No. 1245 **28 December 2007**

SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)

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

Engineering

registered by Organising Field 06 – Manufacturing, Engineering and Technology, publishes the following Qualification for public comment.

This notice contains the title, field, sub-field, NQF level, credits, and purpose of the Qualification. The full Qualification can be accessed via the SAQA web-site at **www.saqa.org.za**. Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the Qualification should reach SAQA at the address below and ***no later than 1 February 2008.*** All correspondence should be marked **Standards Setting – Engineering** and addressed to

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SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
National Certificate: Engineering

SAQA QUAL ID	***QUALIFICATION TITLE***		
60071	National Certificate: Engineering		
ORIGINATOR		***PROVIDER***	
SGB Engineering			
QUALIFICATION TYPE	***FIELD***	***SUBFIELD***	
National Certificate	6 - Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	***MINIMUM CREDITS***	***NQF LEVEL***	***QUAL CLASS***
Undefined	120	Level 6	Regular-ELOAC

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

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

The qualification, prepares the learner for an established engineering occupation by incorporating the knowledge gained from previous engineering qualification (120 Certificate) to:

- Provide sufficient fundamental engineering knowledge to support progression to other higher engineering qualifications in a specific occupation.
- Provide competencies required for the specific occupation.
- Provide fundamental and further knowledge relevant to and applicable in the specific occupation.
- Provide learners with management principles appropriate to the specific occupation.

Curriculum developers will use this generic qualification framework to design their curricula using specified occupation-related content and skills.

Rationale:

The Engineering profession contributes through its range of distinctive skills to the technological, socio-economic, built environment and environmental infrastructure of the country. Engineering activity facilitates socio-economic growth and sustainability. Engineering activity requires a range of types of professionals (engineers, technologists, technicians and certificated engineers), specialised support personnel as well as artisans. A large number of focussed, specialised or specified occupations support the engineering process. Functions include completion of designs by insertion of codified detail, development and supply of manufacturing and construction information, quality control, inspections, or supervision of production or construction in support of engineering professionals.

These occupations may originate in several ways: they may be generally recognised; may be an industry sector requirement; may be required by an Act or may be established by ECSA as specified categories.

These occupations have a common set of generic competencies but differ in detailed technical knowledge and work-related skills. Because these occupations are each focussed on specific technical activities, the qualification allows the learner to become proficient in a limited time. At the same time, the qualification seeks to provide the basis for vertical and horizontal articulation to and from other technical qualifications.

Engineering higher education and training qualifications are structured in a coherent framework with common sets of generic requirements and discipline or occupation-specific specialisation. This qualification is intended to create a generic base common to a large number of engineering support occupation qualifications. The generic standards approach used to define the requirements for BEng, BTech, ND is therefore used for these certificate qualifications.

Notes:

- Programmes implementing this qualification correspond to the Advanced Certificate at NQF Level 6 as defined in the Higher Education Qualifications Framework.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
It is assumed that learners are already competent in communication, mathematics and science at NQF Level 5.

Recognition of Prior Learning:

- RPL is permitted. This qualification may be obtained in part or wholly through recognition of prior learning.

Access to the Qualification:

- Access to this qualification is open bearing in mind learning assumed to be in place.

QUALIFICATION RULES
The minimum credits in the various knowledge areas is as follows.

Table 1: Minimum credits by knowledge area.

Component; Credits:

- Mathematical Sciences; 15 Credits.
- Basic Sciences; 10 Credits.
- Engineering Sciences; 40 Credits.
- Engineering Practice; 10 Credits.
- Computing and IT; 15 Credits.
- Complementary Disciplines; 10 Credits.
- Subtotal; 100 Credits.
- Discretionary for addition to above areas; 20 Credits.
- Total Credits; 120 Credits.

Notes to Table 1:

- Complementary studies are portable and include communication skills.
- Discretionary credits range from 0-20 provided the total credit is not less than 120.

EXIT LEVEL OUTCOMES

1. Apply engineering principles to systematically diagnose and solve well-defined specific engineering problems.

Range:

Problems are well-defined specific engineering problems having some or all of the following characteristics:

- Problem statement is concrete, requirements are largely complete and certain in a specified field, but may require refinement.
- Problems may be unfamiliar but occur in a limited range of familiar contexts and are amenable to solution by established methods.
- Approach to solution involves standardized methods or codified best practice.
- Information is concrete and complete, requires checking and possible supplementation.
- Solutions are encompassed by standards, codes and documented procedures; judgement of outcome needed.
- Involves specific issues but with few of these imposing conflicting constraints within limitations of procedures.

2. Execute operational procedures appropriate to the occupational context.

Range:

Occupational contexts involve at least one of the following:

- Perform design support functions, by applying design procedures using given parameters and produce construction/manufacturing/implementation information.
- Perform inspections according to specified requirements.
- Maintain specific equipment, plant or infrastructure.
- Perform tests in accordance with specified requirements.
- Set up and run manufacturing operations.

3. Demonstrate the application of mathematical, science and engineering knowledge in a specific engineering context.

Range:

Knowledge is characterized by some or all of the following:

- Coherent range of fundamental principles in mathematics, basic science and engineering science underlying the support occupation or recognised practice area.
- Coherent range of fundamental principles in engineering science and technology underlying an engineering support occupation or recognised practice area.
- Codified practical knowledge in recognised practice area.
- Professional communication, social impact, environmental impact, cost analysis, quality procedures.
- Use of codified engineering analysis methods and procedures, supported by established mathematical formulas, to perform technical calculations.

4. Communicate technical, supervisory and general management information.

Range:

• Communication includes orally or in writing, using appropriate medium, language, terminology, structure, style and graphical support.
• Communicate technical information to superiors and peers, interpret instructions; issue clear oral and written instructions to subordinates; receive reports, present technical/project, product/service overviews progress information using defined formats.

5. Work according to ethics and best practice.

Range:

These outcomes will be demonstrated in a learning environment.

6. Demonstrate understanding of management principles appropriate to the occupation.

Range:

• The learner must display the self-management attributes 1-5 in the assessment criteria. If the qualification has further management, criteria 6-8 must also be satisfied.

ASSOCIATED ASSESSMENT CRITERIA
Assessment Criteria for Exit Level Outcome 1:

• The problem is identified and defined through engineering principles to determine possible solutions.
• Information relating to the problem is gathered and analysed through the use of relevant engineering principles.
• Methodologies chosen for solving the problem are appropriate to the problem and provide a workable solution.
• Potential solutions to the problem are synthesised in accordance with accepted engineering practices.
• The solution to the problem is achieved through acceptable engineering principles.
• Results are evaluated and verified in terms of their suitability to the problem.

Assessment Criteria for Exit Level Outcome 2:

• Procedures, processes, codes of practice and regulations are identified and explained in the context of the occupation.
• The operational procedure selected is justified in terms of its suitability to the context.
• Procedures and processes selected are executed in accordance with context specific requirements.
• Variances and risks are identified and actions taken to minimise the risk are appropriate to the context.
• Reports of activities undertaken are recorded in accordance with context requirements.
• Legal requirements and codes of practice are adhered to in accordance with the relevant context.

Assessment Criteria for Exit Level Outcome 3:

• Mathematical, basic science and engineering principles are used appropriately to solve engineering problems in the specific context.
• Measuring instruments and techniques are used and applied appropriately to solve engineering problems.
• Engineering processes are planned and implemented in accordance with specified context requirements.
• Engineering processes are reported on and recommendations for future improvement are appropriate to the context.

Assessment Criteria for Exit Level Outcome 4:

- Data and information relevant to the communication is generated and assembled through the use of available resources.
- Technical data is interpreted in accordance with the original meanings.
  - Range: Technical books, periodicals, data packs and quality manuals.
- Graphical techniques are applied to present the information effectively.
  - Range: Line graphs, histograms, pie charts, bar charts.
- Technical documents are compiled with sufficient detail relevant to the context.
- Information is communicated interactively with peers and individuals.
- Technical presentations are compiled and delivered with a level of technicality appropriate to the target audience.

Assessment Criteria for Exit Level Outcome 5:

- The need for maintaining continued competence is identified and explained in accordance with the work context.
- The role of the occupation in the engineering team is described in terms of relationships and responsibilities.
- Socio-economic impacts associated with the work context are identified and explained in terms of their causes and effect.
- The boundaries of personal competence are discerned in relation to working in own occupations.
- Decision making is limited to the area of current competence.
- Ethical principles are explained and applied in the occupational context.
- Consequences of acting outside own limits of competence are identified and accepted in terms of ethics and liability.

Assessment Criteria for Exit Level Outcome 6:

- Self-management principles are described and justified appropriately to a given scenario.
- Work relationships are established and maintained in accordance with applicable team requirements and ethics.
- Performance measures or benchmarks are identified for specific roles within the occupation.
- Quality assurance issues are identified and integrated into work performance in accordance with given role responsibilities.
- Health, safety and environmental risk issues are identified and integrated into work performance in accordance with given role responsibilities.
- Management principles are applied appropriately to a project, process or operation in accordance with a given scenario.
- Projects, processes and operations are monitored and controlled in accordance with a given scenario.
- Entrepreneurial skills are identified and applied appropriately to a given context.

Integrated Assessment:

Providers of programmes shall in the quality assurance process demonstrate that an effective integrated assessment strategy is used. Clearly identified components of assessment must address summative assessment of the exit level outcomes. Evidence should be derived from major work or multiple instances of limited scale work.

INTERNATIONAL COMPARABILITY

International comparability of this qualification is based on the combination of the Level 5 qualifications that would typically precede a programme leading to this certificate. The

combination is of these qualifications is comparable with Dublin Accord diplomas in Canada, Ireland, UK and New Zealand of two years duration with no work-integrated learning.

Australia:

The Australian Qualifications Framework has Diplomas that a similar which prepares candidates for both employment and further education and training. These qualifications in the Australian context may be gained through a wide range of pathways, including: Australian Apprenticeships (including traineeships); work-based and/or school/institution-based training; recognition of prior learning (which may include training programs or an accumulation of short courses).

Ireland:

The National Qualifications Authority of Ireland and the Irish FET Awards Council that has awards in Engineering Skills, Engineering Technology and General Engineering Operations at a comparable level. These qualifications enable holders to undertake further training and develop new skills within a structured and managed environment and will arm them with qualities and transferable skills necessary for employment requiring the exercise of some personal responsibility.

United Kingdom:

The UK Business and Technology Education Council (BTEC) HNC has one year qualifications requiring fundamentals such as Analytical methods and Engineering Science which have fundamental components that are comparable.

New Zealand:

The New Zealand National Qualifications Framework has National Certificates at NZ NQF Level 7 which are focused on particular disciplines or engineering occupations which prepare candidates for both employment and further education and training. These National Certificates recognise skills and knowledge that meet nationally endorsed standards.

SADC Nations:

International Comparability with qualifications of countries within the SADC region proved to be difficult as in most countries no similar qualifications could be found. Only Namibia has qualifications similar but not the same.

Emerging Economies:

In an attempt to do a comparison with a country with an emerging economy, the following websites were searched:

www.lan.gov.my:

- This sites directs searches to the Malaysian Accreditation Body: Lenbaga Akcreditasi Negara.

www.naac-india.com:

- This site directs searches to the National Assessment and Accreditation Council (India).

www.nigeria.com:

- Provides links and access to the Federal Ministry of Education in Nigeria.

This qualification could not be compared to qualifications of any of the countries with an emerging economy because some of the websites are not presented in English and from those that are; there is no information available on the accreditation of learning programmes against national standards and/or qualifications.

ARTICULATION OPTIONS

This qualification provides a focus for a number of articulation options. It provides progression from the NC: Engineering NQF Level 5 Certificate programmes for persons wanting to become Engineering Technicians, Engineering Technologists and Certificated Engineers. Programmes may be designed on the basis of this qualification to articulate with credit into the National Diploma or a technology degree programmes or progress to training in more highly skilled engineering support occupations.

MODERATION OPTIONS

- Anyone assessing a learner or moderating the assessment of a learner against this Unit Standard must be registered as an assessor with the relevant ETQA 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 Unit Standard must be Accredited as a provider with the relevant ETQA 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 ETQA 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 at exit points of the Qualification, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described both in individual Unit Standards as well as the integrated competence described in the Qualification.

- Anyone wishing to be assessed against this Unit Standard 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

Registration of assessors is delegated to the Higher Education and Training (HET) providers responsible for programmes. However, they should be registered as generic assessors and then as constituency assessors.

NOTES

Appendix 1: Definitions:

Engineering Operations and Support Occupation:

- A narrowly specified occupation that relies on technical knowledge and skills to perform specific technical or supervisory functions in engineering activity.

Specified Categories:

- Means a category of registration created for persons who must be licensed through the Engineering Profession Act or a combination of the Engineering Profession Act and external legislation as having specific competencies related to an identified need to protect the public safety, health and interest or the environment, in relation to an engineering activity (ECSA definition).

Well defined Specific Engineering Problems: These are problems that have one or more property:

- Are largely defined but may require refinement.
- Are routine or unfamiliar but in familiar context.
- Are encompassed by standards, codes and documented procedures.

Appendix 2: Knowledge Area Definitions:

Basic Sciences:

- Physics (including mechanics), chemistry, earth sciences and the biological sciences which focus on understanding the physical world, as applicable in each engineering disciplinary context.

Complementary Studies:

- Cover those disciplines outside of engineering sciences, basic sciences and mathematics which: (a) are essential to the practice of engineering, including engineering economics, the impact of technology on society and effective communication; and (b) (for levels 6 and above) broaden the student's perspective in the humanities or social sciences to support an understanding of the world.

Computing and Information Technologies:

- Encompasses the use of computers, networking and software to support engineering activity and as an engineering activity in itself as appropriate to the discipline.

Engineering Practice:

- Embraces in an appropriate mix for the level and target occupation includes design-related, inspection, testing, maintenance and operations activities.

Engineering Sciences:

- Have roots in the mathematical and basic sciences, and where applicable, in other basic sciences but extend knowledge and develop models and methods in order to lead to engineering applications and solve engineering problems.

Mathematical Sciences:

- An umbrella term embracing the techniques of mathematics, numerical analysis, statistics and aspects of computer science cast in an appropriate mathematical formalism.

UNIT STANDARDS
This qualification is not based on Unit Standards.

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None