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**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

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

Engineering

Registered by Organising Field 06, Manufacturing, Engineering and Technology, publishes the following qualification and unit standards for public comment.

This notice contains the titles, fields, subfields, NQF levels, credits, and purpose of the qualification and unit standards. The qualification and unit standards can be accessed via the SAQA web-site at www.saqqa.org.za. Copies may also be obtained from the Directorate for Standards Setting and Development at the SAQA offices, **Hatfield Forum West, 1067 Arcadia Street, Hatfield, Pretoria.**

Comment on the qualification should reach SAQA at the address **below and no later than 17 August 2006**. All correspondence should be marked **Standards Setting – SGB for Engineering** and addressed to

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S BHIKHA
DIRECTOR STANDARDS SETTING AND DEVELOPMENT



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:

National Certificate: Metrology

SAQA QUAL ID		QUALIFICATION TITLE	
57228		National Certificate: Metrology	
SGB NAME		ORGANISING FIELD ID	PROVIDER NAME
SGB Engineering		6	
QUAL TYPE		ORGANISING FIELD DESCRIPTION	SUBFIELD
National Certificate		Manufacturing, Engineering and Technology	Engineering and Related Design
ABET BAND	MINIMUM CREDITS	NQF LEVEL	QUALIFICATION CLASS
Undefined	138	Level 5	Regular-Unit Standards Based

PURPOSE AND RATIONALE OF THE QUALIFICATION

Purpose:

The basis for Metrology is being able to ensure that all measurements undertaken are in compliance with international standards of measurement. This entails calibration of all types of measurement equipment. Learners achieving this qualification will be able to perform measurements that are confirmed against national measuring standards. They will also be able to maintain laboratory standard measurement artefacts, generate new standard measurement artefacts and calibrate laboratory equipment

Learners will be able to:

- > Solve measurement and metrology problems.
- > Communicate Metrology information in the workplace.
- > Demonstrate understanding of Metrology principles.
- > Initiate and control a test or calibration laboratory.

And one of the following outcomes, depending on the specialisation category selected:

- > Perform Electrical measurements and calibrations.
- > Perform Temperature measurements and calibrations.
- > Perform Mass measurements and calibrations.
- > Perform Dimensional measurements and calibrations.
- > Perform Force Torque and Hardness measurements and calibrations.
- > Perform Radio Frequency measurements and calibrations.
- > Perform Time & Frequency measurements and calibrations.
- > Perform Pressure measurements and calibrations.
- > Perform Humidity measurements and calibrations.
- > Perform Flow measurements and calibrations.
- > Perform Legal Metrology measurements and calibrations.
- > Perform Optical Radiometry measurements and calibrations.
- > Perform Fibre Optical measurements and calibrations.
- > Perform Ionizing Radiation measurements and calibrations.

Performing measurement and calibration is critically important to the entire engineering industry and learners at the level of this qualification will take full responsibility for ensuring the correctness of measurements that may be used in industry, taking cognisance of varying factors in the operation of measuring equipment

Rationale:

Metrology may be defined as "the science of ensuring the equivalence of measurement in order to improve

the quality of life". This implies that inaccurate measurements will have a direct negative effect on the quality of life for all citizens of South Africa. This Qualification reflects the workplace-based needs of measurements in Industry as expressed by stakeholders and provides the learner with accessibility to employment opportunities within the Metrology Industry.

Measurement is used in all engineering disciplines and Metrology comprises a wide variety of applications in which measurement must be ensured. This qualification provides the learner with flexibility to articulate in the measurement environment through selecting one of the specialisation options, and further articulation within the Engineering Sector.

The competencies identified within the range of electives will allow the individual to pursue a career as a specialist Metrologist in the selected category. The competencies achieved from each of the elective categories will serve as foundational knowledge and skills relevant to the other categories, thereby ensuring greater flexibility for the learner.

Measurement standards and equipment are maintained and calibrated on a daily basis in order to support accurate and traceable measurements in industry. There are currently no registered qualifications for the Metrology industry at any NQF level and training currently provided is not against nationally recognised qualifications. This qualification will promote portability and accessibility within the Metrology environment by providing learners with the competencies required. As current and past training has taken place against non-registered qualifications, this qualification will also be used as a benchmark in providing recognition for prior learning.

RECOGNIZE PREVIOUS LEARNING?

Y

LEARNING ASSUMED TO BE IN PLACE

It is assumed that learners are already competent in:

> Communication and Mathematical Literacy at NQF level 4.

Recognition of prior learning:

This qualification can be achieved wholly or in part through recognition of prior learning in terms of the defined exit level outcomes.

Evidence can be presented in various ways, including international and/or previous local qualifications, products, reports, testimonials mentioning functions performed, work records, portfolios, videos of practice and performance records.

All such evidence will be judged in accordance with the general principles of assessment described above and the requirements for integrated assessment.

Access to the qualification:

Access to this qualification is open, but learners should already have achieved the competencies reflected in the learning assumed to be in place.

QUALIFICATION RULES

Fundamental:

Candidates are required to achieve all of the available **28** credits for mathematics and communications.

Core:

Candidates must achieve all **25** credits in the core component.

Electives:

Stream Specific:

Candidates must achieve at least **63** credits from any of the available streams of their choice and additional elective unit standards to make up **138** credits required to obtain the qualification.

EXIT LEVEL OUTCOMES

1. Solve measurement and metrology problems.
 2. Communicate Metrology information in the workplace.
 3. Demonstrate understanding of Metrology principles.
 4. Establish and manage a test or calibration laboratory.
 5. Perform specific measurements and calibrations.
- > Range: Within specialisation category selected.

Critical Cross-Field Outcomes:

This qualification addresses the following critical cross-field outcomes:

- > Identifying and solving problems in which responses indicate that responsible decisions using critical and creative thinking have been made.
- > Working effectively with others as a member of a team, group, organisation or community.
- > Organising and managing oneself and one's activities responsibly and effectively.
- > Collecting, analysing, organising and critically evaluating information.
- > Communicating effectively using visual, mathematical and/or language skills in the modes of oral/written persuasion.
- > Using science and technology effectively and critically, showing responsibility towards the environment and health of others.
- > Demonstrating and understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation.

Learning programmes directed towards this qualification will also contribute to the full personal development of each learner and the social and economic development of the society at large, by making individuals aware of the importance of:

1. Reflecting on and exploring a variety of strategies to learn more effectively.
2. Participating as responsible citizens in the life of local, national and global communities.
3. Being culturally and aesthetically sensitive across a range of social contexts.
4. Exploring education and career opportunities; and developing entrepreneurial opportunities.

ASSOCIATED ASSESSMENT CRITERIA

1.

- > Mathematical information is collected, analysed and categorised in relation to the type of problem.
- > Mathematical, statistical and scientific methods are selected to suit the problems that need to be solved.
- > Well defined measurement problems are explained in relation to metrology concepts and principles.
- > Solutions are derived and justified on the basis of engineering concepts and principles.

2.

- > Data to be communicated is gathered and assimilated according to the needs of the recipient.
- > Data and information is clustered into logical themes and sub-themes.
- > Sources of information are listed according to recognised conventions.
- > Information is transferred between forms without losing the initial intentions.
- > Communication method and style selected is appropriate to the target audience.
- > Verbal presentations are conducted in accordance with target audience requirements.
- > Data is presented graphically through the use of graphical tools within software packages.
- > Workplace documentation is chosen and developed against selected criteria for a specific purpose.
- > The structure, style and language of documentation are appropriate to the document type.

3.

- > The structure, role and function of the international measurement system are explained in terms of scope and responsibility.
- > The concept and definition of accuracy traceability is explained with reference to measurement standards.
- > The relationship between the International Measuring System and Quality Systems is explained in terms of compliance requirements.
- > The concepts and methodology of uncertainty of measurement are defined and explained in terms of the International Standards Organisation guide to the estimation of uncertainty of measurement.
- > The basic contributors to uncertainty of measurement are analysed according to the International Standards Organisation guide to the estimation of uncertainty of measurement.
- > Uncertainty of measurement is estimated in terms of the international Standards Organisation guide to the estimation of uncertainty of measurement.
- > Calibration and test methods and procedures are developed to suit specific situations.
- > Measurement results are reported in accordance with workplace requirements.

4.

- > Management and technical requirements for a measurement quality system are described and clarified.
- > A measurement quality system is developed for a given specific laboratory environment.
- > The effectiveness of the implemented measurement quality system is confirmed.
- > A business plan for the successful establishment of a selected test/calibration laboratory is generated.

5.

- > Data is captured and analysed to determine calibration interval to be documented.
- > Values are assigned to a unit under test or unknown standard in terms of laboratory reference standards.
- > The results and associated uncertainty of unit under test or unknown standard are recorded according to standard practices.
- > Instruments are calibrated and performance verified in accordance with manufacturer specifications.
- > Calibration certificates are issued in accordance with requirements.

Integrated assessment

The practical, applied, foundational and reflective competencies demonstrated for the exit level outcomes in this qualification must prove that the whole competence is more than the sum of the parts of the competencies.

Oral or written questioning regarding the reflective competencies within the qualification is essential. If the identifying and **solving** of problems, team work, organising **one-self**, the using of applied science, the implication of actions and reactions in the world as a set of related systems are not clear from the observation through a method of oral or written questioning, a case study can also be used to determine the person's development and integration of applied knowledge and skills.

The planning, preparation, conducting and concluding of measurement and calibration related installations, maintenance, planning & design, and quality assurance can be assessed in one application.

Applicable assessments tools must be used to establish the foundational, reflective and embedded knowledge of problem solving and application of the world as a set of related systems within the Metrology environment.

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

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

Assessments should be structured in such a manner as to assess both specific and critical **cross-field** outcomes. During integrated assessments the assessor should make use of formative and summative assessment methods and should assess combinations of practical, applied, foundational and reflective competencies.

INTERNATIONAL COMPARABILITY

The requirements for testing and calibration which support international trade are met via universally accepted practices. For more than 30 years the output of these activities in South Africa has been demonstrated as internationally equivalent through peer assessment of laboratory staff competence. This is largely due to the uniquely SA approach to metrology training since 1980.

This training has been benchmarked internationally since 1998 both formally and informally and it was concluded that this training is not only on par with similar activities but in some cases was viewed as best **practice** in its own right.

As leaders in the field of metrology we elected to consider the following countries and metrology training institutes with regard to this comparability study. A search for formal standards in this area was unsuccessful.

United States of America:

California State University, Dominguez Hills

- > 4 Year Degree Programme with a Measurement Science option.

- > Entry level High School GED.

Central Georgia Technical College

- > Metrology Associate Degree.
 - > Programme Length 107 Credit Hours.
 - > Education Requirements High School graduate or GED recipient.
 - > The Metrology Associate Degree programme is designed to meet the precision measurement needs of industry by preparing graduates through both theoretical and hands-on laboratory work to successfully enter the work force.
- > Metrology Diploma Programme.
 - > Programme Length 90 Credit Hours.
 - > Education Requirements High School graduate or GED recipient.
 - > The Metrology diploma programme is designed to meet the precision measurement needs of industry by preparing graduates through both theoretical and hands-on laboratory work to successfully enter the work force.

Australia:

Swinburne University of Technology

- > Graduate Certificate of Engineering (Metrology and Quality).
 - > Programme Length Two years part-time.
 - > This programme provides training and experience in specific areas of Metrology and has the potential to prepare participants for higher degrees. It also provides the opportunity to serve a specialist group, which previously had not been adequately serviced by the education sector.

United Kingdom:

Brunel University (School of Engineering and Design)

- > Manufacturing Metrology
 - > Entry Requirements: Normally an honours degree or equivalent usually in an engineering scientific or technological subject. Other qualifications such as Higher National diploma and suitable experience would be considered on an individual basis.
 - > Programme Duration:
 - > 1 year Full-time.
 - > Part-time: 2 - 3 years - attendance for 4 block weeks.
 - > Distance Learning - open ended.

Note that although Brunel have discontinued providing this qualification due to market pressures, the content and level was considered relevant when it was benchmarked against the Certificate in Metrology.

France:

Ecole Supérieure de Métrologie

- > Diplôme d'Ingénieur Spécialisé de l'Ecole Supérieure de Métrologie (Diploma Engineer)
- > Titre de **Mastère** en Métrologie et Systèmes de Mesure (Masters)

Conclusion:

It was noted from the above that the range of these courses, both in level and content, is in line with the requirements of the South African Metrology industry. It was established that by pitching this qualification at NQF Level 5, candidates will be on a comparable level with their counterparts in other countries.

Although it could be seen that the content of this qualification is similar to those used in the benchmarking exercise, an advantage of the Certificate in Metrology is the strong focus on competency and outcomes based results.

SADC benchmarking:

Whilst using the countries above as a yardstick for benchmarking the qualification was also evaluated against the requirements of the SADC countries for metrologists.

In this case it was established that nearly all the countries have relied on either South Africa or Europe for obtaining the necessary skills and only Zimbabwe and Tanzania appear to have some metrology training. This is mostly been in specific areas of metrology and has not resulted in a broad based qualifications such as in this Certificate. There was much interest displayed in this qualification and it may well be that it could be adopted by the region in the future.

Certification- USA:

The American Society for Quality ASQ offers a Calibration Technician Certification - CCT programme which is being used by employers to verify and certify the competency of calibration/metrology technicians in the United States of America. Their definition of a Certified Calibration Technician is one who tests, calibrates, maintains and repairs electrical, mechanical, electromechanical, analytical and electronic measuring, recording and indicating instruments and equipment for conformance to established standards.

After careful analysis of this activity it has been established that the knowledge component of the Metrology Certificate NQF 5 is comparable and it is intended that ECSA will be approached to provide similar registration of Metrology Technicians in the future.

ARTICULATION OPTIONS

This qualification has been developed for professional practice across the Metrology Industry. The intent is to ensure professionalism within the Metrology Industry and ensuring the increase of occupational performance standards in general.

It is applicable to micro and macro businesses. The qualification builds on other professional certificates or diplomas from a range of sub-sectors and will provide articulation within a range of qualifications in engineering and service areas of practice.

Learners can move horizontally or vertically between related qualifications, although in most cases, certain competencies will be required horizontally before moving to another qualification vertically.

This qualification articulates horizontally with the following qualifications:

- > National Certificate in Measurement, Control & Instrumentation (level 5), ID 49746.

This qualification articulates vertically with the following qualifications:

- > National Diploma in Metrology (level 6).
- > National Diploma in Engineering Technology (level 6), ID 49744.

MODERATION OPTIONS

Moderation must include internal and external moderation of assessments. internal and external moderation systems must ensure that all assessors produce assessments that are credible, fair, reliable and practicable.

Moderation systems must provide assessment opportunities that are transparent, affordable and enhance development in the field and sub-field of the National Qualifications Framework.

The accredited provider with the relevant ETQA must be able to provide internal moderation. Any institution offering learning that will enable achievement of this qualification or parts of this qualification must be accredited as a provider through the relevant ETQA by SAQA.

External moderation will be done by the relevant ETQA according to the particular ETQA's policies and guidelines for assessment and moderation.

CRITERIA FOR THE REGISTRATION OF ASSESSORS

Anyone assessing a learner must be a registered SANAS Technical Assessor and registered as an assessor with the relevant ETQA. He/she must possess a similar qualification at one level higher than the level of the qualification and a minimum of at least 12 months relevant working experience.

NOTES

NIA

UNIT STANDARDS*(Note: A blank space after this line means that the qualification is not based on Unit Standards..)*

	UNIT STANDARD ID AND TITLE	LEVEL	CREDITS	STATUS
Core	119236 Report measurement results	Level 5	3	Registered
Core	119238 Define the role, functions and operation of the international measurement system	Level 5	1	Registered
core	119241 Develop calibration and test methods and procedures	Level 5	3	Registered
Core	119242 Establish and manage a test/calibration laboratory	Level 5	7	Registered
Core	119244 Implement a quality system to ensure technically valid measurement results in accordance with ISO/IEC 17025	Level 5	6	Registered
Core	119255 Apply the ISO document 'guide to the expression of uncertainty in measurement' to estimate uncertainty of measurement	Level 5	5	Registered
Elective	119233 Perform impedance measurements and calibrate devices	Level 5	12	Registered
Elective	119234 Perform temperature measurements using secondary temperature standards	Level 5	6	Registered
Elective	119240 Perform AC electrical and AC/DC transfer measurements and calibrate devices	Level 5	17	Registered
Elective	119248 Calibrate oscilloscopes	Level 5	18	Registered
Elective	119251 Measure frequency using frequency counters	Level 5	3	Registered
Elective	119254 Perform DC electrical and resistance measurements and calibrate devices.	Level 5	17	Registered
Elective	119258 Perform AC power and energy measurements and calibrate devices	Level 5	12	Registered
Elective	230189 Measure percentage relative humidity using secondary humidity standards	Level 5	4	Draft - Prep for P Comment
Elective	230190 Perform radiation thermometry measurements and calibrate/nfra-red Radiation Thermometers	Level 5	6	Draft - Prep for P Comment
Elective	230191 Perform surface temperature measurements and calibrate devices	Level 5	6	Draft - Prep for P Comment
Elective	230192 Calibrate isothermal media by temperature simulation and temperature mapping at temperatures not exceeding 250°C	Level 5	10	Draft - Prep for P Comment
Elective	230193 Generate reference temperatures and scales	Level 5	12	Draft - Prep for P Comment
Elective	230194 Perform resistance thermometry measurements and calibrate resistance temperature devices (RTD's)	Level 5	6	Draft - Prep for P Comment
Elective	230195 Calibrate installations by temperature simulation and measurement in furnaces at temperatures exceeding 250°C	Level 5	7	Draft - Prep for P Comment
Elective	230196 Perform Liquid in Glass Thermometry measurements and calibrate Liquid in Glass Thermometers (LIG's)	Level 5	6	Draft - Prep for P Comment
Elective	230197 Perform thermocouple thermometry measurements and calibrate thermocouple devices	Level 5	6	Draft - Prep for P Comment
Fundamental	12432 Use mathematical and statistical techniques effectively	Level 5	20	Registered
Fundamental	12433 Use communication techniques effectively	Level 5	8	Registered



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

1

Measure percentage relative humidity using secondary humidity standards

SAQA US ID	UNIT STANDARD TITLE		
230189	Measure percentage relative humidity using secondary humidity standards		
SGB NAME	ORGANISING FIELD ID	PROVIDER NAME	
SGB Engineering	6		
UNIT STANDARD TYPE	ORGANISING FIELD ID	SUBFIELD DESCRIPTION	
Regular	Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	CREDITS	NQF LEVEL	UNIT STANDARD TYPE
Undefined	4	Level 5	Regular

SPECIFIC OUTCOME 1

Explain the fundamentals of temperature and percentage relative humidity.

SPECIFIC OUTCOME 2

Measure percentage relative humidity.

SPECIFIC OUTCOME 3

Record and evaluate results.

SPECIFIC OUTCOME 4

Apply corrections for the effects of percentage relative humidity.



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

2

<i>SAQA US ID</i>	<i>UNIT STANDARD TITLE</i>		
230190	Perform radiation thermometry measurements and calibrate Infra-red Radiation Thermometers		
<i>SGB NAME</i>		<i>ORGANISING FIELD ID</i>	<i>PROVIDER NAME</i>
SGB Engineering		6	
<i>UNIT STANDARD TYPE</i>		<i>ORGANISING FIELD DESCRIPTION</i>	<i>SUBFIELD DESCRIPTION</i>
Regular		Manufacturing, Engineering and Technology	Engineering and Related Design
<i>ABET BAND</i>	<i>CREDITS</i>	<i>NQF LEVEL</i>	<i>UNIT STANDARD TYPE</i>
Undefined	6	Level 5	Regular

SPECIFIC OUTCOME 2

Calibrate Infra-red Radiation Thermometers.

SPECIFIC OUTCOME 3

Record, evaluate and report results.



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

3

Perform surface temperature measurements and calibrate devices

SAQA US ID	UNIT STANDARD TITLE		
230191	Perform surface temperature measurements and calibrate devices		
SCB NAME	ORGANISING FIELD ID	PROVIDER NAME	
SGB Engineering	6		
UNIT STANDARD TYPE	ORGANISING FIELD DESCRIPTION	SUBFIELD DESCRIPTION	
Regular	Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	CREDITS	NQF LEVEL	UNIT STANDARD TYPE
Undefined	6	Level 5	Regular

SPECIFIC OUTCOME 1

Prepare Surface Contact Thermometers for calibration.

SPECIFIC OUTCOME 2

Calibrate Surface Contact Thermometers.

SPECIFIC OUTCOME 3

Record, evaluate and report results.



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

4

SAQA US ID	UNIT STANDARD TITLE		
230192	Calibrate isothermal media by temperature simulation and temperature mapping at temperatures not exceeding 250°C		
SGB NAME	ORGANISING FIELD ID	PROVIDER NAME	
SGB Engineering	6		
UNIT STANDARD TYPE	ORGANISING FIELD DESCRIPTION	SUBFIELD DESCRIPTION	
Regular	Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	CREDITS	NQF LEVEL	UNIT STANDARD TYPE
Undefined	10	Level 5	Regular

SPECIFIC OUTCOME 1

Simulate known temperatures electrically.

SPECIFIC OUTCOME 2

Verify Iso-thermal device temperatures.

SPECIFIC OUTCOME 3

Record, evaluate and report results.



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

5

Generate reference temperatures and scales

SAQA US ID	UNIT STANDARD TITLE		
230193	Generate reference temperatures and scales		
SGB NAME		ORGANISING FIELD ID	PROVIDER NAME
SGB Engineering		6	
UNIT STANDARD TYPE		ORGANISING FIELD DESCRIPTION	SUBFIELD DESCRIPTION
Regular		Manufacturing, Engineering and Technology	Engineering and Related Design
ABET BAND	CREDITS	NQF LEVEL	UNIT STANDARD TYPE
Undefined	12	Level 5	Regular

SPECIFIC OUTCOME 1

Perform measurements to realise the Ice Point.

SPECIFIC OUTCOME 2

Maintain a reference Standard Platinum Resistance Thermometer (SPRT).

SPECIFIC OUTCOME 3

Generate temperatures using controlled temperature environments and measure scale points.

SPECIFIC OUTCOME 4

Generate and record the International Temperature Scale.


SOUTH AFRICAN QUALIFICATIONS AUTHORITY

SAQA US ID	UNIT STANDARD TITLE		
230194	Perform resistance thermometry measurements and calibrate Resistance Temperature Devices (RTDs)		
SGB NAME		ORGANISING FIELD ID	PROVIDER NAME
SGB Engineering		6	
UNIT STANDARD TYPE		ORGANISING FIELD DESCRIPTION	SUBFIELD DESCRIPTION
Regular		Manufacturing, Engineering and Technology	Engineering and Related Design
ABET BAND	CREDITS	NQF LEVEL	UNIT STANDARD TYPE
Undefined	6	Level 5	Regular

SPECIFIC OUTCOME 1

Prepare Resistance Temperature Devices for calibration (RTDs).

SPECIFIC OUTCOME 2

Calibrate Resistance Temperature Device (RTD) over given temperature range.

SPECIFIC OUTCOME 3

Record, evaluate and report measurement results.



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

7

SAQA US ID	UNIT STANDARD TITLE		
230195	Calibrate installations by temperature simulation and measurement in furnaces at temperatures exceeding 250°C		
SGB NAME	ORGANISING FIELD ID	PROVIDER NAME	
SGB Engineering	6		
UNIT STANDARD TYPE	ORGANISING FIELD DESCRIPTION	SUBFIELD DESCRIPTION	
Regular	Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	CREDITS	NQF LEVEL	UNIT STANDARD TYPE
Undefined	7	Level 5	Regular

SPECIFIC OUTCOME 1

Simulate known temperatures electrically.

SPECIFIC OUTCOME 2

Verify Furnace temperatures.

SPECIFIC OUTCOME 3

Record, evaluate and report results.


SOUTH AFRICAN QUALIFICATIONS AUTHORITY

SAQA US ID	UNIT STANDARD TITLE		
230196	Perform Liquid in Glass Thermometry measurements and calibrate Liquid in Glass Thermometers (LIGs)		
SGB NAME	ORGANISING FIELD ID	PROVIDER NAME	
SGB Engineering	6		
UNIT STANDARD TYPE	ORGANISING FIELD DESCRIPTION	SUBFIELD DESCRIPTION	
Regular	Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	CREDITS	NQF LEVEL	UNIT STANDARD TYPE

5

SPECIFIC OUTCOME 1

Prepare Liquid in Glass Thermometers (LIGs) for calibration.

SPECIFIC OUTCOME 2

Calibrate Liquid in Glass Thermometers.(LIG).

SPECIFIC OUTCOME 3

Record, evaluate and report results.



SAQA US ID	UNIT STANDARD TITLE		
230197	Perform thermocouple thermometry measurements and calibrate thermocouple devices		
SGB NAME		ORGANISING FIELD ID	PROVIDER NAME
SGB Engineering		6	
UNIT STANDARD TYPE		ORGANISING FIELD DESCRIPTION	SUBFIELD DESCRIPTION
Regular		Manufacturing, Engineering and Technology	Engineering and Related Design
ABET BAND	CREDITS	NQF LEVEL	UNIT STANDARD TYPE
Undefined	6	Level 5	Regular

SPECIFIC OUTCOME 1

Prepare Thermocouples (TCs) for calibration.

SPECIFIC OUTCOME 2

Calibrate a Thermocouple over given temperature ranges.

SPECIFIC OUTCOME 3

Record, evaluate and report results.