioning, refrigeration industry is explained.
2.3 Electrical circuits applicable to single-phase air conditioning, refrigeration and ventilations are drawn and explained according to industry standards.
2.4 Plant layout, its components and sketches is explained according to industry standards.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Relevant power tools, equipment and instruments used in the air-conditioning, refrigeration and ventilation trades are identified.
3.2 Relevant power tools, equipment and instruments used in the air-conditioning, refrigeration and ventilation trades are used safely according to standard operating procedures.
3.3 Relevant power tools, equipment and instruments used in the air-conditioning, refrigeration and ventilation trades are maintained in accordance with standard operating procedures.
3.4 The purpose of power tools and other installation equipment is explained and demonstrated.
3.5 Sample of refrigeration oils are analysed accurately and explanation is given on how oil can determine the general condition of a refrigeration system.

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 The importance of adhering to health and safety requirements is explained in terms of installation, connection and maintenance of electrical cables and conductors within the air-conditioning, refrigeration and ventilation industries.
4.2 The consequences of non compliance is explained as per industry standards.
4.3 Legal requirements when handling group 1 refrigerants are adhered to according to South African Bureau of Standards (SABS 0147).
4.5 Precautions required to ensure the safety of workers and others in the vicinity are explained and demonstrated in terms of the Occupational Health and Safety Standards.
4.6 The responsibility of handling refrigerants (groups 1 and 2) and the consequences of unsafe procedures are explained.

Associated Assessment Criteria for Exit Level Outcome 5:

5.1 The concept of vapour compression is explained according to industry standards.
5.2 The operation of the vapour compression refrigeration system is explained with the aid of block diagram.

5.3 The relationship between pressure and the temperature of a refrigerant is discussed.

Associated Assessment Criteria for Exit Level Outcome 6:

6.1 The air-conditioning, refrigeration and ventilation plant layout is interpreted in relation to its components drawings, sketches and specifications.
6.2 All system components are identified and the function of each explained in relation to the complete process.
6.3 Typical operating temperatures/pressure parameters are explained in relation to the complete process.
6.4 Sketches are drawn according to specifications.

Integrated Assessment:

Integrated assessment at the level of this qualification will evaluate the learner's capacity to integrate engineering principles, processes and behaviour across a range of workplace domains and thus be able to carry out maintenance, repair and installation work under supervision for the benefit of his employer.

Integrated assessment must specifically evaluate the learner`s ability to:

> Understand and apply mathematics literacy, communicate and behave appropriately.
> Understand and use tools, instruments and equipment safely and purposefully.
> Understand and apply the engineering principles and safety considerations related to the specific workplace tasks and environment.

This will require assessment methodologies which will include demonstration, oral and written responses, both summative and formative, and evidence of these in the form of portfolios or projects. The learner must show sufficient evidence of ability to understand engineering principles and responsibility in workplace behaviour and procedures. Such ability may be obtained in a formal learnership, by practice gained in the workplace (RPL) or by a combination of formal learning and practice in the workplace. The assessment must also ensure that learners have achieved the critical outcomes.

INTERNATIONAL COMPARABILITY
European Union:

Through the European Federation of National Refrigeration and Air Conditioning Associations (ERA. comprising 21 EU states), there is a move towards the harmonisation of EU refrigeration training and certification.

This stems from the current lack of a singular reference point in respect of competence levels and a resulting measurement of compliance to EU refrigeration codes. For example, there is an EU legislative requirement (EC842-2006 for F Gas handling) which requires refrigeration workers to achieve certification in the handling of gases. This can be achieved through (City & Guild 2078) or CITB. The handling of ammonia is dealt with at Level 2 and at subsequent levels in our system.

Great Britain:

> Equivalent qualifications to the South African Qualifications in Britain include the 6087 series, that is, Level 2: Small commercial air conditioning systems below 10kw, Level 3: Commercial and industrial non ammonia refrigeration systems above 10kw, Level 3: Ammonia refrigeration system.

> South African, air conditioning, refrigeration and ventilation qualifications at NQF Levels 2-4 are equivalent to the expansive NVQ (UK) and SVQ's (Scottish) Levels1, 2 ,3 and some elements of their Level 4.

On the other hand, the City and Guilds equivalents are found in the following range: 207- Level 2 (refrigeration and air conditioning craft certificate); 207- Level 3 refrigeration and air conditioning advanced certificate and 257 technician certificate).

Commonalities between the SA (NQF Level 2, 3 and 4) and UK Qualifications 6087 NVQ in Refrigeration and Air Conditioning Levels 2, 3 and 4) are as follows:

The core competence areas under which there is commonality across the four levels are from simple to complex systems, as follows:

> People skills range: Maintaining effective work relationships, diversity and supervision.
> Safety and compliance range: Health, safety and regulatory requirements in respect of national, international codes of practice and applicable legislation.
> Commissioning and decommissioning of refrigeration and air conditioning systems:
> Range: Planning and factoring of tools, requirements, process and use.
> Service and repair: Installation, maintenance, diagnosis and fault finding.

In both jurisdictions the various levels have the following similarities:

> Level 2: Basic safety, the handling of ammonia and the installation of simple systems.
> Level 3: Relevant safety area, assembling, design and sketching of a complex system.
> Level 4: Maintenance, fault finding/diagnosis, repair of a complex system, measurements of air flow, supervision, determining evaluation parameters and servicing.

Operatives:

The operatives (SA) in the air conditioning, refrigeration and ventilation field are: Assistant mechanic at Level 2, who carries out technical work under supervision; the mechanic (without supervision) at Level 3; the Technician/protect Leader at Level 4 whose role is supervisory and is able to deal with complex systems.

In the UK Level 2 is for the Trainee, Level 3 is for the craftsperson and Level 4 is for the Specialist/Supervisor and Team leader.

An example from British Columbia:

For illustration, we picked a specific Heating, Ventilation an Air-conditioning Technician course from British Columbia Institute of Technology (BCIT) in Canada. In it there is consistency with the SA and UK qualifications in the core/main elements, though with some minor differences of terminology, duration and qualification pegging.

> Total number of Credits for Qualification; 125 (BCIT), 133 (SAQA).
> Duration of Qualification; Two (2) years (BCIT).
> NQF Level; 1-3 (BCIT); 02 (SAQA).

It is noted that the BCIT qualification has been made up of 3 separate levels of Unit Standards that make up the total Credit of 125. The South African equivalent qualifications have three qualifications that span three levels, that is, Levels 2-4 with credits as follows: (Level 2; 133, Level 3: 122 and Level 4 at 156 credits).

The Table below illustrates the difference in the BCIT Credit level 1 Unit Standards and South African Qualification Unit standard Level 2 Qualification and their respective Credits.

> HVAC 1095: Apply Effective Learning Technique, Level 1, 0.5 Credits.
> HVAC 1100: Apply Trade Safety Practices, Level 1, 2.0 Credits.
> HVAC 1101: Process Technical Information, Level 1, 2.5 Credits.
> HVAC 1103: Apply Trade Tools and Fastener, Level 1, 4.0 Credits.
> HVAC 1104: Apply Fundamental of Refrigeration, Level 1, 8.5 Credits.
> HVAC 1105: Proper Service Procedures, Level 1, 5.5 Credits.
> HVAC 1106: Apply Electrical Fundamentals, Level 1, 5.5 Credits.
> HVAC 1107: Interpret Electrical Diagrams, Level 1, 3.0 Credits.
> HVAC 1108: Apply Electrical Test Equipment, Level 1, 2.0 Credits.
> HVAC 1109: Install Electrical Devices, Level 1, 4.0 Credits.
> HVAC 1111: Install Refrigeration Project, Level 1, 2.0 Credits.
> HVAC 1112: Prepare for Employment, Level 1, 0.5 Credits.
> HVAC 1990: Co-op 1, Level 1, 22.0 Credits.

An example from British Columbia:

It should be noted that the international standard is arguably set higher than the South African standards based on the reason listed below. A BCIT qualified graduate at level two is expected to be able to Design Refrigeration Systems, Describe Basic HVAC Systems, Air Distribution Arrangement for HVAC, Air Properties and Measurement, Explain HVAC Control Loops, Maintain Heat Pump Systems, whereas our graduate is only expected to demonstrate understanding of the basic understanding of mechanical/technical equipment and carry out technical work and understand principles of Air-Conditioning, refrigeration and ventilation and demonstrate a b. The BCIT graduate would have learned all South African Level 2 core unit standards in his/her Level 1.

New Zealand:

South African Level 3 and 4 qualifications compare relatively favourably with those of New Zealand (Level 3: 1415, Level 4:1416; Level 4: 0124; Level 4: 0130). It is noted that the New Zealand Qualifications Authority allows for specialization in the following areas: Automotive Heating etc. Automotive machining, Diesel Fuel injection and Motorsport. The New Zealand Qualification Authority (NZQA) has listed an equivalent qualification as a Heating, Ventilation an Air-conditioning (HVAC) qualification which would be a component of an Engineering Qualification (e.g. Mechanical Engineering, Motor Industry Engineering or Building maintenance).

SADC and beyond:

> Many SADC countries are still in the early stages of developing their NQF's. Equivalents for the qualifications under review were not found.

Summary:

The International comparability exercise has revealed the following:

New Zealand, Great Britain, and EU qualifications have a number of occupational streams and learning pathways within the domestic, commercial/industrial and auto applications of heating, ventilation and air conditioning. It was also observed that the South African air conditioning unit standards within the NQF Level range 2-4 overlaps the international equivalent at Levels 1-6, in the various countries. Other countries make provision for school based vocational education at Level 1 equivalent, for example, the United States of America.

In line with the international experience, the South African Qualifications seek comply with the requirements of safety, national standards and the handling of dangerous substances.

ARTICULATION OPTIONS
This Qualification allows for both horizontal and vertical articulation.

Horizontal articulation:

ID 58862: National Certificate: Electro-Mechanical Winding, at NQF Level 3.

Vertical articulation:

ID 50371: National Certificate: Domestic Appliance Repair, at NQF Level 4.

MODERATION OPTIONS
> Anyone assessing a learner or moderating the assessment of a learner against the qualification must be registered as an assessor with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

> Any institution offering learning that will enable the achievement of this qualification must be accredited as a provider with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

> Assessment and moderation of assessment will be overseen by the relevant Education, Training, Quality, Assurance (ETQA) Body, or by an ETQA that has a Memorandum of Understanding with the relevant ETQA, according to the ETQA's policies and guidelines for assessment and moderation.

> Moderation must include both internal and external moderation of assessments, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described in the associated unit standards.

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

CRITERIA FOR THE REGISTRATION OF ASSESSORS
Anyone assessing a learner against this qualification must be registered with the relevant ETQA as an assessor.

Any institution offering learning that will enable the achievement this qualification must be accredited as a provider with the relevant ETQA. Assessment will be overseen by the relevant ETQA according to the policies and guidelines for assessment of that ETQA, in terms of agreements reached around assessment and between various ETQA's (including professional bodies).

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

The options as listed above provide the opportunity to ensure that assessment and moderation can be transparent, affordable, valid reliable and non-discriminatory.

For an applicant to register as an assessor or moderator of this qualification, the applicant needs:

> To be registered as an assessor with the relevant ETQA.
> To be in possession of the relevant qualification.
> To have sufficient relevant experience.

> To have the appropriate qualification to assess communication and mathematical literacy.

NOTES

This qualification replaces qualification 48963, "National Certificate: Air-Conditioning, Refrigeration and Ventilation", Level 3, 189 credits.

> All credits are at NQF Level 3 and the associated unit standards are shown in the titles matrix annexure.
> Certain rules of combination of elective credits are applicable, refer to the titles matrix annexure.

The assessment criteria for each unit standard are to be used by the assessor as the basis for assessment judgments, first in relation to each unit standard, and then in relation to integration at Exit Outcome Level.

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119458	Analyse and respond to a variety of literary texts	Level 3	5
Fundamental	9010	Demonstrate an understanding of the use of different number bases and measurement units and an awareness of error in the context of relevant calculations	Level 3	2
Fundamental	9013	Describe, apply, analyse and calculate shape and motion in 2-and 3-dimensional space in different contexts	Level 3	4
Fundamental	119466	Interpret a variety of literary texts	Level 3	5
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	9012	Investigate life and work related problems using data and probabilities	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	7456	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	Level 3	5
Core	116226	Identify and set ON-OFF control devices as used in air conditioning and refrigeration systems, explain their operation and discuss their application and fault finding	Level 2	6
Core	116243	Install, connect and maintain electrical cables and conductors as applied in air conditioning, refrigeration and ventilation installations	Level 2	6
Core	116244	Sketch and construct electrical circuits applicable to single-phase air conditioning, refrigeration and ventilation installations	Level 2	9
Core	116468	Adhere to the legal requirements of SANS 10147 (SABS 0147) standards when handling group 1 refrigerants	Level 3	6
Core	261819	Apply an understanding of various systems, system components, the actual and the theoretical refrigeration cycle	Level 3	7
Core	116719	Demonstrate knowledge of the OHS Act as it affects experienced workers in the air conditioning, refrigeration and ventilation industries	Level 3	3
Core	116712	Dismantle and assemble air conditioning and refrigeration equipment	Level 3	6
Core	116697	Fault find an air-conditioning, refrigeration or ventilation plant stoppage or failure	Level 3	5
Core	116702	Identify, handle and sample refrigeration oils for analysis, and demonstrate how oil can indicate the general condition of a refrigeration system	Level 3	2
Core	116696	Identify, use and maintain power tools used in the air-conditioning, refrigeration and ventilation trades	Level 3	8
Core	116717	Interpret air-conditioning, refrigeration and ventilation plant layout and component drawings, sketches and specifications	Level 3	6
Core	9530	Manage work time effectively	Level 3	3

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	116233	Identify and state application of belt drives, couplings, gearboxes and bearings used on air-conditioning, refrigeration and ventilation plants and recognize misaligned, mismatched and worn components	Level 2	6
Elective	9266	Install self propelled transport refrigeration systems	Level 2	4
Elective	116703	Check and maintain air-conditioners in vehicles	Level 3	4
Elective	9532	Demonstrate basic knowledge of computers	Level 3	6
Elective	116708	Diagnose and repair air-conditioners in vehicles	Level 3	4
Elective	116701	Handle and place in position equipment used within the air-conditioning, refrigeration and ventilation industries	Level 3	4
Elective	116707	Identify and apply insulation methods and materials for piping and flat surfaces as applicable to air-conditioning and refrigeration systems	Level 3	8
Elective	116465	Identify and commission modulating control systems as used in air conditioning and refrigeration systems	Level 3	6
Elective	244589	Identify causes of stress and techniques to manage it in the workplace	Level 3	2
Elective	116718	Identify water reticulation systems, its components, accessories and controls used in air-conditioning and refrigeration installations	Level 3	4
Elective	116713	Install and service power transmission systems for air-conditioning, refrigeration and ventilation equipment	Level 3	6
Elective	9546	Install externally powered transport refrigeration systems	Level 3	6
Elective	116706	Operate water treatment systems used in air-conditioning and refrigeration installations	Level 3	3
Elective	116715	Remove, install and service bearings used on air-conditioning, refrigeration and ventilation equipment	Level 3	6
Elective	116720	Show understanding of diversity in the workplace	Level 3	3
Elective	116705	Supply and fit air conditioners to vehicles	Level 3	3
Elective	9533	Use communication skills to handle and resolve conflict in the workplace	Level 3	3

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
Further Education and Training Certificate: Air-conditioning, Refrigeration and Ventilation

SAQA QUAL ID	*QUALIFICATION TITLE*		
65509	Further Education and Training Certificate: Air-conditioning, Refrigeration and Ventilation		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
Further Ed and Training Cert	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	152	Level 4	Regular-Unit Stds Based

This qualification replaces:

Qual ID	Qualification Title	NQF Level	Min Credits	Replacement Status
20721	National Certificate: Air Conditioning, Refrigeration and Ventilation	Level 4	135	Will occur as soon as 65509 is registered
48966	Further Education and Training Certificate: Air-conditioning, Refrigeration and Ventilation	Level 4	169	Will occur as soon as 65509 is registered

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

The air conditioning, refrigeration and ventilation industry provides a service to many sectors of the country's economy such as food processing and warehousing, food transportation, distribution and retailing, deep level mining and industrial process, high rise and retail property, specialized medical care, automotive and mass transport, tourism and hospitality.

This qualification provides the learner with the skills required to service, repair, commission and operate mechanical/electrical equipment and systems in the air conditioning, refrigeration and ventilation sub-field in a variety of applications, and to supervise work teams.

The current rate of urban development, the advance in technology and development of tourism creates an ever-increasing demand for air conditioning, refrigeration and ventilation equipment and systems and therefore a corresponding demand for technicians to repair, maintain, install and manufacture such equipment and systems.

The technical skills required for this purpose are scarce and there is a growing demand for technicians skilled in the mechanical, electrical and thermal sciences. These qualifications are ideally suited to school-leavers (male and female) who have an interest in the engineering sciences and have practical skills. This series of qualifications also equips the learner with entrepreneurial skills which would lead to self employment in the SMME field (Most businesses in the field of air conditioning, refrigeration, and ventilation are in fact SMME's).

South Africa is the only country in Sub-Saharan Africa which has established qualifications and a network of training providers countrywide. South African trained technicians are the obvious

choice for work in this field in all African countries north of our borders. We also see an untapped potential for training of learners from NEPAD countries which would assist in the further development of our training resources.

This qualification specifically suits learners who have an interest in science and mathematics as well as manual dexterity (ability to use tools) and a consciousness of personal and environmental safety. It is also suitable for workers who have had advanced practical and technical experience working in the air conditioning, refrigeration and ventilation industry but lack the formal learning required in the qualification and who have a level to competence equivalent of the NQF Level 3 qualification in air conditioning, refrigeration and ventilation as determined in formal assessment by an assessor who meets the criteria for the registration of assessors.

To achieve competence in this qualification the learner must be able to:

> Compile feasibility and commissioning reports.
> Interpret and present the effects of operating conditions on components, safety and control devices.

Rationale:

Air conditioning, refrigeration and ventilation are subfields of specialized engineering which account for the design, manufacture, installation, maintenance, and repair of systems which provide artificial cooling for the environment and the processing and preservation of foodstuffs. The development of the urban lifestyle with its concentration of population into centralized areas, the food chain from producer to consumer as well as the working environment and medical care would not be possible without these specialized engineering services.

This is the third qualification in a series of qualifications which will lead to a learner acquiring all the skills required to work in the industry in the repair, maintenance, installation, manufacture and ultimately design of the mechanical/electrical systems which provide temperature control for environmental or process needs. By qualifying at this level a learner will achieve the status of an artisan in air conditioning, refrigeration and ventilation and will have an advanced knowledge of systems and equipment and be able to supervise working teams.

> Assistant mechanic: NQF Level 2 (Technical competence: Has a basic understanding of equipment and is able to carry out technical work under supervision).
> Mechanic: NQF Level 3 (Technical competence: Has a knowledge of equipment and systems and is able to carry out technical work without supervision).
> Artisan: NQF Level 4 (Technical competence: Has an advanced knowledge of systems and equipment and is able to work without supervision and to supervise a team).
> Technician/Project Leader: NQF Level 5 (Has knowledge of system design, selection and engineering and has management skills).

The learner will be required to reach competence in the advanced skills of the servicing, repair and commissioning of systems and the selection of components and to understand and operate supervisory control systems. He will be required to supervise work teams and communicate at all levels in the workplace and with customers.

There are many applications of air conditioning, refrigeration and ventilation which relate directly to the tourism and hospitality industry:

> Air conditioning of hotels, restaurants and recreation areas.
> Air conditioning of luxury buses, automobiles and other transport modes.
> Refrigeration related to the food chain (producers, processors, warehouses, transport, retailing).

The future events and subsequent increase in level of tourism will create further demand for the services of trained technicians to install, service and repair cooling equipment at all skills levels.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
This qualification assumes that the candidate has already achieved the following:

> Communication and Mathematical literacy at NQF Level 2 or an equivalent.

Recognition of Prior Learning:

Whether a candidate attends formal courses or acquires the required skills through informal means, the same standards apply as per the matrix of unit standards. The qualification and the standards have been written in such a way that the learning has to be assessed in an integrated way. Assessors will assess evidence to establish what the learners know and can do. Such evidence may be gathered through course related activities and/or through work related activities. In cases where candidates do not attend formal courses, assessors should seek work related evidence as far as possible.

Where courses are provided for learners, institutions can use the unit standards and this qualification to assess learning achievements.

For candidates who are not able to achieve the outcomes, providers can then use the standards and qualifications to determine a specific learning programme to suit the candidates' learning needs.

QUALIFICATION RULES
Fundamental Component:

All fundamental unit standards are compulsory (56 credits).

The fundamental Component consists of the following, which is compulsory for all learners:

> Unit standards at NQF Level 4, totaling 16 credits in Mathematical Literacy.

Core Component:

All core unit standards are compulsory (64 credits).

Elective Component:

A minimum of 32 credits is required to meet requirement of this Qualification. A leaner may select any combination of credits adding up to a minimum of 32
credits.

EXIT LEVEL OUTCOMES
1. Demonstrate an understanding of procedures within industry and the ability to service, repair and start-up air conditioning, refrigeration and ventilation systems including the use and maintenance of equipment and tooling to meet quality and output requirements, working safety and in an environmentally aware manner.

2. Demonstrate an understanding of the need for control of quality in the manufacturing, installation, maintenance and repair processes relating to air conditioning, refrigeration and ventilation.

3. Demonstration an understanding of the application and procedures relating to the operation of various control devices, control systems and programmable logic systems used in air conditioning, refrigeration and ventilation plants.

4. Demonstrate an understanding and application of all the various types of systems used and related to the air conditioning, refrigeration and ventilation industry.

5. Manage subordinates, communicate with clients, peers and members of management levels by demonstrating the ability to summarise information and express opinion on given information in spoken and written form.

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

7. Demonstrate and understanding of the processes involved in the use of appropriate mathematics literacy and financial skills and the skills in written and oral communication applicable to the workplace and life in general.

Critical Cross-Field Outcomes:

The following indicates the critical cross-field outcomes relative to the exit level outcomes of the qualification:

Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have made when:

> Diagnosing operational faults in refrigeration systems.

Work effectively with others as a member of a team, group, organisation and community during:

> Supervision of a team.

Organise oneself and one`s activities responsibly and effectively when:

> Conducting quality checks.
> Designing and constructing three-phase circuits used in air-conditioning, refrigeration and ventilation plants.

Communicate effectively using visual and language skills when:

> Compiling feasibility and commissioning reports.

Understand the world as a set of related systems when:

> Explaining the operation of different systems and refrigerants in the air-conditioning, refrigeration and ventilation industry.

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

> Procedures to be followed when servicing, repairing and starting-up air-conditioning, refrigeration and ventilation systems are explained as per industry standards.

Associated Assessment Criteria for Exit-Level-Outcome 2:

> The importance of quality control in the manufacturing, installation, maintenance and repair processes relating to air-conditioning, refrigeration and ventilation is explained.
> The standards for control of quality are explained and their application is discussed.

Associated Assessment Criteria for Exit-Level-Outcome 3:

> The consequences of defective material and assembly are explained in terms of safety, legal and contractual considerations.
> The standards for control of quality are explained and their application is discussed.

Associated Assessment Criteria for Exit-Level-Outcome 4:

> The functioning of the devices and systems are explained by means of control and wiring diagrams.
> The need for control devices and systems is explained.

Associated Assessment Criteria for Exit-Level-Outcome 5:

> The safety considerations of the work team and others in the vicinity are discussed in terms of the OSH Act and practical safety.

Associated Assessment Criteria for Exit-Level-Outcome 6:

> The required personal skills are explained and demonstrated.
> The procedures or processes are explained in relation to the appropriate refrigeration system or component.
> The required installation methods or application are discussed and safety precautions noted.

Integrated Assessment:

Integrated assessment at the level of this qualification will evaluate the learner's capacity to integrate engineering principles, processes and behaviour across a range of workplace domains and thus be able to carry out maintenance, repair and installation work under supervision for the benefit of his employer.

Integrated assessment must specifically evaluate the learner's ability to:

> Demonstrate competence by means of the practical application of the embedded knowledge in a manner that meets the required performance standards required.

This will require assessment methodologies which will include demonstration, oral and written responses, both summative and formative, and evidence of these in the form of portfolios or projects. Since this is a basic qualification, the learner must show sufficient evidence of ability to understand engineering principles and workplace behaviour and procedures. Such ability may be obtained in a formal learnership, by practice gained in the workplace (RPL) or by a combination of formal learning and practice in the workplace. The assessment must also ensure that learners have achieved the critical outcomes.

INTERNATIONAL COMPARABILITY
European Union:

Through the European Federation of National Refrigeration and Air Conditioning Associations (ERA. comprising 21 EU states), there is a move towards the harmonisation of EU refrigeration

training and certification. This stems from the current lack of a singular reference point in respect of competence levels and a resulting measurement of compliance to EU refrigeration codes.

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This can be achieved through (City and Guild 2078) or CITB.

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Equivalent qualifications to the South African Qualifications in Britain include the 6087 series, that is:

> Level 2: Small commercial air conditioning systems below 10kw.
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> Level 3: Ammonia refrigeration system.

South African air conditioning, refrigeration and ventilation qualifications at NQF Levels 2-4 are equivalent to the expansive NVQ and SVQ's (Scottish) levels1, 2, 3 and some elements of their Level 4.

On the other hand, the City and Guilds equivalents are found in the following range: 207- Level 2 (refrigeration and air conditioning craft certificate); 207- Level 3 (refrigeration and air conditioning advanced certificate and 257 technician certificate.

SADC and beyond:

Many SADC countries are still in the early stages of developing their NQF's. Equivalents for the qualifications under review were not found.

New Zealand:

South African NQF Level 3 and 4 qualifications compare relatively favourably with those of New Zealand (Level 3: 1415, Level 4:1416, Level 4: 0124, Level 4: 0130). It is note that the New Zealand Qualifications Authority allows for specialization in the following areas: Automotive Heating etc. Automotive machining, Diesel Fuel injection and Motorsport. The New Zealand Qualification Authority (NZQA) has listed an equivalent qualification as a Heating, Ventilation an Air-conditioning (HVAC) qualification which would be a component of an Engineering Qualification (e.g. Mechanical Engineering, Motor Industry Engineering or Building maintenance).

In Summary:

The International comparability exercise has revealed the following:

> New Zealand, Great Britain, and EU qualifications have a number of occupational streams and learning pathways within the domestic, commercial/industrial and auto applications of heating, ventilation and air conditioning. It was also observed that the South African air conditioning unit standards within the NQF Level range 2-4 overlaps the international equivalent at Levels 1-6, in the various countries. Other countries make provision for school based vocational education at Level 1 equivalent, for example, the United States of America.

> In line with the international experience, the South African Qualifications seek comply with the requirements of safety, national standards and the handling of dangerous substances.

ARTICULATION OPTIONS

This Qualification allows for both horizontal and vertical articulation.

Horizontal Articulation:

> ID 58270: Further Education and Training Certificate: Electro Mechanics, NQF Level 4.
> ID 58539: Further Education and Training Certificate: Automotive Repair and Maintenance, NQF Level 4.

Vertical Articulation:

> National Certificate: Generic Management, NQF Level 5.

MODERATION OPTIONS

> Anyone assessing a learner or moderating the assessment of a learner against the qualification must be registered as an assessor with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

> Any institution offering learning that will enable the achievement of this qualification must be accredited as a provider with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

CRITERIA FOR THE REGISTRATION OF ASSESSORS

> Anyone assessing a learner against this qualification must be registered with the relevant ETQA as an assessor.

> Assessors should have a technical knowledge and experience of mechanical, electrical and thermal processes equivalent to one NQF Level higher than this qualification. They should also have sufficient expertise to assess communication, mathematical literacy and life skills.

NOTES

This qualification replaces the following qualifications:

> ID 48966, which is "National Certificate in Air Conditioning, Refrigeration and Ventilation", Level 4, 135 credits.
> ID 20721, which is "National Certificate: Air Conditioning, Refrigeration and Ventilation", Level 4, 135 credits.

The assessment criteria for each unit standard are to be used by the assessor as the basis for assessment judgments, first in relation to each unit standard, and then in relation to integration at exit outcome level.

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119458	Analyse and respond to a variety of literary texts	Level 3	5
Fundamental	119466	Interpret a variety of literary texts	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	9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	Level 4	6
Fundamental	119470	Evaluate literary texts	Level 4	5
Fundamental	119461	Make and motivate judgements on selected literary 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

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
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
Core	116698	Carry out elementary airflow measurements and calculations	Level 3	4
Core	12488	Complete feasibility and commissioning reports	Level 3	3
Core	116699	Determine, define and evaluate operating parameters of a refrigeration system	Level 3	5
Core	116463	Fault find, repair and maintain AC motors, circuitry and controls as applied to air conditioning, refrigeration and ventilation installations	Level 3	8
Core	116466	Inspect and maintain electrical control panels and circuitry as used for air-conditioning, refrigeration and ventilation installations	Level 3	6
Core	116464	Sketch and construct three-phase circuits as used in air-conditioning, refrigeration and ventilation installations	Level 3	8
Core	116379	Demonstrate knowledge of the OHS Act applicable to technicians employed in the air-conditioning, refrigeration and ventilation industries	Level 4	4
Core	116406	Diagnose operational faults in refrigeration systems and take remedial action or propose corrective action	Level 4	6
Core	262178	Interpret the effect of operating conditions on components, safety and control devices	Level 4	6
Core	116380	Supervise workers at levels 2 and 3	Level 4	6
Core	116392	Understand, implement, maintain and monitor general quality standards within the air-conditioning, refrigeration and ventilation industries	Level 4	8
Elective	116695	Determine the properties of air from a psychometric chart and carry out basic calculation involving heat and mass transfer	Level 3	7
Elective	116701	Handle and place in position equipment used within the air-conditioning, refrigeration and ventilation industries	Level 3	4
Elective	116716	Install eutectic and multi compartment transport refrigeration systems	Level 3	6
Elective	116714	Lead a team, plan, allocate and assess their work	Level 3	4
Elective	116710	List the commonly applied air-conditioning systems, state their application and explain their operation	Level 3	8
Elective	116704	Maintain safety in the handling of ammonia refrigerant	Level 3	9
Elective	7465	Collect and use data to establish complex statistical and probability models and solve related problems	Level 4	5
Elective	116460	Demonstrate an understanding of logic controllers as used in air conditioning, refrigeration and ventilation applications	Level 4	7
Elective	262158	Perform maintenance and repair on specialised marine refrigerated containers and generator sets	Level 4	15
Elective	116421	Repair and overhaul air-conditioning, refrigeration and ventilation equipment	Level 4	8
Elective	116403	Service a refrigeration system and set it in operation	Level 4	8
Elective	116389	Write a technical report	Level 4	4
Elective	262159	Inspect and evaluate the conformance of air-conditioning and refrigeration pressure equipment	Level 5	15

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Perform maintenance and repair on non-specialised marine refrigerated containers

SAQA US ID	*UNIT STANDARD TITLE*		
261802	Perform maintenance and repair on non-specialised marine refrigerated containers		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	8

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

SPECIFIC OUTCOME 1
Inspect and repair marine refrigerated container box exterior and interior structures and components.

SPECIFIC OUTCOME 2
Inspect marine refrigerated container systems.

SPECIFIC OUTCOME 3
Repair marine refrigerated container systems.

SPECIFIC OUTCOME 4
Carry out a Pre-Trip Inspection Procedure.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	65449	National Certificate: Air-conditioning, Refrigeration and Ventilation	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Apply an understanding of various systems, system components, the actual and the theoretical refrigeration cycle

SAQA US ID	*UNIT STANDARD TITLE*		
261819	Apply an understanding of various systems, system components, the actual and the theoretical refrigeration cycle		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	7

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

SPECIFIC OUTCOME 1
Explain the process taking place in each component.

SPECIFIC OUTCOME 2
Identify and explain the function of components and accessories of a refrigeration system.

SPECIFIC OUTCOME 3
Explain the differences in operation between the basic and the actual vapour compression refrigeration cycle.

SPECIFIC OUTCOME 4
Compare and discuss the various types of vapour compression refrigeration systems.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	65489	National Certificate: Air-Conditioning, Refrigeration and Ventilation	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Perform maintenance and repair on specialised marine refrigerated containers and generator sets

SAQA US ID	*UNIT STANDARD TITLE*		
262158	Perform maintenance and repair on specialised marine refrigerated containers and generator sets		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	15

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

SPECIFIC OUTCOME 1
Inspect specialised marine refrigerated container systems.

SPECIFIC OUTCOME 2
Repair specialised marine refrigerated container systems.

SPECIFIC OUTCOME 3
Carry out a pre trip inspection procedure.

SPECIFIC OUTCOME 4
Carry out cold treatment procedures on a marine refrigerated container.

SPECIFIC OUTCOME 5
Conduct manufacturer-specified modifications or upgrades on a Specialised marine refrigerated container.

SPECIFIC OUTCOME 6
Carry out a generator set pre trip inspection procedure.

SPECIFIC OUTCOME 7
Conduct off-hire surveys on a Specialised marine refrigerated container.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	65509	Further Education and Training Certificate: Air-conditioning, Refrigeration and Ventilation	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Inspect and evaluate the conformance of air-conditioning and refrigeration pressure equipment

SAQA US ID	*UNIT STANDARD TITLE*		
262159	Inspect and evaluate the conformance of air-conditioning and refrigeration pressure equipment		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Engineering and Related Design	
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
Explain and discuss the legislative framework.

SPECIFIC OUTCOME 2
Plan and prepare to evaluate and inspect the construction of pressure equipment.

SPECIFIC OUTCOME 3
Inspect and evaluate the construction of pressure equipment for conformance.

SPECIFIC OUTCOME 4
Present a report/issue a certificate on pressure equipment conformance/non-conformance.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	65509	Further Education and Training Certificate: Air-conditioning, Refrigeration and Ventilation	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Set instrumentation and perform inspections on marine refrigerated containers

SAQA US ID	*UNIT STANDARD TITLE*		
262161	Set instrumentation and perform inspections on marine refrigerated containers		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	8

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

SPECIFIC OUTCOME 1
Explain and discuss perishable product storage requirements.

SPECIFIC OUTCOME 2
Describe the processing path of a refrigerated container through a depot.

SPECIFIC OUTCOME 3
Identify various types of marine refrigerated containers and explain their purpose.

SPECIFIC OUTCOME 4
Explain and discuss the operating principles of marine refrigerated containers.

SPECIFIC OUTCOME 5
Use marine refrigerated container instrumentation.

SPECIFIC OUTCOME 6
Prepare and present a refrigerated container for inspection.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	65449	National Certificate: Air-conditioning, Refrigeration and Ventilation	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Explain the basic vapour compression cycle, the components, the handing and storage of refrigerants

SAQA US ID	*UNIT STANDARD TITLE*		
262177	Explain the basic vapour compression cycle, the components, the handing and storage of refrigerants		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 2	8

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
116224	Explain the operation of basic vapour compression refrigeration systems, and identify and explain the function of the components and accessories as well as their retrieval and storage procedures	Level 2	8	Will occur as soon as 262177 is registered

SPECIFIC OUTCOME 1
Explain, with the aid of a block diagram, the operation of the vapour compression refrigeration system.

SPECIFIC OUTCOME 2
Name and indicate the components and pipes in the block diagrams drawn and indicate the direction of flow of refrigerant.

SPECIFIC OUTCOME 3
Discuss the relationship between the pressure and the temperature of a refrigerant.

SPECIFIC OUTCOME 4
Explain the safe handling and storage of refrigeration system components and accessories.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	65449	National Certificate: Air-conditioning, Refrigeration and Ventilation	Level 2

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Interpret the effect of operating conditions on components, safety and control devices

SAQA US ID	*UNIT STANDARD TITLE*		
262178	Interpret the effect of operating conditions on components, safety and control devices		
ORIGINATOR		*PROVIDER*	
SGB Air-conditioning Refrigeration and Ventilation			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	6

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
116709	Explain the operation of the vapour compression refrigeration cycle, and identify and explain the operation of the components and the associated controls, safety devices and defrost systems	Level 3	10	Will occur as soon as 262178 is registered

SPECIFIC OUTCOME 1
Explain the effect of actual operating conditions on the performance of the various components in the actual vapour compression cycle.

SPECIFIC OUTCOME 2
List, identify and state the purpose of refrigerant control devices.

SPECIFIC OUTCOME 3
Explain the operation of refrigerant control devices.

SPECIFIC OUTCOME 4
List the commonly applied controls and safety devices for refrigeration plants and explain their purpose and operation.

SPECIFIC OUTCOME 5
Identify refrigeration plant control and safety devices.

SPECIFIC OUTCOME 6
List the commonly used defrost systems and explain their purpose and operation.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	65509	Further Education and Training Certificate: Air-conditioning, Refrigeration and Ventilation	Level 4