

No. 595

16 July 2010

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

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

**MANUFACTURING AND ASSEMBLY PROCESSES**

registered by Organising Field 06 -Manufacturing, Engineering and Technology, publishes the following Qualifications and Unit Standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the Qualifications and Unit Standards. The full Qualifications and Unit Standards can be accessed via the SAQA web-site at [www.saga.org.za](http://www.saga.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 Qualifications and Unit Standards should reach SAQA at the address below and **no later than 16 August 2010**. All correspondence should be marked **Standards Setting – SGB for Manufacturing and Assembly Processes** and addressed to

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## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

### **QUALIFICATION:** **National Certificate: Polymer Compound Manufacturing**

SAQA QUAL ID		QUALIFICATION TITLE	
79408		National Certificate: Polymer Compound Manufacturing	
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
QUALIFICATION TYPE	FIELD	SUBFIELD	
National Certificate	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	MINIMUM CREDITS	NQF LEVEL	QUAL CLASS
Undefined	120	Level 2	Regular-Unit Stds Based

New NQF Level: NQF Level 02

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

#### **PURPOSE AND RATIONALE OF THE QUALIFICATION**

Purpose:

Compound manufacturing refers to the production of polymeric compounds for the manufacture of rubber, plastics, tyre and related products. This involves the processing of polymer compounds into finished products that are used in the polymer compound manufacturing industry. This qualification contains the knowledge and skills required of people who perform routine functions in support of the manufacturing of polymer compounds as input for stage (in process) or final processing, as per customer requirements.

Polymer Compound Process Workers need to understand the basic processes and practices of production. They also need to be familiar with the basic terminology used in the production/manufacturing plant, including the material, process, tools and equipment used.

Such workers have to respond appropriately to situations in a production setting in the areas of health, safety, quality and production processes.

Competent learners:

- Are able to describe manufacturing processes in the Polymer Compound Manufacturing sector.
- Understand the role of the individual in the company in general and in relation to safety and quality processes in particular.
- Know and understand the production requirements of own operational area.
- Can apply production process requirements in own area of work.

This qualification will allow the learner to acquire and develop the following competencies:

- Apply fundamental processes in a polymer compound manufacturing environment.
- Monitor the production process of polymer compound products.
- Carry out own role within a business.

- Keep the work area safe and productive.
- Apply bonding agents to a range of surfaces.

#### Rationale:

Plastic, compound and tyre products are used extensively in our everyday lives. Their basic ingredients, in various forms, are key components in many low to high-technology industries in many parts of the world. Their industrial applications require a combination of theory and workplace or practical exposure. This qualification aims to provide that learning for entry level workers in the sector.

There is a need for entry level Polymer Compound Process Workers to meet the demand for polymer products. There is a need more knowledgeable and skilled workers in the sector to increase capacity at the production line.

Those standing to benefit from this Qualification are Polymer Compound Process Workers in a small to more established polymer compound processing setting. Learners who are currently working in the industry and new entrants who aspire to pursue a career in Polymer Compound manufacturing will find this Qualification beneficial. Small, Micro and Medium enterprises providing products or services to the major players in the industry stand to benefit from this Qualification as it will professionalize their businesses and entrepreneurial initiatives.

This is the first in a series of Polymer Compound manufacturing qualifications that will enable competent learners to participate effectively in the Polymer Compound manufacturing industry, whether in micro, small, medium or large operations. The qualification is set within the context of either mixing, extruding, moulding or calendering.

#### **RECOGNIZE PREVIOUS LEARNING?**

Y

#### **LEARNING ASSUMED IN PLACE**

It is assumed that learners are competent in Communication and Mathematical Literacy at NQF Level 1 or ABET Level 4.

#### Recognition of Prior Learning:

This Qualification can be achieved wholly or in part through the Recognition of Prior Learning. The learner may have attained the knowledge or competencies in the qualification either through formal courses or through informal means or a combination of both.

Assessors should ensure that learners submitting themselves to Recognition of Prior Learning are thoroughly briefed prior to assessment. Learners will be required to submit a Portfolio of Evidence in the prescribed format to be assessed for formal recognition.

#### Access to the Qualification:

Access to this Qualification is open to learners in possession of:

- General Education and Training Certificate.
- Or
- Adult Basic Education and Training Level 4 qualification.

#### **QUALIFICATION RULES**

The minimum credits required for this qualification are 120. This can be achieved as follows:

#### Fundamental Component:

All fundamental unit standards are compulsory, 36 credits.

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

- Unit standards at NQF Level 2, totaling 16 credits in Mathematical Literacy.
- Unit standards at NQF Level 2, totaling 20 credits in Communication.

Core Component:

All core unit standards are compulsory, 41 credits.

Elective Component:

The Elective component consists of a number of specialisations. The learner must choose one of the specialisations and complete unit standards listed for that specialisation, according to the requirements for the specialisation and to give a minimum of 43 credits.

Specialisation 1: Industrial Rubber Manufacturing.

Complete any of the unit standards listed below to give a minimum of 43 credits:

- Manufacture injection moulding products, NQF Level 2, 6 credits.
- Manufacture compound lining products, NQF Level 2, 20 credits.
- Trim, inspect and sort manufactured compound products, NQF Level 2, 8 credits.
- Prepare industrial rubber manufacturing equipment, NQF Level 2, 12 credits.
- Respond to changes in industrial rubber manufacturing processes, NQF Level 2, 12 credits.
- Use and care for services, tools and equipment in the industrial rubber manufacturing process, NQF Level 2, 10 credits.
- Work with and look after materials in the industrial rubber manufacturing process, NQF Level 2, 12 credits.

Specialisation 2: New Tyre and/or Retreads.

Complete any of the unit standards listed below to give a minimum of 43 credits:

- Trim, inspect and sort manufactured compound products, NQF Level 2, 8 credits.
- Prepare casings for retreading, NQF Level 2, 16 credits.
- Apply tread compound to casings, NQF Level 2, 8 credits.
- Inspect, trim, balance and sort manufactured tyres, NQF Level 2, 19 credits.
- Repair and buff tyres, NQF Level 2, 8 credits.
- Transport materials, components or products in the tyre manufacturing process, NQF Level 2, 12 credits.
- Set and operate equipment with control systems, NQF Level 2, 15 credits.

Specialisation 3: Plastics.

Learners are to complete the following two unit standards totalling 23 credits:

- Monitor the quality of the input material and the manufactured plastic product, NQF Level 2, 19 credits.
- Identify and process waste, NQF Level 2, 4 credits.

And

Additional unit standards totalling a minimum of 23 credits from the following list:

- Provide risk-based primary emergency care/first aid in the workplace, NQF Level 2, 5 credits.
- Perform basic fire fighting, NQF Level 2, 4 credits.
- Participate in work group activities, NQF Level 2, 4 credits.
- Monitor the quality of the output from a rubber manufacturing process, NQF Level 2, 12 credits.
- Apply study and learning techniques, NQF Level 2, 3 credits.
- Develop learning strategies and techniques, NQF Level 2, 3 credits.

### **EXIT LEVEL OUTCOMES**

1. Describe manufacturing processes in the Polymer Compound Manufacturing sector.
  - Range: Understanding of fundamental processes in the Polymer Compound Manufacturing sector is demonstrated in terms of product types.
2. Understand and perform own role in the company with specific reference to safety and quality processes.
3. Understand production requirements of own operational area.
4. Apply production process requirements in own area.

Critical Cross-field Outcomes:

Critical Cross-Field Outcomes have been addressed as follows:

1. Identify and solve problems.

This will be achieved when qualifying learners:

- Identify and classify product and process in the polymer compound manufacturing sector.
2. Work effectively with others as a member of a team or organisation.

This will be achieved when qualifying learners:

- Contribute to team and operational goals.
- Adhere to operational procedures.
- Support team members in adhering to procedures and work roles to be carried out.
- Adhere to team and organisational protocols.

3. Organise and manage oneself and one's activities responsibly and effectively.

This will be achieved when qualifying learners:

- Respond appropriately to risk and hazards.
- Apply work procedures appropriately to meet product and product process requirements.

4. Collect, analyse, organise and critically evaluate information.

This will be achieved when qualifying learners:

- Identify, defect and product deformations and product tooling requirements.
- Respond appropriately to quality situations.
- Apply health, safety and quality practices.

- Choice and use of equipment, tooling and machinery.

5. Communicate effectively by using mathematical and language skills in the modes of oral and written presentations:

This will be achieved when qualifying learners:

- Report defects and product deformations.
- Brief role players on deviations in the production environment.
- Communicate with team members.

6. Use science and technology effectively and critically, showing responsibility towards the environment and health of others.

This will be achieved when qualifying learners:

- Apply occupational health, safety and environmental requirements in the workplace.
- Adhere to production practices.
- Use and care for equipment, tooling and machinery properly.

7. Demonstrate an understanding of the world as a set of related systems by recognizing that problem solving contexts do not exist in isolation.

This will be achieved when qualifying learners:

- Contributing towards adhering to quality and safety standards.
- Assist team members.
- Contribute towards achievement of production deadlines and targets.

#### **ASSOCIATED ASSESSMENT CRITERIA**

Associated Assessment Criteria for Exit Level Outcome 1:

- Equipment and machinery are listed and described.
- Safe handling of equipment and machinery is demonstrated.
- Material used in the production processes using the equipment and machinery is identified.

Associated Assessment Criteria for Exit Level Outcome 2:

- Safety practices are identified and explained.
- Quality practices are identified and explained.
- Quality is monitored for own work area.
- Quality and safety practices are implemented.
- Housekeeping for own working area is maintained.

Associated Assessment Criteria for Exit Level Outcome 3:

- Equipment and tooling requirements are explained per product and process type.
- The need for care of and safe handling of tooling and machinery is explained in terms of health and safety requirements and cost-effectiveness.
- Operational practices are explained for each product and process.
- Product material requirements are identified and explained for each product and process.

Associated Assessment Criteria for Exit Level Outcome 4:

- Tools and equipment are used correctly during production process according to organisational and manufacturer's requirements.
- Operational practices are performed according to organisational policy and procedures for each product and process.
- Product material is checked to ensure compliance with requirements for each product and/or process.

#### Integrated Assessment:

The Qualification and the Unit 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, understand and can do. Such evidence may be gathered through course related activities and/or through work related activities.

Integrated assessment evaluates the learner's ability to combine actions and ideas across a range of activities and knowledge areas. The integrated assessment must specifically assess 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.
- Illustrate a clear understanding of the concepts, theory and principles that underpin the practical action taken.

The assessment will require assessment methods which measure and evaluate evidence generated during learning and on-the-job activities. Because assessment practices must be open and transparent, fair, valid and reliable; ensuring that no learner is disadvantaged in any way whatsoever, an integrated assessment approach is incorporated into the Qualification.

A variety of methods must be used in assessment tools and activities must be appropriate to the context in which the learner is working or will work. Where it is not possible to assess the learner at the workplace, simulations, case studies role plays and other similar techniques should be used to provide a context appropriate to the assessment.

The term integrated assessment implies that theoretical and practical components should be assessed together. Whenever possible, the assessment of knowledge, skills, attitudes and values shown in the Unit Standards should be integrated and, during integrated assessment, the assessor should make use of a range of formative and summative assessment tools and methods. Combinations of practical, applied, foundational and reflective competencies should be assessed. Assessment should further ensure that all specific outcomes, embedded knowledge and critical cross field outcomes are evaluated in an integrated way.

Assessors must assess and give credit for the evidence of learning that has already been acquired through formal, informal and non-formal learning and work experience as the assessment process is capable of being applied to Recognition of Prior Learning, subject to the rules and criteria of the relevant ETQA.

#### **INTERNATIONAL COMPARABILITY**

This international comparative review has been done for the suite of qualifications in polymer manufacturing, which includes qualifications from NQF Level 2 to 5. This approach gives a clearer picture of how the South African suite of qualifications and how the individual qualifications that make up that suite compare with what is offered internationally.

Internationally, the course offerings for polymer manufacturing include post-schooling Certificate, Diploma, and Bachelor programmes. Specialised Advanced Diploma courses for Technicians already in the field are also available. There are also smaller units of study that

focus only on specific applications like material moulding and similar processes, at various levels.

Countries selected below are those from which there is a developed, developing and or advanced compound and plastics industry in terms of product output. Singapore, the USA, Japan and the UK are leading countries in the field of polymer technology. However, this review takes a broader view of practices across the globe.

#### **New Zealand:**

New Zealand's NQF provides qualifications similar in approach to those of South Africa in terms of content and approach to qualification design. There is a series of qualifications that span from Level 1 to 5 that are equivalent to those in South Africa.

The New Zealand qualifications in the series are:

- National Certificate in Plastics Processing Technology (Production) (Level 1) NQF Ref: 1361 with strands in General, Injection Moulding, Extrusion, Blow Moulding, Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding, Rotational Moulding, Film Slitting, and Expanded Polystyrene Moulding.
- National Certificate in Plastics Processing Technology (Production) (Level 2) NQF Ref: 1362 with strands in General, Injection Moulding, Extrusion, Blow Moulding, Pressure Thermoforming, Vacuum Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding, Rotational Moulding, Expanded Polystyrene Moulding, and Polystyrene Pre-expansion.
- National Certificate in Plastics Processing Technology (Production) (Level 3) NQF Ref: 1363 with strands in General, and Expanded Polystyrene Moulding.
- National Certificate in Plastics Processing Technology (Technical) (Level 1) NQF Ref: 0260 with strands in Injection Moulding, Extrusion, Blow Moulding, Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding, and Rotational Moulding.
- National Certificate in Plastics Processing Technology (Technical) (Level 2) NQF Ref: 0394 with strands in Injection Moulding, Extrusion, Blow Moulding, Pressure Thermoforming, Vacuum Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding, and Rotational Moulding.
- National Certificate in Plastics Processing Technology (Technical) (Level 3) NQF Ref: 0395 with strands in Injection Moulding, Extrusion, Blow Moulding, Pressure Thermoforming, Vacuum Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding, and Rotational Moulding.
- National Certificate in Plastics Processing Technology (Technical) (Level 4) NQF Ref: 0396 with strands in Injection Moulding, Extrusion, Blow Moulding, Thermoforming, Blown Film Extrusion, Injection Stretch-Blow Moulding Single Stage, Injection Stretch-Blow Moulding Two Stage, and Rotational Moulding.
- National Diploma in Plastics Processing Technology (Level 5) NQF Ref: 1004.

Specialisations and supporting unit standards (New Zealand):

#### **Moulding:**

Supporting these qualifications, there are a number of core unit standards for the various specialisation strands:

#### **Level 1:**

- 295 4 Credits: Perform basic process operations for blow moulding.

#### **Level 2:**



- 296 6 Credits: Operate the blow moulding machine.
- 297 10 Credits: Run and monitor the blow moulding production process.
- 299 7 Credits: Service simple tooling for blow moulding.
- 300 8 Credits: Service advanced tooling for blow moulding.
- 302 8 Credits: Set up simple tooling for blow moulding.
- 287 4 Credits: Perform basic process operations for blown film extrusion.
- 288 8 Credits: Operate the blown film extrusion machine.
- 289 12 Credits: Control and optimise mono-layer production process for blown film extrusion.
- 291 8 Credits: Operate a blown film co-extrusion machine.
- 293 9 Credits: Service mono-layer dies and extruder screws for blown film extrusion.

Level 3:

- 290 9 Credits: Run complex production processes and trials on mono-layer blown film extrusion machines.
- 292 10 Credits: Control and optimise a blown film co-extrusion production process.
- 294 9 Credits: Service co-extrusion dies for blown film extrusion.

Level 4:

- 9710 7 Credits: Demonstrate knowledge of the application of advanced processing technology.

Expanded Polystyrene Moulding Extrusion:

Level 1:

- 281 4 Credits: Perform basic extrusion process operations.

Level 2:

- 282 8 Credits: Operate the extrusion machine.
- 283 12 Credits: Run and monitor the extrusion production process.
- 285 10 Credits: Change dies and set ancillary equipment for extrusion.

Level 3:

- 284 8 Credits: Control and optimise the extrusion production process.
- 286 6 Credits: Demonstrate knowledge of extrusion tooling and change extruder screws.

Level 4:

- 9715 7 Credits: Maintain extrusion tooling and demonstrate knowledge of tooling design principles.

Film Conversion:

Level 1:

- 275 3 Credits: Perform basic process operations for film conversion.
- 279 3 Credits: Perform basic process operations for film slitting.

Level 2:

- 276 7 Credits: Operate the machine for film conversion.
- 277 10 Credits: Set up and control simple operations for film conversion.
- 280 7 Credits: Set, operate and operate and control the production process for film slitting.

Level 3:

- 278 8 Credits: Set up and control advanced operations for film conversion.

Injection Moulding:

Level 1:

- 252 4 Credits: Perform basic process operations for injection moulding.

Level 2:

- 253 6 Credits: Operate the injection moulding machine.
- 254 9 Credits: Run and monitor the injection moulding production process.
- 256 8 Credits: Set up simple moulds for injection moulding.
- 258 6 Credits: Service simple moulds for injection moulding.
- 259 4 Credits: Service advanced moulds for injection moulding.

Level 3:

- 255 12 Credits: Control and optimise the injection moulding production process.
- 257 7 Credits: Set up advanced moulds for injection moulding.
- 260 10 Credits: Maintain simple and advanced moulds, and service a complex mould for injection moulding.

Level 4:

- 9712 6 Credits: Trial an advanced injection mould.
- 9713 5 Credits: Set up and remove complex injection moulds.

Injection Stretch-Blow Moulding:

Level 1:

- 15206 5 Credits: Perform basic process operations for injection stretch-blow moulding.

Level 2:

- 15207 6 Credits: Operate injection stretch-blow moulding equipment.
- 15208 9 Credits: Set and run the injection stretch-blow moulding production process.
- 15211 6 Credits: Service tooling for injection stretch-blow moulding.

Level 3:

- 15209 8 Credits: Trial and optimise the single stage injection stretch-blow moulding production process.
- 15210 12 Credits: Trial and optimise the two stage injection stretch-blow moulding production process.
- 15212 8 Credits: Demonstrate knowledge and carry out routine maintenance of perform injection moulds.
- 15213 6 Credits: Set up tooling for injection stretch-blow moulding.

Thermoforming:

Level 1:

- 261 4 Credits: Perform basic process operations for thermoforming.

Level 2:

- 262 6 Credits: Operate the thermoforming machine.
- 263 8 Credits: Run and monitor the production process for vacuum thermoforming.
- 264 8 Credits: Run and monitor the production process for pressure thermoforming.
- 267 8 Credits: Set up simple tooling for thermoforming.
- 269 6 Credits: Service simple tooling for thermoforming.

Level 3:

- 265 8 Credits: Control and optimise the production process for vacuum thermoforming.
- 266 10 Credits: Control and optimise the production process for pressure thermoforming.
- 268 9 Credits: Set up complex tooling for thermoforming.
- 270 8 Credits: Service complex tooling for thermoforming.
- 20298: Fill and close containers (level 1).
- 20299: Label containers manually (level 2).
- 20300: Set up and operate automated container labelling equipment (level 3).
- 20301: Set up and operate automated filling equipment (level 3).

The United Kingdom (UK):

The National Database of Accredited Qualifications (NDAQ) contains details of qualifications that are accredited by the regulators of external qualifications in England (Ofqual), Wales (DCELLS) and Northern Ireland (CCEA).

There is an opportunity for learners to also do EDEXCEL qualifications that are recognised all over the UK. Learners can also enrol for a Level 3 BTEC Extended Certificate in Engineering (applied Science). Its distinct feature is that it offers specialist units that have relevance for Plastics and Compound processing: Basic Polymer Technology, Engineering Studies for Polymer Technicians, ICT and MIS in the Polymer Industry, ICT and MIS in the Polymer Industry, Plastics Materials, Plastics Processing, Polymer Process Engineering, Polymer Science, Polymer Technology Investigations, Compound Products and Specialist Elastomers, Compound Technology, Using Science in the Workplace.

The Diploma in manufacturing and product design is for all learners, and has particular relevance to learners who are 14-19 and who seek to acquire knowledge and develop skills in the broad context of manufacturing industries. Such a diploma will enable learners to, amongst others: acquire relevant personal, learning and thinking skills (PLTS) in a manufacturing context, offer progression to other Diplomas, to transfer laterally and progress to further education, apprenticeships and training and aid effective transition to further education, work-based learning or higher education and to working life. The diploma structure has the following components: Principal Learning; Generic Learning and Additional and Specialist Learning. Each Level has three themes: Business and Enterprise, Production Design and Production Systems. Learners have the opportunity to explore the manufacturing sector within their local area.

There is a specialist learning focus for the Diploma in manufacturing and product design, which outlines the sector requirements for specialist learning.

Progression across the 3 levels:

**Level 1 Summary of themes and topic titles:****Theme A Business and enterprise:**

- Topic 1.1: Introduction to manufacturing; 30.
- Topic 1.2: Dealing with customers and suppliers; 30.
- Topic 1.3: Introduction to working practices; 30.

**Theme B Product design and materials science:**

- Topic 1.4: Introduction to product design and development; 60.
- Topic 1.5: Introduction to materials science; 30.

**Theme C Production systems:**

- Topic 1.6: Manufacturing a product; 60.

**Level 2 Summary of themes and topic titles:****Themes and topics GLH:****Theme A Business and enterprise:**

- Topic 2.1: Running a manufacturing business; 60.
- Topic 2.2: The global business world; 60.
- Topic 2.3: Working in manufacturing; 60.

**Theme B Product design and materials science:**

- Topic 2.4: Designing and developing products; 60.
- Topic 2.5: Materials science; 60.

**Theme C Production systems:**

- Topic 2.6: Processing systems; 60.
- Topic 2.7: Product manufacture; 60.

**Level 3 Summary of themes and topic titles:****Themes and topics GLH:****Theme A Business and enterprise:**

- Topic 3.1: Manufacturing business principles; 60.
- Topic 3.2: Customer needs and market requirements; 60.
- Topic 3.3: Supply chain management; 30.
- Topic 3.4: Management of resources and working practices; 30.

**Theme B Product design and materials science:**

- Topic 3.5: Research, development and introduction of new products; 90.
- Topic 3.6: Materials science; 90.

**Theme C Production systems:**

- Topic 3.7: Production and processing systems; 90.
- Topic 3.8: Management of production and processing operations; 60.
- Topic 3.9: Quality in manufacturing; 30.

The London Metropolitan University offers a distance learning University Certificate Preparatory Award over two to three years. The target group is young people new to the industry or those employed as technicians and wishing to develop their careers in the polymer, manufacturing and allied industries. The entry requirement is a minimum of five General Certificate of School Education subjects (including Mathematics, English and a relevant science), or a BTEC/Edexcel First Award in an engineering, science or technology subject. In many cases, suitable industrial experience will be accepted in lieu of academic qualifications. The modules offered are (Year 1): Polymer Materials Overview; Basic Mathematics; Computing; Basic Science; Polymer science; Practical Skills. (Year 2) Polymer Processing Overview; Polymer Properties and Testing Engineering practices Industry and Communication Practical Skills. Learners are required to have two optional modules from the following: Extrusion Polymer Process Engineering; Composites Compound Technology; Injection Moulding. These practical classes can be completed in the workplace or at designated short courses at the University, depending on the facilities available to learners at their place of work. In, addition, there is a requirement that learners learn and acquire IT skills.

The United States of America (USA):

The following is a stand-alone specialist compound qualification that is on offer at a University entry level. The University of Milwaukee School of Continuing Education offers an entry-level Elastomer/Compound Technology Certificate that has the following as core courses: Dynamic Properties of Compound and Product Performance, Compound Adhesion: Principles and Practice Compound Compounding and Mixing for Performance, Compound Extrusion Technology, Moulding of Compound and Design of Compound Moulds Compound Materials Selection, Silicone Elastomers Technology and Fabrication The Elective Courses are: Geometric Dimensioning and Tolerancing and Tolerance Stack Up Analysis.

India:

Compound Technology is strong in India.

Anna University offers a BTech Programme Compound and Plastics Technology since 2000 that is recognised by and receives input from trade and industry bodies.

Mauritius:

The BSc (polymers) degree offered by the University of Mauritius offers the following topics: Concept of Macromolecules/polymers, history of polymers, terminology, classification and representation of polymers/copolymers, types of interactions, cohesive energy, overview of mechanical properties Molecular structure and Isomerism: stereo chemical, geometrical, tacticity, dashed-wedged and Fischer representations. Polymer morphology. Tutorials on isomerism Molar mass determination. Viscosity measurements, size-exclusion chromatography, universal calibration, NMR Polycondensation: general principles, kinetics, molar mass and DP<sub>n</sub>, functionality and gelification Free-radical polymerization: general scheme, kinetics, transfer, stereochemistry of polymerization, living free radical polymerization Copolymerization, determination and interpretation of reactivity ratios, Q-e scheme Cationic polymerization: conventional and living Anionic polymerization: conventional and living Tutorials on copolymerization, cationic and anionic polymerization Polymerization techniques: bulk, solution, suspension, emulsion Coordination polymerization: Ziegler-Natta, metallocene, metathesis (ROMP) Structure-property relationship.

**Singapore:**

In 2008, the chemical industry's contribution to the annual manufacturing output of Singapore was 38.6%, maintaining the sector's consistently key role and high growth rates. While the country is already recognised as a global hub for the industry, further growth is anticipated as several world-scale manufacturing facilities come on stream in the next few years. Developments in the newly targeted automotive, lifestyle products & services, natural resources, nanotechnology and intelligent systems sectors will further drive the demand for chemicals, advanced and specialty materials.

The Diploma in Materials Science aims to equip next generation graduates with the materials science knowledge relevant to this rapidly evolving environment. A distinctive feature of the Diploma will be the inclusion of management skills training that will allow graduates to fully participate in and benefit from the exciting industry developments. While one of the newest offerings from Singapore Polytechnic, the Diploma is nevertheless built on the solid heritage of the Diploma in Chemical Process Technology, which has been widely recognised, both locally and overseas, for its academic excellence and industrial relevance.

Academically, the Diploma in Materials Science comprises both newly developed and updated modules that are delivered through a comprehensive programme of lectures and tutorials. The Materials Science content is supplemented by extensive laboratory practicals where invaluable experience on a wide range of modern and sophisticated equipment may be gained in the Polymer Characterisation Centre, Polymer Chemistry Laboratory, Polymer Processing Laboratory, Materials Science Laboratory as well as the Advanced Materials Technology Centre. A wide range of local and overseas industrial attachment opportunities as well as a challenging Final Year Project will provide students with real working or research experience.

**National University of Singapore:**

- Advanced Diploma in Plastics Technology renamed to Advanced Diploma in Polymer Technology.

**Similarities:**

The New Zealand and South African qualifications in compound products are similar in the way they are structured. Levels 1 to 4 of New Zealand's Plastics Manufacturing (which incorporates paint, compound and plastics) are closer, though not identical, to South Africa's Levels 2 to 4 compound manufacturing qualifications.

Qualifications in both countries have a core element, as well as specialist areas where specific knowledge and skills are differentiated. Fundamental learning areas are South Africa's unique feature.

Areas of similarity between New Zealand's Qualifications and South Africa's compound Qualifications (including similar qualifications from other countries in this survey) is that the content includes: materials science, production and processing systems and quality considerations in product manufacturing.

Approaches at National Certificate and Diploma Levels have broad similarities that differ in packaging. For example, the UK's Diploma in Manufacturing and Product Design has very strong elements packaged as Principal Learning and Generic Learning, with very nuanced industry specific specialist learning areas. The same approach can also be discerned in Singapore.

**Differences:**

The differences are that South Africa's qualification series starts at Level 2, with New Zealand's equivalent starting at NQF Level 1. New Zealand has an arrangement under which the compound and paint technologies are treated as sub-sets of Plastics, which accounts for the larger breadth of specialist areas.

Conclusion:

The structural, product and product process proximity of the qualifications in the area of compound manufacturing argue for clustering together of similarities. This then leaves room for specialisations as determined in the qualification series.

### **ARTICULATION OPTIONS**

This Qualification articulates both horizontally and vertically.

The qualification articulates horizontally to:

- ID 48800: National Certificate: Quality Checking and Finishing of Manufactured Tyres, NQF Level 2.
- ID 48793: National Certificate: Tyre and Tyre Component Manufacturing, NQF Level 2.
- ID 49450: National Certificate: Plastics Manufacturing, NQF Level 2.

Vertical articulation:

The qualification articulates vertically to:

- ID 49449: National Certificate: Plastics Manufacturing, NQF Level 3.
- ID 48794: National Certificate: Quality Checking of Tyres and Tyre Components, NQF Level 3.
- ID 48798: National Certificate: Tyre and Tyre Component Manufacturing, NQF Level 3.
- ID 48795: National Certificate: Tyre Assembly, NQF 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 needs to:

- Be registered as an assessor with the relevant ETQA.
- Be in possession of a relevant qualification at NQF Level 3 or higher.
- Have relevant practical experience in the sector.

#### NOTES

N/A

#### UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119463	Access and use information from texts	Level 2	5
Fundamental	9009	Apply basic knowledge of statistics and probability to influence the use of data and procedures in order to investigate life related problems	Level 2	3
Fundamental	7480	Demonstrate understanding of rational and irrational numbers and number systems	Level 2	3
Fundamental	119454	Maintain and adapt oral/signed communication	Level 2	5
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	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	376921	Apply bonding agent to a range of surfaces	Level 2	4
Core	376920	Describe and apply fundamental processes in a polymer compound manufacturing environment	Level 2	15
Core	376980	Develop a learning plan and a portfolio for assessment	Level 2	6
Core	12466	Explain the individual's role within business	Level 2	4
Core	13220	Keep the work area safe and productive	Level 2	8
Core	376922	Monitor the production process of polymer compound products	Level 2	4
Elective	376961	Apply study and learning techniques	Level 2	3
Elective	256177	Apply tread rubber to casings	Level 2	8
Elective	9909	Identify and process waste	Level 2	4
Elective	115063	Inspect, trim, balance and sort manufactured tyres	Level 2	19
Elective	376944	Manufacture injection moulding products	Level 2	6
Elective	376927	Manufacture polymer compound lining products	Level 2	20
Elective	119139	Monitor the quality of the input materials and the manufactured plastic product	Level 2	12
Elective	13164	Monitor the quality of the output from a rubber manufacturing process	Level 2	12
Elective	13258	Participate in work group activities	Level 2	4
Elective	12484	Perform basic fire fighting	Level 2	4
Elective	256175	Prepare casings for retreading	Level 2	16



	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	13160	Prepare industrial rubber manufacturing equipment	Level 2	12
Elective	120496	Provide risk-based primary emergency care/first aid in the workplace	Level 2	5
Elective	115061	Repair and buff tyres	Level 2	8
Elective	13161	Respond to changes in industrial rubber manufacturing processes	Level 2	12
Elective	115111	Set and operate equipment with simple control systems	Level 2	15
Elective	115055	Transport materials, components or products in the tyre manufacturing process	Level 2	12
Elective	376941	Trim, inspect and sort manufactured polymer compound products	Level 2	8
Elective	13163	Use and care for services, tools and equipment in the industrial rubber manufacturing process	Level 2	10
Elective	13158	Work with and look after materials in the industrial rubber manufacturing process	Level 2	12
Elective	376943	Develop learning strategies and techniques	Level 3	3

**LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION**

**None**



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:**

***Describe and apply fundamental processes in a polymer compound manufacturing environment***

<b>SAQA US ID</b>		<b>UNIT STANDARD TITLE</b>	
376920		Describe and apply fundamental processes in a polymer compound manufacturing environment	
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Manufacturing and Assembly Processes			
<b>FIELD</b>		<b>SUBFIELD</b>	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 2	15

New NQF Level: NQF Level 02

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

**SPECIFIC OUTCOME 1**

Describe fundamental production processes and specialisation areas in a polymer compound manufacturing environment.

**SPECIFIC OUTCOME 2**

Identify and use equipment and machinery used in a polymer compound manufacturing process.

**SPECIFIC OUTCOME 3**

Identify and apply safety practices in a polymer compound manufacturing process.

**SPECIFIC OUTCOME 4**

Identify and apply quality practices in a polymer compound manufacturing process.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	79408	National Certificate: Polymer Compound Manufacturing	Level 2



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Apply bonding agent to a range of surfaces***

SAQA US ID		UNIT STANDARD TITLE	
376921		Apply bonding agent to a range of surfaces	
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 2	4

New NQF Level: NQF Level 02

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

**SPECIFIC OUTCOME 1**

Prepare material for bonding purposes.

**SPECIFIC OUTCOME 2**

Prepare surface for bonding purposes.

**SPECIFIC OUTCOME 3**

Apply bonding agent in line with surface conditions and requirements.

**SPECIFIC OUTCOME 4**

Handle and store bonding agent in line with industry standards.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	79408	National Certificate: Polymer Compound Manufacturing	Level 2



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Monitor the production process of polymer compound products***

SAQA US ID	UNIT STANDARD TITLE		
376922	Monitor the production process of polymer compound products		
ORIGINATOR	PROVIDER		
SGB Manufacturing and Assembly Processes			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 2	4

New NQF Level: NQF Level 02

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

**SPECIFIC OUTCOME 1**

Determine product quality requirements in a polymer compound production process.

**SPECIFIC OUTCOME 2**

Conduct functionality checks on manufacturing equipment.

**SPECIFIC OUTCOME 3**

Visually inspect elements of the production process.

**SPECIFIC OUTCOME 4**

Describe incidents and problems resulting from the visual inspection of the production process and the quality of the product output.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

ID	QUALIFICATION TITLE	LEVEL
Core 79408	National Certificate: Polymer Compound Manufacturing	Level 2



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Manufacture polymer compound lining products***

SAQA US ID		UNIT STANDARD TITLE	
376927		Manufacture polymer compound lining products	
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 2	20

New NQF Level: NQF Level 02

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

**SPECIFIC OUTCOME 1**

Prepare material required for polymer compound lining products.

**SPECIFIC OUTCOME 2**

Apply bonding agent to substrate.

**SPECIFIC OUTCOME 3**

Apply polymer compound lining to substrate as required by customer specification(s).

**SPECIFIC OUTCOME 4**

Conduct pre-cure inspection in line with industry standards.

**SPECIFIC OUTCOME 5**

Cure polymer compound lining product as required.

**SPECIFIC OUTCOME 6**

Conduct final visual inspection of the vulcanized product.

**SPECIFIC OUTCOME 7**

Store product material in line with industry standards.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

ID	QUALIFICATION TITLE	LEVEL
Elective 79408	National Certificate: Polymer Compound Manufacturing	Level 2



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Trim, inspect and sort manufactured polymer compound products***

<b>SAQA US ID</b>		<b>UNIT STANDARD TITLE</b>	
376941		Trim, inspect and sort manufactured polymer compound products	
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Manufacturing and Assembly Processes			
<b>FIELD</b>		<b>SUBFIELD</b>	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 2	8

New NQF Level: NQF Level 02

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

**SPECIFIC OUTCOME 1**

Load polymer compound product on to operating bench.

**SPECIFIC OUTCOME 2**

Inspect polymer compound product being manufactured.

**SPECIFIC OUTCOME 3**

Trim polymer compound product in line with product specifications and process requirements.

**SPECIFIC OUTCOME 4**

Sort finished polymer compound product.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	79408	National Certificate: Polymer Compound Manufacturing	Level 2



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Manufacture injection moulding products***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
376944	Manufacture injection moulding products		
<b>ORIGINATOR</b>	<b>PROVIDER</b>		
SGB Manufacturing and Assembly Processes			
<b>FIELD</b>	<b>SUBFIELD</b>		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 2	6

New NQF Level: NQF Level 02

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

**SPECIFIC OUTCOME 1**

Obtain strip from source to commence the manufacturing of moulded products.

**SPECIFIC OUTCOME 2**

Feed rubber into injection mould for manufacturing.

**SPECIFIC OUTCOME 3**

Remove product from mould to complete the process.

**SPECIFIC OUTCOME 4**

Store product according to company procedures and in line with product specifications.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	79408	National Certificate: Polymer Compound Manufacturing	Level 2



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Apply study and learning techniques***

SAQA US ID	UNIT STANDARD TITLE		
376961	Apply study and learning techniques		
ORIGINATOR	PROVIDER		
SGB Manufacturing and Assembly Processes			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 2	3

New NQF Level: NQF Level 02

***This unit standard replaces:***

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13202	Apply study and learning techniques	Level 2	3	Will occur as soon as 376961 is registered

**SPECIFIC OUTCOME 1**

Describe common study and learning techniques.

**SPECIFIC OUTCOME 2**

Select suitable study and learning techniques.

**SPECIFIC OUTCOME 3**

Reflect on study and learning techniques selected.

**SPECIFIC OUTCOME 4**

Evaluate and report on progress with the learning process.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	79408	National Certificate: Polymer Compound Manufacturing	Level 2





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:***Develop a learning plan and a portfolio for assessment*

SAQA US ID		UNIT STANDARD TITLE	
376980		Develop a learning plan and a portfolio for assessment	
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 2	6

New NQF Level: NQF Level 02

***This unit standard replaces:***

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
12465	Develop a learning plan and a portfolio for assessment	Level 2	6	Will occur as soon as 376980 is registered

**SPECIFIC OUTCOME 1**

Explain and discuss the learning and assessment system in South Africa.

**SPECIFIC OUTCOME 2**

Develop a learning plan.

**SPECIFIC OUTCOME 3**

Prepare a Portfolio of Assessment Evidence.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	79408	National Certificate: Polymer Compound Manufacturing	Level 2



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

### **QUALIFICATION:** **National Certificate: Polymer Compound Manufacturing**

SAQA QUAL ID	QUALIFICATION TITLE		
79407	National Certificate: Polymer Compound Manufacturing		
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
QUALIFICATION TYPE	FIELD	SUBFIELD	
National Certificate	6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly	
ABET BAND	MINIMUM CREDITS	NQF LEVEL	QUAL CLASS
Undefined	145	Level 3	Regular-Unit Stds Based

New NQF Level: NQF Level 03

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

#### **PURPOSE AND RATIONALE OF THE QUALIFICATION**

Purpose:

Compound manufacturing refers to the production of polymeric compounds for the manufacture of rubber, plastics, tyre and related products. This involves the processing of polymer compounds into finished products that are used in the polymer compound manufacturing industry.

This Qualification is for the Polymer Compound Processing Machine Operator. The NQF Level 3 Polymer Compound Processing Machine Operator may, in addition to the normal operator role or roles, assume the role(s) of the team leader.

In performing the more advanced/additional roles, the Polymer Compound Processing Machine Operator sets tooling, prepares material for production and the operational site, monitors the production cycle, handles safety and quality applications and oversees the production cycle. This is achieved through specialised knowledge and skills which are offered in this Qualification.

Qualifying learners are able to:

- Implement production procedures and set tooling in a safe manner, in line with quality specifications.
- Handle, operate and care for equipment and machinery used in various polymer compound manufacturing plants.
- Use diversity to handle conflict at the workplace.
- Manage basic business finance.
- Apply team skills to enhance team performance in the workplace.

This Qualification provides the qualifying learner with the skills required to:

- Apply quality procedures.
- Apply safety, health and environmental protection procedures.

- Change and set up simple tooling.
- Develop learning strategies and techniques.
- Explain and use organisational procedures.
- Manage basic business finance.
- Manage work time effectively.
- Show understanding of diversity in the workplace.
- Use communication skills to handle and resolve conflict in the workplace.

**Rationale:**

This Qualification is intended for Polymer Compound Processing Machine Operators who also function as supervisors and team leaders. At this level, learners are assisted to acquire the competence sets for setting up tooling and operating production manufacturing equipment, in their areas of specialisation.

It makes possible the progression from routine, entry level skills to those at a level immediately above the entry level. It also addresses the need of Polymer Compound Manufacturer and processing companies for competent Polymer Compound Processing Machine Operators.

This Qualification is for learners who are currently working in the industry, and new entrants who aspire to pursue a career in polymer compound manufacturing.

The qualification will also benefit small, micro and medium enterprises that provide products or services to polymer compound manufacturing companies.

This is the second Qualification in a series of Polymer Compound manufacturing within the context of either mixing, extruding, moulding or calendaring, that will enable competent learners to participate effectively in the Polymer Compound manufacturing industry, whether in micro, small, medium or large operations.

**RECOGNIZE PREVIOUS LEARNING?**

Y

**LEARNING ASSUMED IN PLACE**

This qualification assumes that the learner is competent in Communication and Mathematical Literacy at NQF Level 2.

**Recognition of Prior Learning:**

This Qualification can be achieved wholly or in part through the Recognition of Prior Learning. The learner may have attained the knowledge or competencies in the qualification either through formal courses or through informal means or a combination of both.

Assessors should ensure that learners submitting themselves to Recognition of Prior Learning are thoroughly briefed prior to assessment. Learners will be required to submit a Portfolio of Evidence in the prescribed format to be assessed for formal recognition.

**Access to the Qualification:**

Access to this Qualification is open, however it is preferable that learners first accessing this qualification first complete the National Certificate: Compound Manufacturing Level 2.

**QUALIFICATION RULES**

The minimum requirement for this Qualification is 145 credits.

**Fundamental Component:**

All fundamental unit standards are compulsory (36 credits).

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

- Unit standards at NQF Level 3, totalling 16 credits in Mathematical Literacy.
- Unit standards at NQF Level 3, totalling 20 credits in Communication.

Core Component:

All core unit standards are compulsory (53 credits).

Elective Component:

The Elective component consists of a number of specialisations. The learner must choose one of the specialisations and complete unit standards listed for that specialisation, according to the requirements for the specialisation, to give a minimum of 56 credits.

Specialisation 1: Industrial Rubber.

Complete any of the unit standards listed below to give a minimum of 56 credits:

- Cure a range of manufactured products, NQF Level 3, 18 credits.
- Manufacture a range of conveyor belt products, NQF Level 3, 25 credits.
- Manufacture a range of hose products, NQF Level 3, 22 credits.
- Manufacture extruded products, NQF Level 3, 18 credits.
- Manufacture a range of latex products, NQF Level 3, 20 credits.
- Test industrial rubber products, NQF Level 3, 20 credits.
- Operate and monitor industrial rubber manufacturing equipment, NQF Level 3, 20 credits.
- Prepare materials for industrial rubber production, NQF Level 3, 12 credits.

Specialisation 2: New and/or retread tyres.

Complete any of the unit standards listed below to give a minimum of 56 credits:

- Manufacture retreated type products, NQF Level 3, 10 credits.
- Set up and operate calendaring equipment to produce tyre components, NQF Level 3, 18 credits.
- Test tyre related products and identify faults, NQF Level 3, 24 credits.
- Monitor the quality of manufactured tyres, NQF Level 3, 24 credits.
- Assemble tyres, NQF Level 3, 48 credits.
- Set up, operate and monitor extrusion equipment for tyre component manufacturing, NQF Level 3, 18 credits.
- Prepare tyre fabrics for coating, NQF Level 3, 18 credits.
- Operate tyre curing presses, NQF Level 3, 18 credits.
- Operate and monitor compounding equipment for tyre component manufacturing, NQF Level 3, 18 credits.

Specialisation 3: Plastics.

Learners are to complete the following three unit standards totalling 20 credits.

- Work with and look after materials in the plastics manufacturing production process, NQF Level 3, 12 credits.

- Perform routine maintenance tasks on plastics manufacturing equipment, NQF Level 3, 2 credits.
- Transport and care for tooling in plastics manufacturing process, NQF Level 3, 6 credits.

And

Additional unit standards totalling a minimum of 23 credits from the following list:

- Operating cranes, NQF Level 3, 10 credits.
- Perform basic fire fighting, NQF Level 2, 4 credits.
- Operating lift trucks, NQF Level 3, 6 credits.
- Perform the role of a safety, health and environmental protection representative, NQF Level 3, 4 credits.
- Apply knowledge of self and team in order to develop a plan to enhance team performance, NQF Level 3, 5 credits.
- Coach a team member in order to enhance individual performance in work environment, NQF Level 3, 5 credits.
- Communicate in an assertive manner with clients and fellow workers, NQF Level 4, 4 credits.
- Demonstrate ability to lead a team or group, NQF Level 2, 3 credits.
- Manage individual and team performance, NQF Level 4, 8 credits.
- Plan team work functions and complete reports, NQF Level 3, 4 credits.
- Communicate with clients, NQF Level 3, 3 credits.
- Compile feasibility and commissioning reports, NQF Level 3, 3 credits.

#### **EXIT LEVEL OUTCOMES**

1. Implement production procedures and set tooling in a safe manner, in line with quality specifications.
2. Handle, operate and care for equipment and machinery used in polymer compound manufacturing plants.
3. Use diversity to handle conflict at the workplace.
4. Manage basic business finance.
5. Apply team skills to enhance team performance in the workplace.

Critical Cross-field outcomes have been addressed by the exit level outcomes, as follows:

1. Identify and solve problems:

This will be achieved when qualifying learners:

- Identify and classify polymer compound applications and processes in the polymer compound manufacturing sector.
- Identify materials required for polymer compound production processes.
- Identify and use safety procedures.
- Identify organisational processes.
- Identify and use quality procedures.

2. Work effectively with others as a member of a team or organisation.

This will be achieved when qualifying learners:

- Contribute to team and production goals.

- Adhere to operational procedures.
- Support team members in adhering to procedures and work roles to be carried out.
- Adhere to safety and quality standards.
- Explain organisational processes.

3. Organise and manage oneself and one's activities responsibly and effectively.

This will be achieved when qualifying learners:

- Respond appropriately to safety and quality situations.
- Apply work procedures appropriately to meet product and product process requirements.
- Change and set up tooling.
- Prepare material for production.
- Operate equipment and use tools.

4. Collect, analyse, organise and critically evaluate information.

This will be achieved when qualifying learners:

- Analyse material needs for product manufacturing.
- Evaluate quality of manufactured products.
- Evaluate health, safety and quality requirements.
- Make correct choice and proper use of equipment, tooling and machinery.

5. Communicate effectively by using mathematical and language skills in the modes of oral and written presentations.

This will be achieved when qualifying learners:

- Report defects and product deformations.
- Brief role players on deviations in the production environment.
- Communicate with team members.

6. Use science and technology effectively and critically, showing responsibility towards the environment and health of others.

This will be achieved when qualifying learners:

- Apply occupational health, safety and environmental requirements in the workplace.
- Adhere to production standards.
- Use and care for equipment, tooling and machinery.

7. Demonstrate an understanding of the world as a set of related systems by recognizing that problem solving contexts do not exist in isolation.

This will be achieved when qualifying learners:

- Contribute towards adhering to quality and safety standards.
- Assist team members.
- Contribute towards achievement of production deadlines and targets.

**ASSOCIATED ASSESSMENT CRITERIA**

Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Safety procedures are applied in line with process and product requirements.

- 1.2 Quality procedures are applied in line with process and product requirements.
- 1.3 Reasons for application of safety procedures are given.
- 1.4 Reasons for application of quality procedures are given.

Associated Assessment Criteria for Exit Level Outcome 2:

- 2.1 Equipment and machinery used in various polymer compound manufacturing plants are identified.
- 2.2 Equipment and machinery used in various polymer compound manufacturing plants are handled in line with product type and process requirements.
- 2.3 Equipment and machinery used in various polymer compound manufacturing plants are operated in line with product type and process requirements.

Associated Assessment Criteria for Exit Level Outcome 3:

- 3.1 Possible conflict situations in a diverse workforce are described.
- 3.2 Possible reasons for conflict at the workplace are given.
- 3.3 Conflict resolution techniques through communication skills are used in line with company procedures.

Associated Assessment Criteria for Exit Level Outcome 4:

- 4.1 Reasons for sound management of business finances are described.
- 4.2 Consequences of not managing basic business finances managing are described.
- 4.3 Methods and techniques of managing basic business finances are implemented.

Associated Assessment Criteria for Exit Level Outcome 5:

- 5.1 The reasons why team skills need to be applied in the workplace are given.
- 5.2 Characteristics of a fully functioning team in the workplace are described.
- 5.3 Methods and techniques of a fully functioning team are applied.
- 5.4 Consequences of a non-functioning team are described.

Integrated Assessment:

Integrated assessment evaluates the learner's ability to combine actions and ideas across a range of activities and knowledge areas. The integrated assessment must specifically assess 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.
- Illustrate a clear understanding of the concepts, theory and principles that underpin the practical action taken.

The assessment will require assessment methods which measure and evaluate evidence generated during learning and on-the-job activities. Because assessment practices must be open and transparent, fair, valid and reliable; ensuring that no learner is disadvantaged in any way whatsoever, an integrated assessment approach is incorporated into the Qualification.

A variety of methods must be used in assessment tools and activities must be appropriate to the context in which the learner is working or will work. Where it is not possible to assess the learner at the workplace, simulations, case studies role plays and other similar techniques should be used to provide a context appropriate to the assessment.

The term integrated assessment implies that theoretical and practical components should be assessed together. Whenever possible, the assessment of knowledge, skills, attitudes and

values shown in the Unit Standards should be integrated and, during integrated assessment, the assessor should make use of a range of formative and summative assessment tools and methods. Combinations of practical, applied, foundational and reflective competencies should be assessed. Assessment should further ensure that all specific outcomes, embedded knowledge and critical cross field outcomes are evaluated in an integrated way.

Assessors must assess and give credit for the evidence of learning that has already been acquired through formal, informal and non-formal learning and work experience as the assessment process is capable of being applied to Recognition of Prior Learning, subject to the rules and criteria of the relevant ETQA.

### **INTERNATIONAL COMPARABILITY**

This international comparative review has been done for the suite of qualifications in polymer manufacturing, which includes qualifications from NQF Level 2 to 5. This approach gives a clearer picture of how the South African suite of qualifications and how the individual qualifications that make up that suite compare with what is offered internationally.

Internationally, the course offerings for polymer manufacturing include post-schooling Certificate, Diploma, and Bachelor programmes. Specialised Advanced Diploma courses for Technicians already in the field are also available. There are also smaller units of study that focus only on specific applications like material moulding and similar processes, at various levels.

Countries selected below are those from which there is a developed, developing and or advanced compound and plastics industry in terms of product output. Singapore, the USA, Japan and the UK are leading countries in the field of polymer technology. However, this review takes a broader view of practices across the globe.

#### **New Zealand:**

New Zealand's NQF provides qualifications similar in approach to those of South Africa in terms of content and approach to qualification design. There is a series of qualifications that span from Level 1 to 5 that are equivalent to those in South Africa.

The New Zealand qualifications in the series are:

- National Certificate: Plastics Processing Technology (Production) (Level 1) NQF Ref: 1361 with strands in General, Injection Moulding, Extrusion, Blow Moulding, Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding, Rotational Moulding, Film Slitting, and Expanded Polystyrene Moulding.
- National Certificate: Plastics Processing Technology (Production) (Level 2) NQF Ref: 1362 with strands in General, Injection Moulding, Extrusion, Blow Moulding, Pressure Thermoforming, Vacuum Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding, Rotational Moulding, Expanded Polystyrene Moulding, and Polystyrene Pre-expansion.
- National Certificate: Plastics Processing Technology (Production) (Level 3) NQF Ref: 1363 with strands in General, and Expanded Polystyrene Moulding.
- National Certificate: Plastics Processing Technology (Technical) (Level 1) NQF Ref: 0260 with strands in Injection Moulding, Extrusion, Blow Moulding, Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding; and Rotational Moulding.
- National Certificate: Plastics Processing Technology (Technical) (Level 2) NQF Ref: 0394 with strands in Injection Moulding, Extrusion, Blow Moulding, Pressure Thermoforming, Vacuum



Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding, and Rotational Moulding.

- National Certificate: Plastics Processing Technology (Technical) (Level 3) NQF Ref: 0395 with strands in Injection Moulding, Extrusion, Blow Moulding, Pressure Thermoforming, Vacuum Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding; and Rotational Moulding.

- National Certificate: Plastics Processing Technology (Technical) (Level 4) NQF Ref: 0396 with strands in Injection Moulding, Extrusion, Blow Moulding, Thermoforming, Blown Film Extrusion, Injection Stretch-Blow Moulding Single Stage, Injection Stretch-Blow Moulding Two Stage, and Rotational Moulding.

- National Diploma: Plastics Processing Technology (Level 5) NQF Ref: 1004.

Specialisations and supporting unit standards (New Zealand):

Moulding:

Supporting these qualifications, there are a number of core unit standards for the various specialisation strands:

Level 1:

- 295; 4 Credits; Perform basic process operations for blow moulding.

Level 2:

- 296; 6 Credits; Operate the blow moulding machine.
- 297; 10 Credits; Run and monitor the blow moulding production process.
- 299; 7 Credits; Service simple tooling for blow moulding.
- 300; 8 Credits; Service advanced tooling for blow moulding.
- 302; 8 Credits; Set up simple tooling for blow moulding.
- 287; 4 Credits; Perform basic process operations for blown film extrusion.
- 288; 8 Credits; Operate the blown film extrusion machine.
- 289; 12 Credits; Control and optimise mono-layer production process for blown film extrusion.
- 291; 8 Credits; Operate a blown film co-extrusion machine.
- 293; 9 Credits; Service mono-layer dies and extruder screws for blown film extrusion.

Level 3:

- 290; 9 Credits; Run complex production processes and trials on mono-layer blown film extrusion machines.
- 292; 10 Credits; Control and optimise a blown film co-extrusion production process.
- 294; 9 Credits; Service co-extrusion dies for blown film extrusion.

Level 4:

- 9710; 7 Credits; Demonstrate knowledge of the application of advanced processing technology Expanded Polystyrene Moulding.

Extrusion:

Level 1:

- 281; 4 Credits; Perform basic extrusion process operations.

Level 2:

- 282; 8 Credits; Operate the extrusion machine.
- 283; 12 Credits; Run and monitor the extrusion production process.
- 285; 10 Credits; Change dies and set ancillary equipment for extrusion.

Level 3:

- 284; 8 Credits; Control and optimise the extrusion production process.
- 286; 6 Credits; Demonstrate knowledge of extrusion tooling and change extruder screws.

Level 4:

- 9715; 7 Credits; Maintain extrusion tooling and demonstrate knowledge of tooling design principles.

Film Conversion:

Level 1:

- 275; 3 Credits; Perform basic process operations for film conversion.
- 279; 3 Credits; Perform basic process operations for film slitting.

Level 2:

- 276; 7 Credits; Operate the machine for film conversion.
- 277; 10 Credits; Set up and control simple operations for film conversion.
- 280; 7 Credits; Set up and control the production process for film slitting.

Level 3:

- 278; 8 Credits; Set up and control advanced operations for film conversion.

Injection Moulding:

Level 1:

- 252; 4 Credits; Perform basic process operations for injection moulding.

Level 2:

- 253; 6 Credits; Operate the injection moulding machine.
- 254; 9 Credits; Run and monitor the injection moulding production process.
- 256; 8 Credits; Set up simple moulds for injection moulding.
- 258; 6 Credits; Service simple moulds for injection moulding.
- 259; 4 Credits; Service advanced moulds for injection moulding.

Level 3:

- 255; 12 Credits; Control and optimise the injection moulding production process.
- 257; 7 Credits; Set up advanced moulds for injection moulding.
- 260; 10 Credits; Maintain simple and advanced moulds, and service a complex mould for injection moulding.

## Level 4:

- 9712; 6 Credits; Trial an advanced injection mould.
- 9713; 5 Credits; Set up and remove complex injection moulds.

## Injection Stretch-Blow Moulding:

## Level 1:

- 15206; 5 Credits; Perform basic process operations for injection stretch-blow moulding.

## Level 2:

- 15207; 6 Credits; Operate injection stretch-blow moulding equipment.
- 15208; 9 Credits; Set and run the injection stretch-blow moulding production process.
- 15211; 6 Credits; Service tooling for injection stretch-blow moulding.

## Level 3:

- 15209; 8 Credits; Trial and optimise the single stage injection stretch-blow moulding production process.
- 15210; 12 Credits; Trial and optimise the two stage injection stretch-blow moulding production process.
- 15212; 8 Credits; Demonstrate knowledge and carry out routine maintenance of perform injection moulds.
- 15213; 6 Credits; Set up tooling for injection stretch-blow moulding.

## Thermoforming:

## Level 1:

- 261; 4 Credits Perform basic process operations for thermoforming.

## Level 2:

- 262; 6 Credits; Operate the thermoforming machine.
- 263; 8 Credits; Run and monitor the production process for vacuum thermoforming.
- 264; 8 Credits; Run and monitor the production process for pressure thermoforming.
- 267; 8 Credits; Set up simple tooling for thermoforming.
- 269; 6 Credits; Service simple tooling for thermoforming.

## Level 3:

- 265; 8 Credits; Control and optimise the production process for vacuum thermoforming.
- 266; 10 Credits; Control and optimise the production process for pressure thermoforming.
- 268; 9 Credits; Set up complex tooling for thermoforming.
- 270; 8 Credits; Service complex tooling for thermoforming.
- 20298; Fill and close containers (Level 1).
- 20299; Label containers manually (Level 2).
- 20300; Set up and operate automated container labelling equipment Level 3).
- 20301; Set up and operate automated filling equipment (Level 3).

## The United Kingdom (UK):

The National Database of Accredited Qualifications (NDAQ) contains details of qualifications that are accredited by the regulators of external qualifications in England (Ofqual), Wales (DCELLS) and Northern Ireland (CCEA).

There is an opportunity for learners to also do EDEXCEL qualifications that are recognised all over the UK. Learners can also enrol for a Level 3 BTEC Extended Certificate in Engineering (applied Science). Its distinct feature is that it offers specialist units that have relevance for Plastics and Compound processing: Basic Polymer Technology, Engineering Studies for Polymer Technicians, ICT and MIS in the Polymer Industry, ICT and MIS in the Polymer Industry, Plastics Materials, Plastics Processing, Polymer Process Engineering, Polymer Science, Polymer Technology Investigations, Compound Products and Specialist Elastomers, Compound Technology, Using Science in the Workplace.

The Diploma in manufacturing and product design is for all learners, and has particular relevance to learners who are 14-19 and who seek to acquire knowledge and develop skills in the broad context of manufacturing industries. Such a diploma will enable learners to, amongst others: Acquire relevant personal, learning and thinking skills (PLTS) in a manufacturing context, offer progression to other Diplomas, to transfer laterally and progress to further education, apprenticeships and training and aid effective transition to further education, work-based learning or higher education and to working life. The diploma structure has the following components: Principal Learning; Generic Learning and Additional and Specialist Learning. Each Level has three themes: Business and Enterprise, Production Design and Production Systems. Learners have the opportunity to explore the manufacturing sector within their local area.

There is a specialist learning focus for the Diploma in manufacturing and product design, which outlines the sector requirements for specialist learning.

Progression across the 3 Levels.

Level 1 Summary of themes and topic titles:

- Theme A: Business and enterprise:
  - Topic 1.1 Introduction to manufacturing, 30.
  - Topic 1.2 Dealing with customers and suppliers, 30.
  - Topic 1.3 Introduction to working practices, 30.
- Theme B: Product design and materials science:
  - Topic 1.4 Introduction to product design and development, 60.
  - Topic 1.5 Introduction to materials science, 30.
- Theme C: Production systems:
  - Topic 1.6 Manufacturing a product, 60.

Level 2 Summary of themes and topic titles:

Themes and topics GLH:

- Theme A: Business and enterprise:
  - Topic 2.1 Running a manufacturing business, 60.
  - Topic 2.2 The global business world, 60.
  - Topic 2.3 Working in manufacturing, 60.
- Theme B: Product design and materials science:
  - Topic 2.4 Designing and developing products, 60.
  - Topic 2.5 Materials science, 60.

- Theme C: Production systems:
  - Topic 2.6 Processing systems, 60.
  - Topic 2.7 Product manufacture, 60.

Level 3 Summary of themes and topic titles.

Themes and topics GLH:

- Theme A: Business and enterprise:
  - Topic 3.1 Manufacturing business principles, 60.
  - Topic 3.2 Customer needs and market requirements, 60.
  - Topic 3.3 Supply chain management, 30.
  - Topic 3.4 Management of resources and working practices, 30.
- Theme B: Product design and materials science:
  - Topic 3.5 Research, development and introduction of new products, 90.
  - Topic 3.6 Materials science, 90.
- Theme C: Production systems:
  - Topic 3.7 Production and processing systems, 90.
  - Topic 3.8 Management of production and processing operations, 60.
  - Topic 3.9 Quality in manufacturing, 30.

The London Metropolitan University offers a distance learning University Certificate Preparatory Award over two to three years. The target group is young people new to the industry or those employed as technicians and wishing to develop their careers in the polymer, manufacturing and allied industries. The entry requirement is a minimum of five General Certificate of School Education subjects (including Mathematics, English and a relevant science), or a BTEC/Edexcel First Award in an engineering, science or technology subject. In many cases, suitable industrial experience will be accepted in lieu of academic qualifications. The modules offered are:

- Year 1:
  - Polymer Materials Overview.
  - Basic Mathematics.
  - Computing.
  - Basic Science.
  - Polymer science.
  - Practical Skills.
- Year 2:
  - Polymer Processing Overview.
  - Polymer Properties and Testing.
  - Engineering practices.
  - Industry and Communication.
  - Practical Skills\*.

Learners are required to have two optional modules from the following:

- Extrusion.
- Polymer Process Engineering.
- Composites.
- Compound Technology.
- Injection Moulding.

These practical classes can be completed in the workplace or at designated short courses at the University, depending on the facilities available to learners at their place of work. In, addition, there is a requirement that learners learn and acquire IT skills.

#### The United States of America (USA):

The following is a stand-alone specialist compound qualification that is on offer at a University entry level. The University of Milwaukee School of Continuing Education offers an entry-level Elastomer/Compound Technology Certificate that has the following as core courses: Dynamic Properties of Compound and Product Performance, Compound Adhesion: Principles and Practice Compound Compounding and Mixing for Performance, Compound Extrusion Technology, Moulding of Compound and Design of Compound Moulds; and Compound Materials Selection .Silicone Elastomers Technology and Fabrication The Elective Courses are: Geometric Dimensioning and Tolerancing and Tolerance Stack Up Analysis.

#### India:

Compound Technology is strong in India.

Anna University offers a BTech Programme Compound and Plastics Technology since 2000 that is recognised by and receives input from trade and industry bodies.

#### Mauritius:

The BSc (polymers) degree offered by the University of Mauritius offers the following topics: Concept of Macromolecules/polymers, history of polymers, terminology, classification and representation of polymers/copolymers, types of interactions, cohesive energy, overview of mechanical properties Molecular structure and Isomerism: stereo chemical, geometrical, tacticity, dashed-wedged and Fischer representations. Polymer morphology Tutorials on isomerism Molar mass determination. Viscosity measurements, size-exclusion chromatography, universal calibration, NMR Polycondensation: general principles, kinetics, molar mass and DPn, functionality and gelification Free-radical polymerization: General scheme, kinetics, transfer, stereochemistry of polymerization, living free radical polymerization Copolymerization, determination and interpretation of reactivity ratios, Q-e scheme Cationic polymerization: Conventional and living Anionic polymerization: Conventional and living Tutorials on copolymerization, cationic and anionic polymerization Polymerization techniques: bulk, solution, suspension and emulsion Coordination polymerization: Ziegler-Natta, metallocene, metathesis (ROMP) Structure-property relationship.

#### Singapore:

In 2008, the chemical industry's contribution to the annual manufacturing output of Singapore was 38.6%, maintaining the sector's consistently key role and high growth rates. While the country is already recognised as a global hub for the industry, further growth is anticipated as several world-scale manufacturing facilities come on stream in the next few years. Developments in the newly targeted automotive, lifestyle products and services, natural resources, nanotechnology and intelligent systems sectors will further drive the demand for chemicals, advanced and specialty materials.

The Diploma: Materials Science aims to equip next generation graduates with the materials science knowledge relevant to this rapidly evolving environment. A distinctive feature of the Diploma will be the inclusion of management skills training that will allow graduates to fully participate in and benefit from the exciting industry developments. While one of the newest offerings from Singapore Polytechnic, the Diploma is nevertheless built on the solid heritage of the Diploma in Chemical Process Technology, which has been widely recognised, both locally and overseas, for its academic excellence and industrial relevance.

Academically, the Diploma in Materials Science comprises both newly developed and updated modules that are delivered through a comprehensive programme of lectures and tutorials. The Materials Science content is supplemented by extensive laboratory practicals where invaluable experience on a wide range of modern and sophisticated equipment may be gained in the Polymer Characterisation Centre, Polymer Chemistry Laboratory, Polymer Processing Laboratory, Materials Science Laboratory as well as the Advanced Materials Technology Centre. A wide range of local and overseas industrial attachment opportunities as well as a challenging Final Year Project will provide students with real working or research experience.

National University of Singapore.

Advanced Diploma: Plastics Technology renamed to Advanced Diploma: Polymer Technology:

#### Similarities:

The New Zealand and South African qualifications in compound products are similar in the way they are structured. Levels 1 to 4 of New Zealand's Plastics Manufacturing (which incorporates paint, compound and plastics) are closer, though not identical, to South Africa's Levels 2 to 4 compound manufacturing qualifications.

Qualifications in both countries have a core element, as well as specialist areas where specific knowledge and skills are differentiated. Fundamental learning areas are South Africa's unique feature.

Areas of similarity between New Zealand's Qualifications and South Africa's compound Qualifications (including similar qualifications from other countries in this survey) is that the content includes: Materials science, production and processing systems and quality considerations in product manufacturing.

Approaches at National Certificate and Diploma Levels have broad similarities that differ in packaging. For example, the UK's Diploma: Manufacturing and Product Design has very strong elements packaged as Principal Learning and Generic Learning, with very nuanced industry specific specialist learning areas. The same approach can also be discerned in Singapore.

#### Differences:

The differences are that South Africa's qualification series starts at Level 2, with New Zealand's equivalent starting at NQF Level 1. New Zealand has an arrangement under which the compound and paint technologies are treated as sub-sets of Plastics, which accounts for the larger breadth of specialist areas.

#### Conclusion:

The structural, product and product process proximity of the qualifications in the area of compound manufacturing argue for clustering together of similarities. This then leaves room for specialisations as determined in the qualification series.

#### **ARTICULATION OPTIONS**

This Qualification articulates both horizontally and vertically.

The qualification articulates horizontally to:

ID 49449: National Certificate: Plastics Manufacturing, NQF Level 3, 126 credits.

ID 48794: National Certificate: Quality Checking of Tyres and Tyre Components, NQF Level 3, 134 credits.

ID 48798: National Certificate: Tyre and Tyre Component Manufacturing, NQF Level 3, 134 credits.

ID 48795: National Certificate: Tyre Assembly, NQF Level 3, 131 credits.

Vertical articulation:

ID 49451: Further Education and Training Certificate: Plastics Manufacturing, NQF Level 4, 163 credits.

ID 57712: Further Education and Training Certificate: Generic Management, NQF Level 4, 150 credits.

### **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 a relevant qualification at NQF Level 4 or higher.
- To have relevant sector experience.



**NOTES**

N/A

**UNIT STANDARDS**

	<b>ID</b>	<b>UNIT STANDARD TITLE</b>	<b>LEVEL</b>	<b>CREDITS</b>
Fundamental	117924	Use a Graphical User Interface (GUI)-based word processor to format documents	Level 2	5
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	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	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	7456	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Core	13234	Apply quality procedures	Level 3	8
Core	13223	Apply safety, health and environmental protection procedures	Level 3	6
Core	376943	Develop learning strategies and techniques	Level 3	3
Core	376925	Explain and use organisational procedures	Level 3	6
Core	9526	Manage basic business finance	Level 3	6
Core	9530	Manage work time effectively	Level 3	3
Core	116720	Show understanding of diversity in the workplace	Level 3	3
Core	9533	Use communication skills to handle and resolve conflict in the workplace	Level 3	3
Core	335856	Change and set tooling	Level 4	15
Elective	244608	Demonstrate ability to lead a team or group	Level 2	3
Elective	12484	Perform basic fire fighting	Level 2	4
Elective	13912	Apply knowledge of self and team in order to develop a plan to enhance team performance	Level 3	5
Elective	115058	Assemble tyres	Level 3	48
Elective	113909	Coach a team member in order to enhance individual performance in work environment	Level 3	5
Elective	253656	Communicate with clients	Level 3	3
Elective	12488	Complete feasibility and commissioning reports	Level 3	3
Elective	376928	Cure a range of manufactured polymer compound products	Level 3	18
Elective	376940	Manufacture a range of conveyor belt products	Level 3	25
Elective	376942	Manufacture a range of hose products	Level 3	22
Elective	376923	Manufacture a range of latex products	Level 3	20
Elective	376926	Manufacture extruded polymer compound products	Level 3	18
Elective	376924	Manufacture retreaded type product	Level 3	10
Elective	115060	Monitor the quality of manufactured tyres	Level 3	24
Elective	115066	Operate and monitor compounding equipment for tyre component manufacturing	Level 3	18
Elective	13173	Operate and monitor industrial rubber manufacturing equipment	Level 3	20
Elective	115059	Operate tyre-curing presses	Level 3	18
Elective	8039	Operating cranes	Level 3	10
Elective	8038	Operating lift trucks	Level 3	6
Elective	119174	Perform routine maintenance tasks on plastics manufacturing equipment	Level 3	2
Elective	376981	Perform the role of a safety, health and environmental protection representative	Level 3	4
Elective	12455	Perform the role of a safety, health and environmental protection representative	Level 3	4
Elective	254124	Plan team work functions and complete reports	Level 3	4
Elective	13168	Prepare materials for industrial rubber production	Level 3	12
Elective	115057	Prepare tyre fabrics for coating	Level 3	18

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	115114	Set up and operate calendering equipment to produce tyre components	Level 3	18
Elective	115067	Set up, operate and monitor extrusion equipment for tyre component manufacturing	Level 3	18
Elective	376960	Test industrial rubber product	Level 3	20
Elective	115062	Test tyre related products and identify faults	Level 3	27
Elective	119142	Transport and care for tooling in plastics manufacturing processes	Level 3	6
Elective	119169	Work with and look after materials in the plastics manufacturing production process	Level 3	12
Elective	9506	Communicate in an assertive manner with clients and fellow workers	Level 4	4
Elective	11473	Manage individual and team performance	Level 4	8

**LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION****None**



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Manufacture a range of latex products***

SAQA US ID		UNIT STANDARD TITLE	
376923		Manufacture a range of latex products	
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	20

New NQF Level: NQF Level 03

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

**SPECIFIC OUTCOME 1**

Prepare material to manufacture latex products.

**SPECIFIC OUTCOME 2**

Manufacture product according to specifications.

**SPECIFIC OUTCOME 3**

Conduct drying process per product specifications and requirements.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	79407	National Certificate: Polymer Compound Manufacturing	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Manufacture retreaded type product***

<b>SAQA US ID</b>		<b>UNIT STANDARD TITLE</b>	
376924		Manufacture retreaded type product	
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Manufacturing and Assembly Processes			
<b>FIELD</b>		<b>SUBFIELD</b>	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 3	10

New NQF Level: NQF Level 03

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

**SPECIFIC OUTCOME 1**

Conduct visual inspection of casing to review condition of retread tyre.

**SPECIFIC OUTCOME 2**

Prepare rubber for tyre retreaded process.

**SPECIFIC OUTCOME 3**

Apply safety standards in the manufacture of retreaded type of products.

**SPECIFIC OUTCOME 4**

Apply quality standards in the manufacture of retreaded type of products.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	79407	National Certificate: Polymer Compound Manufacturing	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Explain and use organisational procedures***

SAQA US ID	UNIT STANDARD TITLE		
376925	Explain and use organisational procedures		
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Engineering and Related Design	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	6

New NQF Level: NQF Level 03

***This unit standard replaces:***

<b>US ID</b>	<b>Unit Standard Title</b>	<b>NQF Level</b>	<b>Credits</b>	<b>Replacement Status</b>
12456	Explain and use organisational procedures	Level 3	6	Will occur as soon as 376925 is registered

**SPECIFIC OUTCOME 1**

Define the purpose of the organisation.

**SPECIFIC OUTCOME 2**

Identify key organisational procedures.

**SPECIFIC OUTCOME 3**

Apply business processes in line with standard operating procedures or company requirements.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	79407	National Certificate: Polymer Compound Manufacturing	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Manufacture extruded polymer compound products***

SAQA US ID	UNIT STANDARD TITLE		
376926	Manufacture extruded polymer compound products		
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	18

New NQF Level: NQF Level 03

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

**SPECIFIC OUTCOME 1**

Set up extruder to manufacture extruded polymer compound products.

**SPECIFIC OUTCOME 2**

Feed polymer compound into extruder to commence the manufacturing process.

**SPECIFIC OUTCOME 3**

Maintain and feed the supply of polymer compound into the extruding machine.

**SPECIFIC OUTCOME 4**

Coil product in batches as per product specification(s).

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	79407	National Certificate: Polymer Compound Manufacturing	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Cure a range of manufactured polymer compound products***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
376928	Cure a range of manufactured polymer compound products		
<b>ORIGINATOR</b>	<b>PROVIDER</b>		
SGB Manufacturing and Assembly Processes			
<b>FIELD</b>	<b>SUBFIELD</b>		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 3	18

New NQF Level: NQF Level 03

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

**SPECIFIC OUTCOME 1**

Prepare moulds to be used in a manufacturing process.

**SPECIFIC OUTCOME 2**

Operate curing press to produce moulded products.

**SPECIFIC OUTCOME 3**

Cure polymer compound product to meet product requirements.

**SPECIFIC OUTCOME 4**

Remove polymer compound product from press and store in line with requirements.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	79407	National Certificate: Polymer Compound Manufacturing	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

### UNIT STANDARD:

#### *Manufacture a range of conveyor belt products*

SAQA US ID		UNIT STANDARD TITLE	
376940		Manufacture a range of conveyor belt products	
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Engineering and Related Design	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	25

New NQF Level: NQF Level 03

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

#### **SPECIFIC OUTCOME 1**

Secure material, where required, and prepare material for manufacturing a range of conveyor belt products.

#### **SPECIFIC OUTCOME 2**

Calendar the material, when required, in line with product requirements and process specification(s).

#### **SPECIFIC OUTCOME 3**

Cure material in order to meet specified conveyor belt product requirements.

#### **SPECIFIC OUTCOME 4**

Label and record products according to company procedures and product specifications.

#### **QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	79407	National Certificate: Polymer Compound Manufacturing	Level 3





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Manufacture a range of hose products***

SAQA US ID		UNIT STANDARD TITLE	
376942		Manufacture a range of hose products	
ORIGINATOR		PROVIDER	
SGB Manufacturing and Assembly Processes			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	22

New NQF Level: NQF Level 03

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

**SPECIFIC OUTCOME 1**

Obtain extruded material for the manufacture of hose products.

**SPECIFIC OUTCOME 2**

Apply reinforcements in line with product and process specification(s).

**SPECIFIC OUTCOME 3**

Apply cover to the hose product in line with product specifications.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

ID	QUALIFICATION TITLE	LEVEL
Elective 79407	National Certificate: Polymer Compound Manufacturing	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

### UNIT STANDARD:

#### *Develop learning strategies and techniques*

SAQA US ID	UNIT STANDARD TITLE		
376943	Develop learning strategies and techniques		
ORIGINATOR	PROVIDER		
SGB Manufacturing and Assembly Processes			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Engineering and Related Design		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	3

New NQF Level: NQF Level 03

#### *This unit standard replaces:*

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
12457	Develop learning strategies and techniques	Level 3	3	Will occur as soon as 376943 is registered

#### **SPECIFIC OUTCOME 1**

Discuss learning and assessment opportunities at the workplace.

#### **SPECIFIC OUTCOME 2**

Evaluate current and planned future learning and assessment opportunities at the company and within the sector.

#### **SPECIFIC OUTCOME 3**

Review the selected learning resources, learning and assessment methods.

#### **SPECIFIC OUTCOME 4**

Identify sources of help and assistance for learning purposes.

#### **QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	79408	National Certificate: Polymer Compound Manufacturing	Level 2
Core	79407	National Certificate: Polymer Compound Manufacturing	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Test industrial rubber product***

SAQA US ID	UNIT STANDARD TITLE		
376960	Test industrial rubber product		
ORIGINATOR	PROVIDER		
SGB Manufacturing and Assembly Processes			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	20

New NQF Level: NQF Level 03

***This unit standard replaces:***

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13175	Test industrial rubber product	Level 3	20	Will occur as soon as 376960 is registered

**SPECIFIC OUTCOME 1**

Prepare work area and testing equipment in line with standard operating procedures.

**SPECIFIC OUTCOME 2**

Test rubber samples in accordance with product specification.

**SPECIFIC OUTCOME 3**

Compile a report on testing process in line with standard operating procedure.

**SPECIFIC OUTCOME 4**

Store tested samples according to organisation's procedures.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	79407	National Certificate: Polymer Compound Manufacturing	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Perform the role of a safety, health and environmental protection representative***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
376981	Perform the role of a safety, health and environmental protection representative		
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Manufacturing and Assembly Processes			
<b>FIELD</b>		<b>SUBFIELD</b>	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 3	4

New NQF Level: NQF Level 03

***This unit standard replaces:***

<b>US ID</b>	<b>Unit Standard Title</b>	<b>NQF Level</b>	<b>Credits</b>	<b>Replacement Status</b>
12455	Perform the role of a safety, health and environmental protection representative	Level 3	4	Will occur as soon as 376981 is registered

**SPECIFIC OUTCOME 1**

Identify and explain the legal and workplace operational framework relevant to the health, safety and environmental protection representative.

**SPECIFIC OUTCOME 2**

Identify and explain the role and responsibilities of a safety, health and environmental protection representative.

**SPECIFIC OUTCOME 3**

Identify other role players involved in safety, health and environmental protection and their roles.

**SPECIFIC OUTCOME 4**

Explain the consequences of non-compliance in respect of safety, health and environmental protection and the representative's role.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	79407	National Certificate: Polymer Compound Manufacturing	Level 3