No. 211

22 February 2008



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

Generic Manufacturing, Engineering and Technology

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 Qualification and Unit Standards can be accessed via the SAQA web-site at <u>www.saqa.org.za</u>. 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 20 March 2008*. All correspondence should be marked **Standards Setting – Generic Manufacturing, Engineering and Technology** and addressed to

> The Director: Standards Setting and Development SAQA *Attention: Mr. D. Mphuthing* Postnet Suite 248 Private Bag X06 Waterkloof 0145 or faxed to 012 – 431-5144 e-mail: dmphuthing@saqa.org.za

DR. S. BHIKHA DIRECTOR: STANDARDS SETTING AND DEVELOPMENT



QUALIFICATION: National Certificate: Mechanical Engineering: Pipe-Fitting

SAQA QUAL ID	QUALIFICATION TITLE					
59750	National Certificate: Mech	National Certificate: Mechanical Engineering: Pipe-Fitting				
ORIGINATOR		PROVIDER				
SGB Generic Manufacturin	ng, Engineering &					
Technolog						
QUALIFICATION TYPE	FIELD	SUBFIELD				
National Certificate	6 - Manufacturing, Engineering and Technology	Engineering and Related Design				
ABET BAND	MINIMUM CREDITS	NQFLEVEL	QUAL CLASS			
Undefined	121	Level 3	Regular-Unit Stds Based			

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

PURPOSE AND RATIONALE OF THE QUALIFICATION

Purpose:

The purpose of this qualification is to provide learners with the standards and the range of learning required to work effectively in various industrial environments making use of pipe-fitting knowledge and skills in order to fabricate and install pipe systems and components.

Qualifying learners at NQF Level 3 will be able to:

- Demonstrate highly developed pipe fabrication and installation skills.
- Understand pipe installation and fabrication technology and interpret pipe drawings, codes and specifications.
- Remove and install pipe systems and pipe components which include welded fabrication and installation methods.
- Use a variety of engineering processes in order to prepare for pipe fabrication.
- Evaluate and solve familiar problems pertaining to the maintenance of pipe systems.

Qualifying learners will be able to relate the tasks and processes to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures integral to safety, health and the environment. Learner achievements in this qualification will also serve as a basis for further learning to engage in more complex maintenance and repair activities and processes.

Typical entrants to this qualification could be:

• Learners who have completed the Level 2 qualification and who are engaged on a learning path towards the Level 4 qualification. While work experience after achieving the Level 2 qualification may be advisable, this is not necessarily a requirement.

208 No. 30788

• Individuals currently working in a relevant occupational context, who have acquired fitting or fabrication knowledge and skills at the appropriate level and who have the potential to complete this qualification successfully (RPL candidates).

Rationale:

The field of Mechanical Engineering (Pipe-Fitting) includes pipe installation, fabrication and maintenance, services and support across various industry sectors, namely:

• Manufacturing and Engineering (Metals, Plastics, Tyre and Rubber, Automotive Manufacturing).

- Chemical and Petrochemical.
- Transport (Maritime and Aviation).
- Food and Beverages.
- Other engineering-related industry sectors.

These industries rely on pipe systems to convey fluids and gases which characterise the nature of the plant operation and the need to control its processes. Pipes and pipe systems range from the pipe-work in micro-cooling systems to large petrochemical refineries and fertiliser plant. Learners at NQF Level 3, performing pipe installation and fabrication work, require:

• Mechanical technology orientation in a variety of contexts [mechanical engineering (pipe technology), fluid mechanics, process control].

- Communication skills.
- Team skills.

This qualification (Level 3) forms part of a progression towards obtaining the Further Education and Training Certificate in Mechanical Engineering (Pipe-Fitting). This qualification focuses on developing the skills, knowledge and values required to install welded pipe fabrication assemblies and maintain pipe systems and components.

The qualification also provides:

• Opportunities for further learning in the field of mechanical engineering.

• Recognition of prior learning (RPL) options for learners who have gained relevant experience in the workplace.

RECOGNIZE PREVIOUS LEARNING?

Y

LEARNING ASSUMED IN PLACE

The following competencies are assumed for a learner embarking on this qualification:

- Communication, NQF Level 2.
- Mathematics, NQF Level 2.

In addition, learners are assumed to have the following skills at NQF Level 2 in the context of mechanical pipe-fitting.

• Application of fitting technology, processes and skills applicable to mechanical installation, maintenance and repair within the context of pipe-fitting. Competencies acquired at Level 2 should have included:

- \circ Use pipe systems and pipe components.
- o Install pipe hangers and supports.
- Bend pipe using a pipe bender.
- \circ Cutting screw threads on a pipe-threading machine.

Source: National Learners' Records Database

Qualification 59750

07/02/2008

Page 2

• Apply a variety of mechanical assembly techniques, according to basic mechanical engineering theory and the interpretation of engineering drawings in the context of pipe-fitting.

These skills form the basis for determining the credit allocation in this qualification and may be acquired through the National Certificate: Mechanical Engineering (Fitting) NQF Level 2. If a learner does not have such experience, the learning time will be increased. The allocation of credits is also based on the assumption that the learner will be working towards this qualification as part of a learning programme which integrates the unit standards.

Recognition of Prior Learning:

This qualification may be obtained through a process of RPL. The learner should be thoroughly briefed prior to the assessment and support should be provided to assist the learner in the process of developing a portfolio. The guidelines for integrated assessment should be used to develop the RPL assessment process. As with integrated assessment, while this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the Exit Level Outcomes.

Access to the qualification:

There is open access to this qualification. It is however, necessary to obtain relevant work experience in order to produce the evidence required for the assessment of the Exit Level Outcomes.

QUALIFICATION RULES

Fundamental Component:

The Fundamental Component consists of Unit Standards in:

- Communications at Level 3 to the value of 20 credits.
- Mathematical Literacy at Level 3 to the value of 16 credits.
- All Unit Standards in the Fundamental Component are compulsory.

Core Component:

The Core Component consists of Unit Standards to the value of 61 credits all of which are compulsory.

Elective Component:

The Elective Component consists of a number of specializations each with its own set of Unit Standards. Learners are to choose a specialization area and must choose Elective Unit Standards to the value of 24 credits from the Elective Unit standards listed under that specialization so as to attain a minimum of 121 credits for this qualification.

Learning Programme:

Specialisation Area 1:

• Pipe-Fitting (Manufacturing, Engineering and Related Industries).

Learners must Elective Unit Standards from the list below to give a minimum of 24 credits for the Elective Component:

Category; ID; Unit Standard Title; Level; Credits:

Elective; ID 12246; Assemble and mechanically join sheet, plate, tube, pipe and steel sections; Level 3; 4 Credits.

• Elective; ID 243068; Weld carbon steel work-pieces using the gas tungsten arc welding process in the downhand position; Level 3; 15 Credits.

• Elective; ID 14707; Gouge material with air-carbon-arc gouging process; Level 2; 10 Credits.

• Elective; ID 243061; Assemble work pieces in jigs; Level 2; 3 Credits.

• Elective; ID 253634; Identify and apply insulation methods and materials for pipes and pipe systems; Level 3; 8 Credits.

• Elective; ID 253574; Bevel a pipe using a mechanised pipe bevelling machine; Level 3; 4 Credits.

- Elective; ID 9530; Manage work time effectively; Level 3; 5 Credits.
- Elective; ID 253430; Maintain filters and strainers; Level 3; 4 Credits.
- Elective; ID 253439; Maintain valves; Level 3; 8 Credits.
- Elective; ID 253599; Maintain Steam Traps; Level 3; 4 Credits.
- Elective; ID 253434; Maintain heat exchangers and pressure vessels; Level 3; 8 Credits.
- Elective; ID 243078; Perform destructive testing on welded specimens; Level 3; 5 Credits.
- Elective; ID 116964; Make up a flanged pipe section; Level 2; 2 Credits.

Total: 80 Credits.

Learning Programme:

Specialisation area 2:

• Pipe-Fitting (Chemical Industry).

Learners must do Unit Standard ID 244077 and must choose additional Elective Unit Standards from the list below to give a minimum of 24 credits for the Elective Component:

Category; ID; Unit Standard Title; Level; Credits:

• Elective; ID 244077; Demonstrate understanding of chemicals in a processing environment; Level 2; 6 Credits.

• Elective; ID 12246; Assemble and mechanically join sheet, plate, tube, pipe and steel sections; Level 3; 4 Credits.

• Elective; ID 243068; Weld carbon steel work-pieces using the gas tungsten arc welding process in the downhand position; Level 3; 15 Credits.

• Elective; ID 14707; Gouge material with air-carbon-arc gouging process; Level 2; 10 Credits.

• Elective; ID 243061; Assemble work pieces in jigs; Level 2; 3 Credits.

• Elective; ID 253634; Identify and apply insulation methods and materials for pipes and pipe systems; Level 3; 8 Credits.

• Elective; ID 253574; Bevel a pipe using a mechanised pipe bevelling machine; Level 3; 4 Credits.

• Elective; ID 116964; Make up a flanged pipe section; Level 2; 2 Credits.

Total: 52 Credits.

EXIT LEVEL OUTCOMES

1. Fabricate and install pipe systems and pipe system components.

Range: In order to demonstrate competency in this exit level outcome, learners are able to:

• Interpret pipe drawings, codes, specifications and the identification of welding symbols.

- Demonstrate an understanding of pipe joining methods.
- Maintain pipe systems and pipe fittings.

2. Maintain, remove and install pipe assemblies.

Source: National Learners' Records Database

Qualification 59750

Page 4

- 3. Solve problems during the maintenance of pipe systems.
- 4. Communicate with peers, production, quality control and supervisory personnel and/or clients.

Critical Cross-Field Outcomes:

These are embedded in the unit standards, which make up the qualification and are thus also reflected in the Exit Level Outcomes of the qualification.

The critical cross-field outcomes are supported by the exit level outcomes as follows:

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

- Related to the maintenance, fabrication, fitting and installation of pipes.
- Solving problems during the performance of the maintenance function.

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

- All tasks and work-related experience are performed within a team environment.
- Taking into account, the safety of others.
- Communicating with production, quality control and supervisory personnel and/or clients.

Organising and managing oneself and one's activities responsibly and effectively.

• Related to planning and preparation during the maintenance, fabrication, fitting and installation of pipes.

Collecting, analyzing, organizing and critically evaluating information.

• Related to planning and preparation during the maintenance, fabrication, fitting and installation of pipes.

- Completion of technical reports related to the job activity.
- Solve familiar problems during the maintenance of pipe systems.

Communicating effectively using visual, mathematical and/or language skills.

- Related to planning, preparation and execution of job activities during the maintenance, fabrication, fitting and installation of pipes.
- Completion of technical reports related to the job activity.
- Communicating in a leadership role.

Using science and technology effectively and critically, showing responsibility toward the environment and health of others.

- During the fabrication and installation process.
- Relating to the safety of others.
- Solving problems and the application of science and technology in pipe-fitting.

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

- Integrating fabrication, fitting, installation and maintenance with the plant installation's overall design and by understanding the alignment with the plant processes.
- Solving problems through the integration of various sources of information.

• Demonstrating and understanding of related systems through the use of general and specific channels of communication when dealing with peers, production, quality control and supervisory personnel and/or clients.

ASSOCIATED ASSESSMENT CRITERIA

Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Pipe drawings are interpreted, pipe and welding symbols are explained in terms of industry standards and a welded pipe assembly is fabricated.

1.2 Pipe calculations are applied according to job requirements and pipe offsets are set up at appropriate angles, following a working drawing or instruction.

• Range includes using tables of equivalents and the use of conversion tables, explanations of thermal expansion, performing of right angle trigonometry calculations in order to determine take-outs and offsets.

1.3 Types of pipe systems and pipe-joining methods are discussed and explained in terms of their industrial applications, function and purpose and the ability to produce a welded pipe assembly is demonstrated using butts and sockets.

• Range: For the purpose of assessment:

 \circ Pipe assemblies may include threaded, welded fabrication butts and sockets and/or bolted-type pipe systems.

• Where applicable, removal and installation of pipes and pipe systems may include preparation, alignment and inspection procedures.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Pipe systems and components are maintained to required standards, according to worksite practice and manufacturer's specifications by demonstrating the ability to perform routine maintenance procedures.

2.2 Safe working practices are adhered to in terms of worksite practice and legislative requirements.

2.3 Adjustments are made in order to accommodate changes in environmental conditions after assembly and according to prescribed procedures.

• Range: For the purpose of assessment:

• Routine maintenance tasks are related to misalignment; leakages; pressure loss;

contamination effects; corrosion, deterioration of packing, seals and fastening devices and scheduled maintenance.

• The term "maintain pipe systems" includes dismantling, removal, installation, preparation, alignment and inspection procedures.

o Pipe system and components may include filters, strainers, valves and steam traps.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Various options are explained and solutions are considered before an appropriate solution is chosen, in terms of work-site practices.

3.2 Problems are accurately reported to relevant personnel in a timely manner according to organisational policies and procedures.

3.3 Routine problems on various pipes and related components are identified and explained in terms of operational and/or service conditions and rectified.

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 Information is gathered from a range of sources and accurately summarised into a prescribed format according to company policies.

4.2 Information is clear and accurate and presented in a timely manner in the required format to appropriate parties according to work-site procedures.

4.3 Relationships with peers, production, quality control and supervisory personnel are established and functioning according to organisational procedures.
4.4 Learning options and preparation requirements for further learning are explained according to advancement opportunities on the NQF.

Integrated Assessment:

• Assessment practices must be open, transparent, fair, valid and reliable and should ensure that no learner is disadvantaged in any way whatsoever, so that an integrated approach to assessment is incorporated into the qualification.

• Learning teaching and assessment are inextricably interwoven. Whenever possible the assessment knowledge skills attitudes and values shown in the unit standards should be integrated.

• Assessment of Communication and Mathematical Literacy should be integrated as far as possible with other aspects and should use practical administration contexts wherever possible. A variety of methods must be used in assessment and 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 in the workplace or on-the-job, 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. During integrated assessments, the assessor should make use of a range of summative assessment methods and assess combinations of practical, applied, foundational and reflective competencies.

• Assessors must assess and give credit for the evidence of learning that has already been acquired and could include formal, non-formal learning and work experience.

• Assessment should ensure that all specific outcomes, embedded knowledge and critical cross-field outcomes are evaluated in an integrated manner.

• Integrated assessment instruments may combine practical and theoretical components of assessment with the following unit standards in relation to the Exit Level Outcomes.

Guide to integrated assessment:

Exit level outcomes and associated unit standards.

1. Fabricate and install pipe systems and pipe system components. Category; ID; Title; Level; Credits:

• Core; ID 13223; Apply safety, health and environmental protection procedures; Level 3; 6 Credits.

- Core; ID 12456; Explain and use organisational procedures; Level 3; 6 Credits.
- Core; ID 14492; Read and interpret piping drawings; Level 3; 4 Credits.
- Core; ID 14713; Use welding definitions and symbols; Level 2; 5 Credits.
- Core; ID 243077; Cut material using the oxy-fuel pipe cutting device; Level 3; 3 Credits.
- Core; ID 14698; Cut materials using plasma cutting; Level 4; 4 Credits.
- Core; ID 253577; Maintain pipe systems and pipe components; Level 3; 15 Credits.
- Core; ID 253558; Produce a welded pipe fabrication assembly using butt and socket fittings; Level 3: 15 Credits.
- Fundamental; ID 119457; Interpret and use information from texts; Level 3; 5 Credits.

2. Maintain remove and install pipe assemblies. Category; ID; Title; Level; Credits: • Core; ID 13223; Apply safety, health and environmental protection procedures; Level 3; 6 Credits.

- Core; ID 12456; Explain and use organisational procedures; Level 3; 6 Credits.
- Core; ID 116714; Lead a team, plan, allocate and assess their work; Level 3; 4 Credits.
- Core; ID 14492; Read and interpret piping drawings; Level 3; 4 Credits.
- Core; ID 14713; Use welding definitions and symbols; Level 2; 5 Credits.
- Core; ID 253577; Maintain pipe systems and pipe components; Level 3; 15 Credits.
- Fundamental; ID 119457; Interpret and use information from texts; Level 3; 5 Credits.

• Fundamental; ID 9012; Investigate life and work related problems using data and probabilities; Level 3; 5 Credits.

3. Solve familiar problems during the maintenance of pipe systems. Category; ID; Title; Level; Credits:

• Core; ID 13223; Apply safety, health and environmental protection procedures; Level 3; 6 Credits.

- Core; ID 12456; Explain and use organisational procedures; Level 3; 6 Credits.
- Core; ID 253577; Maintain pipe systems and pipe components; Level 3; 15 Credits.
- Core; ID C.NEW; Perform pipe fabrication calculations; Level 3; 5 Credits.
- Core; ID 9528; Communicate with clients; Level 3; 3 Credits.

• Core; ID 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 Credits.

• Core; ID 9013; Describe, apply, analyse and calculate shape and motion in 2-and 3dimensional space in different contexts; Level 3; 4 Credits.

• Fundamental; ID 9012; Investigate life and work related problems using data and probabilities; Level 3; 5 Credits.

4. Communicate with peers, production, quality control, supervisory personnel and/or clients. Category; ID; Title; Level; Credits:

• Core; ID 13223; Apply safety, health and environmental protection procedures; Level 3; 6 Credits.

- Core; ID 12456; Explain and use organisational procedures; Level 3; 6 Credits.
- Core; ID 9528; Communicate with clients; Level 3; 3 Credits.

• Core; ID 12488; Complete feasibility and commissioning reports; Level 3; 3 Credits.

• Fundamental; ID 119457; Interpret and use information from texts; Level 3; 5 Credits.

INTERNATIONAL COMPARABILITY

1. Introduction:

1.1 The USA Pipe-Fitter Qualification has been chosen as the primary benchmark for the development of this qualification series. The American Qualification has worldwide recognition, and dominates the international standard. This is largely due to the leadership role played by the USA in process control within the Oil and Gas Industry. American influences are evident in pipe fitter training programs in the following countries, namely, in the Middle East (Saudi Arabia, Kuwait, etc.); Malaysia, Singapore, Nigeria, Indonesian Offshore and the North Sea (predominantly British, French and Dutch). Further investigation on the local scene, has revealed that Fluor (an American affiliate organization), based at Sasol Secunda in South Africa, replicates the American learning program for their pipe fitter personnel.

1.2 In addition to this fact, reference to other pipe-fitting qualifications across the globe are also contextualized across a multitude of different environments, namely:

 Process control environment (Refineries/Food Processing/Flow Systems). Please note that domestic flow systems are positioned within a current plumbing qualification series. Marine Source: National Learners' Records Database
 Qualification 59750
 07/02/2008 plumbing (Sea-going Vessels), is placed within this Pipe-Fitter Qualification through the provision of a "learning programme" for the Manufacturing, Engineering and Related Industries.
Automation (Fluid Power) - provision is made within the NC and FETC: Fluid Power NQF Level 2 - 4.

• HVAC - Heating, Ventilation and Air-conditioning - provision is made within the NC and FETC: Air-conditioning, Refrigeration and Ventilation and Gas Installation Qualifications NQF Level 2 -4.

1.3 When researching qualifications dealing with pipe work in the Northern Hemisphere's "cold countries", examples, England, Scotland, Canada and Germany, overlaps were found, which produces a crossover influence between heating (gas and/or steam), plumbing and ventilation in singular qualifications. This need to integrate occupational contexts (HVAC, Gas Installation and Domestic Plumbing), is due to extreme cold climate conditions within the aforementioned countries. The same does not apply in the South African context. The recent development of Gas Installation Qualifications in South Africa is noted. It is commonly agreed that the Pipe-Fitting competencies contained within this qualification series differs through its environment and climatic context.

1.4 The statement of international comparability for Mechanical Engineering (Pipe-Fitting) is separated for NQF Level 2, 3 and 4 as though they are independent levels, although the Pipe-Fitter NQF 4, should be regarded as the sum of all competencies between NQF Level 2 - 4.

1.5 This investigation into international comparability has included Apprenticeship Programs in USA, Canada, Australia and Botswana and other "less appropriate" countries.

Countries using outcomes- and standards-based qualifications appear to differ in occupational contexts as a result of the abovementioned climate factor but have been included in this comparative statement.

The major contributor to the global standard on Pipe-Fitting is the USA.

The context of this Qualification is therefore, "process/flow-control" within a largely industrial or manufacturing and engineering environment.

- 2. Countries and qualifications investigated:
- 2.1 United States:

In the United States model, the "Pipe Fitter" qualification is achieved over a four-year period and is similar to the traditional apprenticeship system in South Africa. The methodology is competency-based as opposed to outcomes-based.

The programme content however, is similar to the broad context of Mechanical Engineering (Pipe Fitting) Levels 2, 3 and 4.

Level 3:

 Advanced Blueprint Reading - Standards and Specifications - Advanced Trade Math -Motorized Equipment - Introduction to Above-Ground Pipe Installation - Identifying and Installing Valves - Field Routing and Vessel Trim - Spring Can Supports - Testing Piping Systems and Equipment - Basic Plumbing.

Conclusion: The Mechanical Engineering (Pipe-Fitting) NQF Level 3 is in line with the US example for year 2/3 of the apprenticeship programme.

2.2 United Kingdom (England and Scotland) - from www.ecitb.org.uk:

Source: National Learners' Records Database

Qualification 59750

216 No. 30788

The qualification from the National Vocational Qualifications (NVQ) which relates to standardsbased programme is the NVQ Pipe Fitter Apprenticeship - The "Pipe Fitting" strand at NVQ Level 3 is usually completed within a workplace context, with monitoring and assessments performed by a training officer).

The NC Mechanical Engineering (Pipe Fitting) Level 3 is not in alignment with the NVQF owing to the differences in level description. However, the South African NC Mechanical Engineering (Pipe Fitting) Level 3 appears to straddle the NVQ (Pipe Fitter) between Levels 2 and 3. Typical on-the-job competencies are listed at Level 2 (South African Level3) below:

- CO1 Contribute to effective working relationships.
- CO2 Work safely, minimize and comply with emergency procedures.
- CO3 Identify and deal with hazards in the work environment.
- IPS Pipe 1 Shape pipe-work components by material removal using hand tools.
- IPS Pipe 2 Assemble pipe-work components to meet specification.
- IPS Pipe 3 Position and install pipe-work.
- IPS Pipe 4 Mark out to the required specification.
- IPS Pipe 5 Establish compliance of an engineering installation with the specification.
- IPS Pipe 6 Prepare work areas for the installation of pipe-work.
- IPS Pipe 7 Prepare materials required for pipe-work installation.
- IPS Pipe 8 Prepare equipment for pipe-work installation.
- IPS Pipe 9 Reinstate the work area after completing the installation of pipe-work.
- IPS Pipe 10 Store pipe-work installation related resources for further use.
- IPS Pipe 11 Test the performance and condition on installed pipe-work.
- IPS Pipe 12 Shape pipe-work components by manually applied pressure.

2.3 Australia (www.ntis.gov.au) in terms of the Australian Quality Training Framework (AQTF):

The following information was obtained on the website: http://www.ntis.au (National Information Training System) with regards to qualifications in "Pipe Fitter" training streams in Australia.

The qualifications investigated for "Pipe Fitters" are only covered within the apprenticeship format.

• "Australian Apprenticeships" is the new name for the scheme formerly known as 'New Apprenticeships'.

• Australian Apprenticeships encompass all apprenticeships and traineeships. They combine time at work with training and can be full-time, part-time or school-based.

Several unit standards overlap the Plumbing, Gas Fitting Steam-Fitting and Pipe Fitting qualifications in making up the Pipe Fitting skills area, namely:

- Carry out simple forms of concreting associated with plumbing work.
- Collect and store roof water.
- Commission air and water systems.
- Conduct pipe layer operations.
- Construct hose/pipe assemblies for competition vehicles.
- Construct hose/pipe.
- Fabricate and install non-ferrous pressure piping assemblies for competition vehicles.
- Fabricate and install steel pressure piping.
- Install and fit off sanitary fixtures.
- Install discharge pipes.
- Install distribution and range pipes.
- Install gas piping systems.

Source: National Learners' Records Database

07/02/2008

- Install gas pressure control equipment.
- Install LP gas storage of aggregate storage capacity up to 500 litres.
- Install product pipe.
- Install small bore heating systems.

From the unit standards above, we assume that there is no coherent similarity with the South African qualification.

2.4 African Comparability:

Southern African Development Community (SADC) - Zimbabwe and Botswana:

• Alignment with the United Kingdom's model of Vocational Education and Training (VET), through the London City and Guilds qualification framework and the National Vocational Qualification system (NVQ).

• The Botswana National Qualifications Act was passed in 1998. At this present time, focus on the development of standards-based qualifications through a Botswana Vocation Education and Training System (BVET) has revolved around the Wholesale and Retail and Tourism sectors.

Currently, pipe fitters in Botswana are trained through the apprenticeship system with one single trade test centre where apprentices are able to receive a certificate of qualification (Red Seal). The length and duration of the practical and theoretical components differ slightly to the South African apprenticeship system, but the learning competencies are similar, with a focus on the predominant diamond mining and small local manufacturing and engineering industries.

East African Community (EAC):

The three member states of the EAC; Kenya, Tanzania and Uganda, are in the process of the harmonisation of education and training systems within the EAC. Currently, no qualification infrastructure exists.

2.5 Canada (www.gov.mb.ca):

Information regarding training was also found on the website of the Manitoba Provincial Government in Canada. The full "Pipe-Fitter" qualification is obtained over a four-year period. The "job description" of the "Pipe-Fitter" overlaps with "Steam Fitter" and "Pipe Fitter", as is the case in all the Commonwealth countries investigated. This is due to the prevalence of steam systems used predominantly for climate control systems (domestic and industrial).

Despite this, "Pipe-Fitters" at certificate level 3 are able to carry out functions, similar to their South African counterparts, as quoted by:

• Read and interpret blueprints, codes, drawings and specifications to determine the type and size of pipe and tools to use.

- Make detailed sketches for pipe and equipment fabrication and installation.
- Fabricate, lay out and assemble fittings, spools and supports.

• Measure, cut, shape, thread, groove, bend and join pipes and related equipment such as valves and fittings.

- Install equipment, supports, pipes, tubes, controls and accessories.
- If necessary, modify structures to accommodate the pipes.

Conclusion: The Canadian qualifications related to Mechanical Engineering (Pipe-Fitting) can be used interchangeably with the qualifications developed for the various South African industry sectors, serving a similar purpose.

Qualification 59750

218 No. 30788

2.6 New Zealand (www.kiwiquals.govt.nz) in terms of the New Zealand Qualifications Framework (NZQF):

Investigation into a New Zealand equivalent "Pipe Fitting" qualification indicated that a standalone qualification does not exist in this country. Similarities with its South African counterpart are found from the range of qualifications listed below in which individual unit standards make up the competencies separately, but not as a whole.

- Certificate in Applied Mechanical Engineering Level 3.
- National Certificate in Engineering (General Engineering Mechanical) Level 3.
- National Certificate in Engineering: Fabrication Level 3.
- National Certificate in Manufacturing and Mechanical Engineering Level 3.
- Summary of comparisons with NC Mechanical Engineering (Pipe Fitting) Level 3:

3.1 Content:

The qualifications from the various countries all address the range of mechanical engineering competencies included in Level 3, thus attending to the need to fulfil the requirements of being intermediately of nature.

3.2 Progression:

The international qualifications all address a progression of competencies, from the basic functions (Level 2), to:

Level 3:

- Advanced Blueprint Reading.
- Standards and Specifications.
- Advanced Trade Math.
- Motorized Equipment.
- Introduction to Above-Ground Pipe Installation.
- Identifying and Installing Valves.
- Field Routing and Vessel Trim.
- Spring Can Supports.
- Testing Piping Systems and Equipment.
- Basic Plumbing.

3.3 The content:

The content of the second/third year of a typical mechanical Pipe Fitting programme in Australian, Canadian, American, British and Botswana, relates favourably to the content of Mechanical Engineering (Pipe Fitting) Level 3:

3.4 Demonstration of work practices:

Investigation into international comparability produces overarching similarities in the outcomes of the various pipe fitter training programmes in all the countries above. They are:

3.5 L3 outcomes within the South African qualification:

- Apply safety, health and environmental protection procedures.
- Explain and use organisational procedures.

• Lead a team, plan, allocate and assess their work Identify, interpret and produce working piping drawings.

- Use welding definitions and symbols.
- Cut material using the oxy-fuel pipe cutting device.
- Cut materials using plasma cutting Maintain pipe systems and pipe components.
- Produce a welded pipe fabrication assembly using butt and socket fittings.
- Perform piping offset calculations.

Conclusion: The above outcomes are mostly replicated word-wide (in part or as a whole).

3.6 Learning delivery:

The learning delivery process in all the examples included on-the-job (practical) and off-the-job (theoretical) components and predominantly using an apprenticeship format (Traditional or in the "Modern Apprenticeship format).

3.7 Outcomes-Based Methodology:

All the examples found either directly or indirectly comply with principles of outcomes-based learning, particularly in terms of outcomes representing meaningful units of learning and assessment being conducted continuously (formatively). There is generally a final integrated summative assessment, typically called a certificate of qualification (trade test), where the candidate is required to demonstrate specific and core (cross-field) knowledge and skills.

3.8 Apprenticeships and VET programmes:

In all the examples found, learning is vocational-based. In some countries (England, Scotland, New Zealand and Australia) these are called "modern apprenticeships". These take the form of two categories, namely a programme-led apprenticeship where learners are able to follow a vocational programme at a college and then seek employment as trainees/apprentice/interns in order to qualify as artisans; and an employer-led apprenticeship, in which learners are engaged in a formal contract of learning and most learning is workplace-based. In most cases learners "earn while they learn".

3.9 Application (Purpose):

As is the intention with the South African qualifications, the international qualifications all prepare learners for pipe fitting across a wide variety of industry sectors.

4. Concluding remarks:

The Level 3 certificate developed for South Africa compares favourably with the international qualifications mentioned above, with its closest relationship being with the American version (The Construction Education Foundation of North Texas-www.ntcef.org).

5. Reference documents:

5.1 Availability of skilled labour in selected occupations in Western Australia (Shah. Cooney, Long and Burke: 2005).

5.2 National Guidelines on Cross-Sectoral Qualification Linkages (Australian Qualifications Framework (AQF) Implementation Handbook: 2002).

5.3 Policy Watch-Apprenticeship framework: A Change in Design (Sian Owen: 2005; Authorised by Steve Besley-UK).

5.4 Training in Engineering Construction Skills-Employers Guide (TECSkills and the ECITB-UK: 2007).

5.5 Modern Apprenticeships-The Way to Work (Cassels Report: 2001)-UK.

Source: National Learners' Records Database

Qualification 59750

Page 13

5.6 Role of Apprenticeship in VET System: The Case of Botswana (Ahmad:2003) at Conference on the Reform of Technical and Vocational Education and Training (TVET) Gaborone, Botswana.

5.7 Challenges facing VET transformation in the SADC region (Akoojee and McGrath: 2003 HSRC - Pretoria) at Conference on the Reform of Technical and Vocational Education and Training (TVET) Gaborone, Botswana.

6. Reference Web-sites:

- www.ecitb.org.za
- www.ntis.gov.au
- www.bota.org.bw
- www.kiwiquals.govt.nz
- www.bcit.ca www.nait.ca
- www.cotr.bc.ca
- www.edexcel.co.uk
- www.tullontraining.co.uk
- www.doleta.com
- www.tecskills.org.za
- www.ntcef.org

ARTICULATION OPTIONS

The qualification was designed to enable qualifying learners to move from one engineering context to another and still get recognition for successful learning achievements in the previous context. This means that credit accumulation towards certification could be obtained across industries.

Vertical articulation:

• FETC: Mechanical Engineering (Pipe-Fitting) NQF 4.

Horizontal articulation:

Fundamental learning at this level applies to equivalent credit accrual for most engineering qualifications at NQF Level 3.

Core learning at this level applies to equivalent credit accrual for some unit standards in the following examples of articulation:

- (ID: 58720); NC: Engineering Fabrication NQF Level 3.
- (ID: 23274); NC: Mechanical Engineering (Fitting) NQF Level 3.
- (ID: 57886); NC: Welding Application and Practice NQF Level 3.

Other horizontal articulation options may exist and need further investigation in cases where recognition of prior learning is sought.

MODERATION OPTIONS

• Anyone assessing a learner or moderating the assessment of a learner against this Qualification must be registered with an appropriate Education and Training Quality Assurance Body (ETQA) or with an ETQA which has a Memorandum of Understanding (MOU) with the relevant ETQA.

• Any institution offering learning that will enable the achievement of this qualification must be accredited as a Training Provider with the relevant ETQA or with an ETQA that has a Memorandum of Understanding (MOU) with the relevant ETQA.

 Moderation of assessment will be overseen by the relevant ETQA or by an ETQA that has a Memorandum of Understanding (MOU) with the relevant ETQA according to that ETQA's guidelines for assessment and moderation.

 Moderation includes both internal and external moderation of assessment/s at the exit points of the gualification, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described both in individual unit standards as well as in exit level outcomes described in this Qualification.

CRITERIA FOR THE REGISTRATION OF ASSESSORS

The following criteria should be applied by a relevant ETQA as a minimum requirement:

Assessors should be in possession of an appropriate gualification, namely:

o Mechanical Engineering (Pipe-Fitting) at NQF level 4 and a minimum period of related experience as specified by the relevant ETQA.

 An artisan gualification in Pipe-Fitting or similar trade-related gualification (Trade test certificate or completed contract of apprenticeship) with a minimum period of related experience as specified by the relevant ETQA.

• Subject matter experience, which may be established through recognition of prior learning (RPL).

- Registration as an assessor with the relevant Education and Training Quality Assurance Body.
- Proven inter-personal skills and the ability to:
- o Maintain national and local industry standards.
- Act in the interest of the learner.
- Understand the need for transformation to redress the legacies of the past.
- Respect the cultural background and language of the learner.

NOTES

This qualification follows on as the second part (Level 3) of the Mechanical Engineering (Pipe Fitting) gualification series towards the Further Education and Training Certificate. Its progression is tracked along the following learning pathway:

 National Certificate: Mechanical Engineering (Fitting) NQF Level 2 with a specialised elective strand for Pipe Fitting.

National Certificate: Mechanical Engineering (Pipe-Fitting) NQF Level 3.

 Further Education and Training Certificate: Mechanical Engineering (Pipe-Fitting) NQF Level 4.

	ID	UNIT STANDARI	D TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audier communication	ice and context needs in oral/signed	Level 3	5
Fundamental	9010	Demonstrate an unde number bases and mo of error in the context	erstanding of the use of different easurement units and an awarenes of relevant calculations	Level 3 s	2
Fundamental	9013	Describe, apply, analy in 2-and 3-dimension	yse and calculate shape and motion al space in different contexts	Level 3	4
Fundamental	119457	Interpret and use info	rmation from texts	Level 3	5
Fundamental	9012	Investigate life and we probabilities	ork related problems using data and	Level 3	5
Fundamental	119467	Use language and con learning programmes	mmunication in occupational	Level 3	5
Fundamental	7456	Use mathematics to in aspects of personal, to	nvestigate and monitor the financial pusiness and national issues	Level 3	5
Source: National L	earners' Records	Database	Qualification 59750	07/02/2008	Page 15

UNIT STANDARDS

National Learners' Records Database

a an		UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Core	253736	Use welding definitions and symbols	Level 2	5
Core	13223	Apply safety, health and environmental protection procedures	Level 3	6
Core	243077	Cut material using the oxy-fuel pipe cutting device	Level 3	3
Core	12456	Explain and use organisational procedures	Level 3	6
Core	116714	Lead a team, plan, allocate and assess their work	Level 3	4
Core	253577	Maintain pipe systems and pipe components	Level 3	12
Core	253588	Perform piping off-set calculations	Level 3	5
Core	253558	Produce a welded pipe fabrication assembly using butt and socket fittings	Level 3	12
Core	253556	Read and interpret working piping drawings	Level 3	4
Core	253734	Cut materials using plasma cutting	Level 4	4
Elective	243061	Assemble work pieces in jigs (minor amendments include the use of manipulators)	Level 2	3
Elective	254357	Bend a pipe by means of a hydraulic pipe bender	Level 2	2
Elective	244077	Demonstrate understanding of chemicals in a processing environment	Level 2	6
Elective	243063	Weld carbon steel work-pieces using the shielded metal arc welding process in the down-hand position.	Level 2	15
Elective	12246	Assemble and mechanically join sheet, plate, tube, pipe and steel sections	Level 3	4
Elective	253574	Bevel a pipe using a mechanised pipe bevelling machine	Level 3	4
Elective	9532	Demonstrate basic knowledge of computers	Level 3	6
Elective	243086	Draw and interpret complex plate, pipe and structural steel plate, pipe and structural steel drawings	Level 3	6
Elective	253737	Gouge material with air-carbon-arc gouging process	Level 3	10
Elective	253430	Maintain filters and strainers	Level 3	4
Elective	253434	Maintain heat exchangers and pressure vessels	Level 3	8
Elective	253599	Maintain steam traps	Level 3	4
Elective	253439	Maintain valves	Level 3	8
Elective	9530	Manage work time effectively	Level 3	3
Elective	243078	Perform destructive testing on welded specimens	Level 3	5
Elective	243068	Weld carbon steel workpieces using the gas tungsten arc welding process in the downhand position	Level 3	15
Elective	253634	Identify and apply insulation methods and materials for pipes and pipe systems	Level 4	8

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION None

ı



QUALIFICATION:

Further Education and Training Certificate: Mechanical Engineering: Pipe-Fitting

SAQA QUAL ID	QUALIFICATION TITLE			
59769	Further Education and T	raining Certificate: Mecha	anical Engineering:	
	Pipe-Fitting	• 		
ORIGINATOR		PROVIDER		
SGB Generic Manufacturing, Engineering &				
Technolog				
QUALIFICATION TYPE	FIELD SUBFIELD			
Further Ed and Training	6 - Manufacturing,	Engineering and Relat	ted Design	
Cert	Engineering and		-	
	Technology			
ABET BAND	MINIMUM CREDITS	NQF LEVEL	QUAL CLASS	
Undefined	123	Level 4	Regular-Unit Stds	
			Based	

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

PURPOSE AND RATIONALE OF THE QUALIFICATION

Purpose:

The purpose of the qualification is to provide learners with the standards and the range of learning required to work effectively in various industry sectors, making use of pipe-fitting and mechanical engineering skills in order to fit and produce pipe systems and pipe components.

Qualifying learners at NQF Level 4 will therefore be able to work as skilled artisans ("pipefitters") in an industrial plant or manufacturing and engineering environment. It must also be noted however, that an additional licensing requirement may be required by the relevant Education and Training Quality Assurance Body or industry sector in order to gain artisan status.

In this qualification the knowledge, skills and values in order to display competency (applied competence) is recognised by showing the ability to:

• Understand specialised pipe-fitting principles and concepts including the interpretation of detailed work instructions, in order to fabricate, fit, test and commission pipe systems.

• Supervise/perform pipe system installations using a reference framework which includes the view of the operating environment as a system within a wider context.

• Demonstrate integrated organisational skills in order to manage personnel in the supervision of pipe fitting and fabrication tasks.

• Apply and carry out actions by interpreting information from drawings, text and operational symbols or representations.

• Use knowledge of the broader mechanical engineering (pipe-fitting) field of expertise to solve common problems within a familiar context, making adjustments or small changes to the application of common solutions within known parameters.

Qualifying learners will also demonstrate autonomy in learning through:

• Taking responsibility for their own learning within a supervised environment by planning, scheduling and evaluating own work according to given criteria.

• Interacting with and developing, the capacity of team members to maintain and support legislative, regulatory, quality, safety and health systems.

• Taking the initiative by addressing problems arising from supervising the fitting, fabrication, installation, testing and/or commissioning of pipe systems.

Typical entrants to this qualification could be:

• Learners who have completed the Level 3 qualification and who intend establishing a career as pipe-fitter artisans. While work experience after achieving the Level 3 qualification may be advisable, this is not necessarily a requirement.

• Individuals who have recently worked in a relevant occupational context, who have acquired pipe-fitting skills deemed to be the exit-level equivalent of the National Certificate: Mechanical Engineering (Pipe-fitting) Level 3 and who have the potential to complete this qualification successfully (RPL candidates).

Rationale:

The field of Mechanical Engineering (Pipe-fitting) is characterised by the provision of engineering maintenance, repair, fabrication, assembly and installation services and support across a wide variety of industry sectors, namely:

• Manufacturing and Engineering (Metals, Plastics, Tyre and Rubber, Electrical Power Generation, Automotive Manufacturing).

- Chemical and Petrochemical.
- Transport (Maritime, Road, Rail and Aviation).
- Civil Engineering and Construction.
- Food and Beverages.
- Other engineering-related industry sectors.

The equipment requiring services and support include, but not be limited to pipe-systems on sea-going vessels to large petrochemical refineries and fertiliser plant.

Learners at NQF Level 4, who perform pipe-fitting activities, require:

- Highly developed mechanical orientation with associated hand skills.
- Specialised technical skills (analytical and diagnostic).
- Communication skills.
- Team and leadership skills.

• Technology orientation in various contexts (example. mechanical, process control systems, instrumentation).

Qualifying learners will obtain a Further Education Certificate in Mechanical Engineering (Pipefitting). This qualification focuses on developing the skills, knowledge and values necessary to complete the range of competencies required in pipe fitting and fabrication, as a skilled worker.

The qualification also provides:

• Opportunities for further learning in the field of Mechanical Engineering.

• Recognition of prior learning (RPL) opportunities to learners who have gained relevant experience in the workplace.

RECOGNIZE PREVIOUS LEARNING?

Y

Qualification 59769

LEARNING ASSUMED IN PLACE

The following competencies are assumed for a learner embarking on this qualification:

- Communication and Literacy, NQF Level 3.
- Mathematical Literacy, NQF Level 3.

In addition, learners are assumed to have the following skills at NQF Level 3 in the context of pipe-fitting:

Maintain, remove and install pipe assemblies.

- Fabricate and install pipe systems and pipe system components.
- Solve familiar problems during the maintenance of pipe systems
- Communicate with peers, production, quality control and supervisory personnel.

These skills form the basis for determining the credit allocation in this qualification. These skills may be acquired through the National Certificate: Mechanical Engineering (Pipe-Fitting) NQF Level 3.

Recognition of Prior Learning:

This qualification may be obtained through a process of RPL. The learner should be thoroughly briefed prior to the assessment and support should be provided to assist the learner in the process of developing a portfolio. The guidelines for integrated assessment should be used to develop the RPL assessment process. Evidence from other occupational experiences may be introduced, providing that such experiences can be contextualised according to the Exit Level Outcomes of this qualification.

Access to the qualification:

Access to this qualification is open. Ideally, individuals who intend commencing this qualification should:

- Have completed a National Certificate in Mechanical Engineering (Pipe-Fitting) NQF Level 3.
- Have completed an equivalent qualification.
- Apply for Recognition of Prior Learning.

QUALIFICATION RULES

Fundamental Component: The Fundamental Component consists of Unit Standards in:

- Communications at NQF Level 4 to the value of 46 credits.
- Mathematical Literacy at NQF Level 4, to the value of 10 credits.
- All Unit Standards in the Fundamental Component are compulsory.

Core Component:

The Core Component consists of Unit Standards to the value of 51 credits all of which are compulsory.

Elective Component:

The Elective Component consists of a number of specializations each with its own set of Unit Standards. Learners are to choose a specialization area and must choose Elective Unit Standards to the value of 16 credits from the Elective Unit standards listed under that specialization so as to attain a minimum of 123 credits for this gualification.

Learning Program:

Source: National Learners' Records Database

Qualification 59769

07/02/2008

226 No. 30788

Specialisation Area 1:

• Pipe-Fitting (Manufacturing and Engineering Industry).

Learners must choose Elective Unit Standards from the list below to give a minimum of 16 credits for the Elective Component:

Category; ID; Unit Standard Title; Level; Credits:

• Elective; ID 14474; Plan and schedule workflow; Level 4; 3 Credits.

• Elective; ID 13260; Perform non-destructive tests on metal parts and components; Level 3; 6 Credits.

- Elective; ID 114194; Demonstrate understanding of regulations codes and drawing office practices for structural steel detailing; Level 4; 7 Credits.
- Elective; ID 14473; Develop and produce computer aided drawings; Level 4; 4 Credits.
- Elective; ID 12252; Develop and fabricate from complex drawings; Level 4; 28 Credits.

Total: 48 Credits.

Learning Program:

Specialisation area 2:

• Pipe-Fitting (Chemical Industry).

Learners must do Unit Standard ID 14783 and must choose additional Elective Unit Standards from the list below to give a minimum of 16 credits for the Elective Component:

Category; ID; Unit Standard Title; Level; Credits:

• Elective; ID 14783; Conform to and apply legislation and operational instructions in chemical processing; Level 3; 4 Credits.

- Elective; ID 14474; Plan and schedule workflow; Level 4; 3 Credits.
- Elective; ID 13329; Stopple operational pipelines; Level 4; 4 Credits.

• Elective; ID 13260; Perform non-destructive tests on metal parts and components; Level 3; 6 Credits.

• Elective; ID 114194; Demonstrate understanding of regulations codes and drawing office practices for structural steel detailing; Level 4; 7 Credits.

- Elective; ID 119328; Perform and coordinate a pipeline network start-up; Level 4; 20 Credits.
- Elective; ID 119327; Perform and coordinate a pipeline network shut-down; Level 4; 12 Credits.
- Elective; ID 253434; Maintain heat exchangers and pressure vessels; Level 3; 8 Credits.
- Elective; ID 253439; Maintain valves; Level 3; 8 Credits.
- Elective; ID 253599; Maintain Steam Traps; Level 3; 4 Credits.
- Elective; ID 253423; Maintain motorised valves; Level 3; 4 Credits.

Total: 77 Credits.

EXIT LEVEL OUTCOMES

1. Fabricate advanced welded pipe assemblies and pipe systems.

2. Plan and schedule pipe-fitting work.

3. Solve a variety of problems, both familiar and unfamiliar, within a maintenance and installation context.

Qualification 59769

4. Demonstrate leadership through effective interaction and communication with clients, peers and members of supervisory and management levels.

Critical Cross-Field Outcomes:

These are embedded in the unit standards, which make up the qualification and are thus also reflected in the Exit Level Outcomes of the qualification.

The critical cross-field outcomes are supported by the exit level outcomes as follows:

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

- Related to the fabrication of advanced welded assemblies.
- Planning and scheduling of work.
- Solving problems during the fitting and fabrication process.

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

• All tasks and work-related experience are performed within a team environment as leader or supervisor.

- Taking into account, the safety of others.
- Communicating with production, quality control and supervisory personnel and/or clients.

Organising and managing oneself and one's activities responsibly and effectively.

- Related to planning and preparation during the fabrication and fitting of pipes.
- Organising and managing oneself through the performance of administrative tasks.
- Perform job activities in a leadership role.

Collecting, analyzing, organizing and critically evaluating information.

- Related to planning and preparation during the fabrication and fitting of pipes.
- Completion of technical reports related to the job activity.
- Solve familiar problems during the fabrication, fitting and installation of pipe systems.

Communicating effectively using visual, mathematical and/or language skills.

• Related to planning, preparation and execution of job activities during the maintenance, fabrication, fitting and installation of pipes.

- Completion of technical reports related to the job activity.
- Communicating in a leadership role.

Using science and technology effectively and critically, showing responsibility toward the environment and health of others.

- During the fabrication and installation process.
- Relating to the safety of others.
- Solving problems and the application of science and technology in pipe-fitting.

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

• Integrating fabrication, fitting, installation and maintenance with the plant installation's overall design and by understanding the alignment with the plant processes.

• Solving problems through the integration of various sources of information.

• Demonstrating and understanding of related systems through the use of general and specific channels of communication when dealing with peers, production, quality control and supervisory personnel and/or clients.

• Combining applied and practical competence.

ASSOCIATED ASSESSMENT CRITERIA

Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Welded pipe assemblies are fabricated and the procedure is explained and demonstrated in terms of worksite practice and manufacturers' prescribed guidelines and specifications.

1.2 Calculations during the fabrication process are based on a clear evaluation of information gathered through worksite operating procedures and pipe drawings.

1.3 Procedures are modified to respond to specific environmental conditions, with specific reference to safety and quality.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Planning and scheduling of own work is demonstrated in terms of productivity, safety, health and the environment.

2.2 Work flow is explained and demonstrated, based on job information, in terms of standard worksite practices.

2.3 Production and maintenance personnel are consulted and downtime on the plant is minimised.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Solutions to maintenance problems are based on a clear analysis of information gathered through faultfinding procedures on the pipe system components, with specific adherence to safety standards.

3.2 Procedures are modified to respond to unfamiliar problems where appropriate in terms of standard operating procedures, with an understanding of the pipe system's operation.

3.3 Questions are answered and issues are discussed related to familiar and unfamiliar problems by demonstrating a logical sequence to faultfinding.

3.4 All actions related to problem solving are accurately recorded for future reference in terms of worksite procedures and adherence to regulatory practices.

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 Relationships with peers, supervisors and management are established and leadership is demonstrated by assertive communication and behaviour within the workplace.

4.2 Technical information is communicated using written reports in terms of workplace documentation by reporting on pipe system data.

4.3 Learning opportunities and preparation requirements are identified in terms of continued learning.

Integrated Assessment:

• Assessment practices must be open transparent fair valid and reliable and should ensure that no learner is disadvantaged in any way whatsoever, so that an integrated approach to assessment is incorporated into the qualification.

• Learning teaching and assessment are inextricably interwoven. Whenever possible the assessment knowledge skills attitudes and values shown in the unit standards should be integrated.

• Assessment of Communication and Mathematical Literacy should be integrated as far as possible with other aspects and should use practical administration contexts wherever possible. A variety of methods must be used in assessment and tools and activities must be appropriate

Source: National Learners' Records Database

07/02/2008

to the context in which the learner is working or will work. Where it is not possible to assess the learner in the workplace or on-the-job, 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. During integrated assessments, the assessor should make use of a range of summative assessment methods and assess combinations of practical, applied, foundational and reflective competencies.

• Assessors must assess and give credit for the evidence of learning that has already been acquired and could include formal, non-formal learning and work experience.

• Assessment should ensure that all specific outcomes, embedded knowledge and critical cross-field outcomes are evaluated in an integrated manner.

• Integrated assessment instruments may combine practical and theoretical components of assessment with the following unit standards in relation to the exit level outcomes.

Guide to Integrated Assessment:

Exit Level Outcomes and Associated Unit Standards:

1. Fabricate advanced welded pipe assemblies and pipe systems according to pipe drawings and industry standards.

Category; ID; Title; Level; Credits:

• Core; ID 10981; Supervise work unit to achieve work unit objectives (individuals and teams); Level 4; 12 Credits.

• Core; ID 13224; Monitor the application of safety, health and environmental protection procedures; Level 4; 4 Credits.

• Core; ID M.REREG; Identify, interpret and produce working pipe drawings; Level 5; 6 Credits.

• Core; ID 253558; Produce advanced welded pipe-fabrication assemblies; Level 4; 15 Credits.

• Core; ID 13234; Apply quality procedures; Level 3; 8 Credits.

• Fundamental; ID 9016; Represent analyse and calculate shape and motion in 2-and 3dimensional space in different contexts; Level 4; 4 Credits.

• Fundamental; ID 119467; Use language and communication in occupational learning programmes; Level 3; 5 Credits.

• Fundamental; ID 119465; Write/present/sign for a wide range of communicative contexts; Level 3; 5 Credits.

2. Plan and schedule work by evaluating production and maintenance requirements in terms of productivity, safety, health and the environment.

Category; ID; Title; Level; Credits:

• Core; ID 10981; Supervise work unit to achieve work unit objectives (individuals and teams); Level 4; 12 Credits.

• Core; ID (M.REREG); Identify, interpret and produce working pipe drawings; Level 5; 6 Credits.

- Core; ID 253558; Produce advanced welded pipe-fabrication assemblies; Level 4; 15 Credits.
- Core; ID 13234; Apply quality procedures; Level 3; 8 Credits.

• Fundamental; ID 119462; Engage in sustained oral/signed communication and evaluate spoken/signed texts; Level 4; 5 Credits.

• Fundamental; ID 9016; Represent analyse and calculate shape and motion in 2-and 3dimensional space in different contexts; Level 4; 4 Credits.

• Fundamental; ID 119467; Use language and communication in occupational learning programmes; Level 3; 5 Credits.

• Fundamental; ID 119465; Write/present/sign for a wide range of communicative contexts; Level 3; 5 Credits.

230 No. 30788

3. Solve a variety of problems, both familiar and unfamiliar, within a maintenance and installation context, by applying mechanical, process and flow control theory and the ability to read and interpret detailed pipe drawings.

Category; ID; Title; Level; Credits:

• Core; ID 13224; Monitor the application of safety, health and environmental protection procedures; Level 4; 4 Credits.

• Core; ID 253587; Perform hydro-static pressure testing procedures on pipes and pipe systems; Level 4; 6 Credits.

• Core; ID 253558; Produce advanced welded pipe-fabrication assemblies; Level 4; 15 Credits.

• Core; ID 13234; Apply quality procedures; Level 3; 8 Credits.

• Fundamental; ID 119457; Interpret and use information from texts; Level 3; 5 Credits.

• Fundamental; ID 119469; Read/view, analyse and respond to a variety of texts; Level 4; 5 Credits.

• Fundamental; ID 9016; Represent analyse and calculate shape and motion in 2-and 3dimensional space in different contexts; Level 4; 4 Credits.

• Fundamental; ID 119467; Use language and communication in occupational learning programmes; Level 3; 5 Credits.

4. Demonstrate leadership through effective interaction and communication with clients, peers and members of supervisory and management levels.

Category; ID; Title; Level; Credits:

• Core; ID 10981; Supervise work unit to achieve work unit objectives (individuals and teams) ; Level 4; 12 Credits.

• Core; ID 253587; Perform hydro-static pressure testing procedures on pipes and pipe systems; Level 4; 6 Credits.

• Fundamental; ID 119457; Interpret and use information from texts; Level 3; 5 Credits.

• Fundamental; ID 119462; Engage in sustained oral/signed communication and evaluate spoken/signed texts; Level 4; 5 Credits.

• Fundamental; ID 119469; Read/view, analyse and respond to a variety of texts; Level 4; 5 Credits.

• Fundamental; ID 119467; Use language and communication in occupational learning programmes; Level 3; 5 Credits.

• Fundamental; ID 119465; Write/present/sign for a wide range of communicative contexts; Level 3; 5 Credits.

INTERNATIONAL COMPARABILITY

1. Qualifications investigated and countries of origin:

1.1 United States (Oregon; Chicago; Washington, North Texas) - www.bat.gov.com; www.workforcedevelopment.com:

The USA Pipe-Fitter Qualification has been chosen as the primary benchmark for the development of this qualification series. The American Qualification has worldwide recognition, and dominates the international standard. This is largely due to the leadership role played by the USA in process control within the Oil and Gas Industry. American influences are evident in pipe fitter training programs in the following countries, namely Middle East (Saudi Arabia, Kuwait, etc.); Malaysia, Singapore, Nigeria, Indonesian Offshore and the North Sea (predominantly British and Dutch).

Qualification 59769

Page 8

In the United States model, the "Pipe-Fitter" qualification is achieved over a four-year period and is similar to the traditional apprenticeship system in South Africa. The methodology is competency-based as opposed to outcomes-based.

Level 4:

- Planning Work Activities.
- Advanced Pipe Fabrication.
- Performing NDE Testing.
- Stress Relieving and Aligning.
- Steam Traps.
- In-Line Specialties.
- Special Piping.
- Hot Taps.
- Maintaining Valves.

The programme content for the third/fourth year of apprenticeship however, is similar to the broad context of Mechanical Engineering (Pipe-Fitting) Level 4.

There is an equivalent correlation between the FETC: Mechanical Engineering (Pipe-Fitter) NQF 4 and that of the American Apprenticeship Program for Pipe-Fitters.

1.2 Australia (www.ntis.gov.au) in terms of the Australian Quality Training Framework (AQTF):

The following information was obtained on the website: http://www.ntis.au (National Information Training System) with regards to qualifications in "Pipe Fitter" training streams in Australia.

The qualifications investigated for "Pipe Fitters" are only covered within the apprenticeship format.

• "Australian Apprenticeships" is the new name for the scheme formerly known as 'New Apprenticeships'.

• Australian Apprenticeships encompass all apprenticeships and traineeships. They combine time at work with training and can be full-time, part-time or school-based.

• Several unit standards overlap the plumbing, gas fitting and steam fitting qualifications in making up the pipe fitting skills area, namely:

Install underground enclosures and pipe/conduit - Install water mains pipe systems -Install/maintain piping & tubing (Electrical) - Install/maintain piping & tubing - Instrumentation) -Install/maintain piping & tubing (Refrigeration & a/conditioning) - Lay irrigation and/or drainage pipes - Lay pipes - Locate and clear blockages - Mark out materials - Perform Gas Metal Arc Welding to weld to AS1796 Certificate 8/8E (plate and pipe) - Perform Gas Metal Arc Welding to Weld to AS1796 Certificate 8/8E (Plate and Pipe) - Perform Gas Tungsten Arc Welding and Manual Metal Arc Welding Processes to Weld to AS1796 Certificate 5 (Alloy Steel Pipe) -Perform Gas Tungsten Arc welding to weld to AS1796 Certificate 7 (pipe) Perform Gas Tungsten Arc Welding to Weld to AS1796 Certificate 7 (Pipe) - Perform Manual Metal Arc Welding process to weld to AS1796 Certificate 2 (low carbon steel pipe) - Perform Manual Metal Arc Welding Process to Weld to AS1796 Certificate 2 (Low Carbon Steel Pipe) - Perform Manual Metal Arc Welding process to weld to AS1796 Certificate 4 (alloy steel pipe) - Perform Manual Metal Arc Welding Process to Weld to AS1796 Certificate 4 (Alloy Steel Pipe) Perform pipe welds to code standards using manual metal arc welding process - Perform pipe welds to code standards using manual metal arc welding process - Perform pipe welds to code standards using manual metal arc welding process - Plan, size and layout consumer gas installations -Renovate large diameter pipes and chambers - Select and fit insulation and sheathing - Select refrigerant pipe/tube, accessories and associated controls - Size consumer piping systems - Trip pipe.

1.3 United Kingdom (England and Scotland) - from www.ecitb.org.uk:

In order to perform a comparative study between the Scottish and National Vocational Qualifications S/NVQs and South African Qualifications, it is necessary to understand the qualifications framework and the classification of S/NVQs for the field of engineering and construction.

The S/NVQF by occupational areas are at 5 distinct levels:

- Level 1 Operations.
- Level 2 Operations and Higher Skills.
- Level 3 Technicians and Craft Employees.
- Level 4 Technician Engineer.
- Level 5 Professional and Chartered Engineers.

NC Mechanical Engineering (Pipe-Fitting) Level 4 compares well to the Scottish and English (UK) qualifications. However, the UK's qualification content is pitched at S/NVQ Levels 2 and 3. This means that an equivalent and parallel level does not truly exist in the same form as the South African NQF.

In comparing the Level 3 program, apprentices should progress to the S/NVQ L3 within a company after having completed Level 2 in a centre-based environment.

This vocational program is combined with a third component, Further Education, which together adds up to two vocational awards (SVQ Level 2 and 3), an educational qualification and the SEMTA Modern Apprenticeship (MA) Certificate. Typical on-the-job competencies are listed at Level 3 (South African Level 4) below:

Setting Out Pipe-work and Marking Out - PF002 Developing Patterns for Pipe-work - PF003 Preparing Pipe Ends using Portable Edge Preparation Machines - PF004 Pipe Bending - PF005 Fabricating Pipe-work Branches and Bends - PF006 Cold Bending Ferrous and Non-ferrous Pipe - PF010 Jointing Pipe-work using Flanged Joints - PF011 Preparing and Assembling Screwed Pipe-work - PF012 Preparing and Assembling Small Bore Non-Ferrous Pipe-work -PF013 Preparing and Assembling Welded Pipe-work - PF014 Preparing and Assembling Nonmetallic Pipe-work - PF015 Assembling and Tightening Bolted Flanged Connections - PF016 Preparing and Bonding GRP Pipe-work - PF018 Assembling and Tensioning Bolted Connections - PF019 Assembling and Tightening Bolted Connections - PF030 Fabricating and Installing Pipe-work Supports - PF031 Installing Pipe-work Systems - PF032 Installing Steam Tracing and Jacketed Pipes - PF033 Preparing and Testing Pipe-work Systems.

There appears to be strong but disproportionate alignment with the South African qualification series.

1.4 African Comparability:

Southern African Development Community (SADC) - Zimbabwe and Botswana:

Alignment with the United Kingdom's model of Vocational Education and Training (VET), through the London City and Guilds qualification framework and the National Vocational Qualification system (NVQ) - The Botswana National Qualifications Act was passed in 1998. At this present time, focus on the development of standards-based qualifications through a Botswana Vocation Education and Training System (BVET) has revolved around the Wholesale and Retail and Tourism sectors.

Qualification 59769

Currently, pipe fitters in Botswana are trained through the apprenticeship system with one single trade test centre where apprentices are able to receive a certificate of qualification (Red Seal). The length and duration of the practical and theoretical components differ slightly to the South African apprenticeship system, but the learning competencies are similar, with a focus on the predominant diamond mining and small local manufacturing and engineering industries.

East African Community (EAC):

The three member states of the EAC; Kenya, Tanzania and Uganda, are in the process of the harmonisation of education and training systems within the EAC. Currently, no qualification infrastructure exists.

1.5 Canada (Manitoba Province http://www.gov.mb.ca/iedm/):

Information regarding training was also found on the website of the Manitoba Provincial Government in Canada. The full "Pipe-Fitter" qualification is obtained over a four-year period. The "job description" of the "Pipe-Fitter" overlaps with "Steam Fitter" and "Pipe Fitter", as is the case in all the Commonwealth countries investigated. This is due to the prevalence of steam systems used predominantly for climate control systems (domestic and industrial).

Despite this, "Pipe-Fitters" at certificate level 4 are able to carry out functions, similar to its South African counterpart, as quoted by:

• "Steamfitter-Pipe fitter lays out, assembles, fabricates, installs, maintains and repairs piping systems used to carry steam, water, air, gases, chemicals, solids and fuel in industrial and manufacturing plants and in water purification and water treatment systems." www.gov.mb.ca.

Conclusion: The Canadian qualifications related to Mechanical Engineering (Pipe-Fitting) can be used interchangeably (in part) with the qualifications developed for the various South African industry sectors, serving a similar purpose.

1.6 New Zealand (www.kiwiquals.govt.nz) in terms of the New Zealand Qualifications Framework (NZQF):

Investigation into a New Zealand equivalent "pipe fitting" qualification indicated that a standalone qualification does not exist in this country. Similarities with its South African counterpart are found from the range of qualifications listed below.

- Certificate in Applied Mechanical Engineering Level 4.
- National Certificate in Engineering (General Engineering Mechanical) Level 4.
- National Certificate in Engineering: Fabrication Level 4 and 5.
- National Certificate in Manufacturing and Mechanical Engineering Level 4.
- National Certificate in Maintenance and Diagnostics Level 5.

Standards-based qualifications are also applied within the context of an apprenticeship format (Modern Apprenticeships), where specific unit standards are accumulated to make up the pipe fitting competencies for Level 4.

"When you've completed your Modern Apprenticeship you'll have a National Certificate at level 3 or 4 on the National Qualifications Framework. Having a national qualification means that the knowledge and expertise you've gained will be recognised by all employers in New Zealand." www.modern-apprenticeships.govt.nz.

2. Summary of comparisons with NC Mechanical Engineering (Pipe-Fitting) Level 4:

Content:

234 No. 30788

The qualifications from the various countries all address the range of mechanical Engineering competencies included in L4, thus attending to the need to fulfil the requirements of being introductory by nature.

Progression:

The international qualifications all address a progression of competencies, example demonstration of the ability to meet the top equipment usage level in the Pipe-Fitting industry, such as:

• "Pipefitters install and repair both high- and low-pressure pipe systems used in manufacturing, in the generation of electricity, and in heating and cooling buildings. They also install automatic controls that are increasingly being used to regulate these systems. Some pipefitters specialize in only one type of system." - USA.

A typical progression is found in the UK apprenticeship Pipe Fitter - England (Off-shore Oil & Gas Industry):

1. NVQ Level 2 (minimum 26 weeks at an accredited training centre).

2. NVQ Level 3 (in the workplace with monitoring and assessments by a training officer).

3. An educational qualification eg. National Certificate (NC) in Engineering Practice (day release at a training centre).

The off-shore oil and gas industry has progression indicators for "Pipe Fitters" which depict the following articulation descriptors, namely:

Class /Title:

- 1. Pipe fitter.
- 2. Pipe fitter Welder.
- 3. Pipe fitter Sub-Foreman.
- 4. Pipe fitter Foreman.

The content of the third/fourth year of a typical "Pipe-Fitting" programme in most countries, relates favourably to the content of Mechanical Engineering (Pipe-Fitting) Level 4.

Demonstration of work practices:

Investigation into international comparability produces overarching similarities in the outcomes of the various "Pipe-Fitter" training programmes in most of the countries above. They are:

Outcomes which are common to most countries (L4):

- Identify, interpret and produce working pipe drawings.
- Perform hydro-static pressure testing procedures (incl pre-hydro test punching).
- Produce advanced welded pipe-fabrication assemblies.
- Apply quality procedures Stopple operational pipelines.
- Maintain valves.
- Maintain.
- Steam Traps.
- Perform non-destructive tests on metal parts and components.
- Demonstrate understanding of regulations codes and drawing office practices for structural steel detailing.
- Develop and produce computer aided drawings.

Qualification 59769

Learning delivery:

The learning delivery process in all the examples included on-the-job (practical) and off-the-job (theoretical) components.

Outcomes-Based Methodology:

All the examples found either directly or indirectly comply with principles of outcomes-based learning, particularly in terms of outcomes representing meaningful units of learning and assessment being conducted continuously (formatively). There is generally a final integrated assessment, typically called a certificate of qualification (trade test certificate - red seal), where the candidate is required to demonstrate specific and core (cross-field) knowledge and skills.

Apprenticeships and VET programmes:

In all the examples found, learning is vocational-based. In some countries (England, Scotland, New Zealand and Australia) these are called "modern apprenticeships". These take the form of two categories, namely a programme-led apprenticeship where learners are able to follow a vocational programme at a college and then seek employment as trainees/apprentice/interns in order to qualify as artisans; and an employer-led apprenticeship, in which learners are engaged in a formal contract of learning and most learning is workplace-based. In most cases learners "earn while they learn".

Application (Purpose):

As is the intention with the South African FETC Level 4 qualification, the international qualifications all prepare learners for working as skilled artisans within the field of Mechanical Engineering (Pipe Fitting).

3. Concluding remarks:

The FETC Mechanical Engineering (Pipe-Fitting) developed for South Africa compares favourably with the international qualifications mentioned above and there is no doubt concerning the portability of the FETC Mechanical Engineering (Pipe-Fitting) qualification for migration purposes.

It must be stated though that certain countries do require an indigenous certification of qualification (trade test certificate). This may mean that individuals may need to be re-assessed in the selected target country.

4. Reference documents:

4.1 Availability of skilled labour in selected occupations in Western Australia (Shah. Cooney, Long and Burke: 2005).

4.2 National Guidelines on Cross-Sectoral Qualification Linkages (Australian Qualifications Framework (AQF) Implementation Handbook: 2002).

4.3 Policy Watch - Apprenticeship framework: A Change in Design (Sian Owen: 2005; Authorised by Steve Besley - UK).

4.4 Training in Engineering Construction Skills - Employers Guide (TECSkills and the ECITB - UK: 2007).

4.5 Modern Apprenticeships - The Way to Work (Cassels Report: 2001) - UK.

4.6 Role of Apprenticeship in VET System: The Case of Botswana (Ahmad: 2003) at Conference on the Reform of Technical and Vocational Education and Training (TVET) Gaborone, Botswana.

4.7 challenges facing VET transformation in the SADC region (Akoojee and McGrath: 2003 HSRC - Pretoria) at Conference on the Reform of Technical and Vocational Education and Training (TVET) Gaborone, Botswana.

5. Reference Web-sites:

- www.ecitb.org.za
- www.ntis.gov.au
- www.bota.org.bw
- www.kiwiquals.govt.nz
- www.bcit.ca
- www.nait.ca
- www.cotr.bc.ca
- www.edexcel.co.uk
- www.tullontraining.co.uk
- www.doleta.com
- www.tecskills.org.za
- www.ntcef.org
- www.bat.gov.com
- www.workforcedevelopment.com

ARTICULATION OPTIONS

The Qualification has been designed and structured so that qualifying learners can move from one engineering context to another. This can be achieved by the appropriate selection of credits in the elective category. Equally, holders of other similar manufacturing and engineering qualifications may be evaluated against this Qualification for the purpose of RPL.

Vertical Articulation:

Possible articulation currently exists for progress to NQF Level 5 through:

• Specialisation in the fitting, welding and fabrication environments - as an Approved Inspection Authority.

• Specialisation in piping draughting (SAQA ID: 58666; Certificate: Construction and Engineering Drafting; NQF Level 5).

• SAQA ID: 3229; Certificate: Engineering Management; NQF Level 5.

• SAQA ID: 14731 Access Certificate: Business; NQF Level 5; or similar Business Administration Certificates.

• SAQA ID:13914; Certificate: Construction Project Management NQF 5; or SAQA ID: 24337; Certificate: Project Management NQF Level 5.

Horizontal articulation:

Fundamental learning at this level applies to equivalent credit accrual for most engineering qualifications at NQF 4.

Core learning at this level applies to equivalent credit accrual for some unit standards in the following examples of articulation:

- (ID: 58721); FETC: Engineering Fabrication NQF Level 4.
- (ID: 23275); FETC: Mechanical Engineering (Fitting and Machining) NQF Level 4.
- (ID: 57887); FETC: Welding Application and Practice NQF Level 4.
- (ID: 50018); FETC: Computer Aided Drawing Office Practice NQF Level 4.

Other horizontal articulation options may exist and need further investigation in cases where recognition of prior learning is sought.

Source: National Learners' Records Database

MODERATION OPTIONS

• Anyone assessing a learner or moderating the assessment of a learner against this Qualification must be registered with an appropriate Education and Training Quality Assurance Body (ETQA) or with an ETQA which has a Memorandum of Understanding (MOU) with the relevant ETQA.

• Any institution offering learning that will enable the achievement of this qualification must be accredited as a Training Provider with the relevant ETQA or with an ETQA that has a Memorandum of Understanding (MOU) with the relevant ETQA.

• Moderation of assessment will be overseen by the relevant ETQA or by an ETQA that has a Memorandum of Understanding (MOU) with the relevant ETQA according to that ETQA's guidelines for assessment and moderation.

• Moderation includes both internal and external moderation of assessment/s at the exit points of the qualification, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described both in individual unit standards as well as in exit level outcomes described in this Qualification.

CRITERIA FOR THE REGISTRATION OF ASSESSORS

The following criteria should be applied by a relevant ETQA as a minimum requirement:

• Assessors should be in possession of an appropriate qualification, namely:

• FETC: Mechanical Engineering (Pipe-Fitting) at NQF Level 4 and a minimum period of related experience, as specified by the relevant ETQA.

• An artisan qualification in Pipe-Fitting or a similar trade-related qualification (Trade test certificate or completed contract of apprenticeship) with a minimum of period of related experience, as specified by the relevant ETQA.

 \circ Subject matter experience, which may be established through recognition of prior learning (RPL).

• Registration as an assessor with the relevant Education and Training Quality Assurance Body.

- Proven inter-personal skills and the ability to:
- o Maintain national and local industry standards.
- Act in the interest of the learner.
- Understand the need for transformation to redress the legacies of the past.
- Respect the cultural background and language of the learner.

NOTES

This qualification concludes the Mechanical Engineering (Pipe Fitting) Series for the Further Education and Training Certificate. Its progression has been tracked along the following learning pathway:

• National Certificate: Mechanical Engineering (Fitting) NQF Level 2 with an elective strand for Pipe Fitting.

• National Certificate: Mechanical Engineering (Pipe-Fitting) NQF Level 3.

• Further Education and Training Certificate: Mechanical Engineering (Pipe-Fitting) NQF Level 4.

This qualification is a generic qualification which has been developed to give meaning to NQF objectives to provide articulation possibilities, enable learners to get recognition for learning achievements across economic sub-sectors and to support the notion of life long learning.

UNIT STANDARDS

Source: National Learners' Records Database

Page 15

238 No. 30788

GOVERNMENT GAZETTE, 22 FEBRUARY 2008

· · · ·	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Fundamental	9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	Level 4	6
Fundamental	119462	Engage in sustained oral/signed communication and evaluate spoken/signed texts	Level 4	5
Fundamental	119469	Read/view, analyse and respond to a variety of texts	Level 4	5
Fundamental	9016	Represent analyse and calculate shape and motion in 2- and 3-dimensional space in different contexts	Level 4	4
Fundamental	119471	Use language and communication in occupational learning programmes	Level 4	5
Fundamental	7468	Use mathematics to investigate and monitor the financial aspects of personal, business, national and international issues	Level 4	6
Fundamental	119459	Write/present/sign for a wide range of contexts	Level 4	5
Core	13234	Apply quality procedures	Level 3	8
Core	253592	Identify, interpret and produce working pipe drawings	Level 4	6
Core	13224	Monitor the application of safety, health and environmental protection procedures	Level 4	4
Core	253587	Perform hydro-static pressure testing procedures on pipes and pipe systems	Level 4	6
Core	253579	Produce advanced welded pipe-fabrication assemblies	Level 4	15
Core	10981	Supervise work unit to achieve work unit objectives (individuals and teams)	Level 4	12
Elective	253434	Maintain heat exchangers and pressure vessels	Level 3	8
Elective	253423	Maintain motorised valves	Level 3	4
Elective	253599	Maintain steam traps	Level 3	4
Elective	253439	Maintain valves	Level 3	8
Elective	13260	Perform non-destructive tests on metal parts and components	Level 3	6
Elective	114194	Demonstrate understanding of regulations codes and drawing office practices for structural steel detailing	Level 4	7
Elective	12252	Develop and fabricate from complex drawings	Level 4	28
Elective	14473	Develop and produce computer aided drawings	Level 4	4
Elective	119328	Perform and coordinate a pipeline network start-up	Level 4	20
Elective	119327	Perform pipeline network shut-down	Level 4	12
Elective	253735	Plan and schedule workflow	Level 4	3
Elective	13329	Stopple operational pipelines	Level 4	16

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION None

÷



UNIT STANDARD:

Read and interpret working piping drawings

SAQA US ID	UNIT STANDARD TITLE			
253556	Read and interpret working pipi	ng drawings	,	
ORIGINATOR	PROVIDER			
SGB Generic Manufact	acturing, Engineering& Technology			
FIELD		SUBFIELD		
6 - Manufacturing, Engineering and Technology		Engineering and Related Design		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL CREDITS		
Undefined	Regular	Level 3	4	

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

SPECIFIC OUTCOME 1

Demonstrate an understanding of piping draughting.

SPECIFIC OUTCOME 2

Read and interpret schematic drawings.

SPECIFIC OUTCOME 3

Identify and describe isometric layouts and flow diagrams.

	ID	QUALIFICATION TITLE	LEVEL
Соге	59750	National Certificate: Mechanical Engineering: Pipe-Fitting	Level 3



Produce a welded pipe fabrication assembly using butt and socket fittings

SAQA US ID	UNIT STANDARD TITLE			
253558	Produce a welded pipe fabricat	ion assembly using b	utt and socket fittings	
ORIGINATOR	PROVIDER			
SGB Generic Manufac	turing, Engineering& Technology			
FIELD		SUBFIELD		
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL CREDITS		
Undefined	Regular	Level 3	12	

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

SPECIFIC OUTCOME 1

Identify, discuss and explain welded pipe fabrications.

SPECIFIC OUTCOME 2

Plan and prepare to produce welded pipe-fabrications.

SPECIFIC OUTCOME 3

Assemble the welded pipe-fabrication.

SPECIFIC OUTCOME 4

Use, maintain and care for tools and equipment.

	ID	QUALIFICATION TITLE	LEVEL
Core	59750	National Certificate: Mechanical Engineering: Pipe-Fitting	Level 3



UNIT STANDARD:

	Bevel a pipe using a mechanised	pipe bevelling mach	ine		
SAQA US ID	UNIT STANDARD TITLE				
253574	Bevel a pipe using a mechanise	Bevel a pipe using a mechanised pipe bevelling machine			
ORIGINATOR	I	PROVIDER			
SGB Generic Manu	Ifacturing, Engineering& Technology				
FIELD	<u> </u>	SUBFIELD			
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly			
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS		
Undefined	Regular	Level 3	4		

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

SPECIFIC OUTCOME 1

Describe and explain the pipe bevelling process using a pipe bevelling machine.

SPECIFIC OUTCOME 2

Prepare for the bevelling operation.

SPECIFIC OUTCOME 3

Cut and bevel pipe to job requirements.

SPECIFIC OUTCOME 4

Confirm the quality of the completed cut and bevel.

SPECIFIC OUTCOME 5

Maintain and care for tools and equipment.

	ID	QUALIFICATION TITLE	LEVEL
Elective	59750	National Certificate: Mechanical Engineering: Pipe-Fitti	ing Level 3



UNIT STANDARD:

Maintain pipe systems and pipe components

SAQA US ID	UNIT STANDARD TITLE			
253577	Maintain pipe systems and pipe	components		
ORIGINATOR	PROVIDER			
SGB Generic Manufactu	lanufacturing, Engineering& Technology			
FIELD	FIELD SUBFIELD			
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL CREDITS		
Undefined	Regular	Level 3	12	

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13218	Maintain pipe systems	Level 2	20	Will occur as soon as 253577 is registered

SPECIFIC OUTCOME 1

Identify and discuss pipe systems and related components.

SPECIFIC OUTCOME 2

Plan and prepare for pipe systems maintenance.

SPECIFIC OUTCOME 3

Maintain pipe system and/or pipe components.

SPECIFIC OUTCOME 4

Care for and store tools and equipment.

	ID	QUALIFICATION TITLE	LEVEL
Core	59750	National Certificate: Mechanical Engineering: Pipe-Fitting	Level 3



UNIT STANDARD:

Produce advanced welded pipe-fabrication assemblies

SAQA US ID	UNIT STANDARD TITLE			
253579	Produce advanced welded pipe	-fabrication assemblies		
ORIGINATOR	PROVIDER			
SGB Generic Manufactu	ring, Engineering& Technology			
FIELD		SUBFIELD		
6 - Manufacturing, Engin	eering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS	
Undefined	Regular	Level 4	15	

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

SPECIFIC OUTCOME 1

Performing calculations required to fabricate welded pipe-fabrication assemblies.

SPECIFIC OUTCOME 2

Lay out fabrication material.

SPECIFIC OUTCOME 3

Fabricate welded pipe-fabrication assemblies.

SPECIFIC OUTCOME 4

Confirm the quality of the welded pipe-fabrication assemblies.

SPECIFIC OUTCOME 5

Maintain and care for tools and equipment.

	ID	QUALIFICATION TITLE	LEVEL
Core	59769	Further Education and Training Certificate: Mechanical	Level 4
		Engineering: Pipe-Fitting	i



UNIT STANDARD:

Perform hydro-static pressure testing procedures on pipes and pipe systems

SAQA US ID	UNIT STANDARD TITLE			
253587	Perform hydro-static pressure to	esting procedures on	pipes and pipe systems	
ORIGINATOR PROVIDER				
SGB Generic Manufacturing, Engineering& Technology				
FIELD		SUBFIELD		
6 - Manufacturing, Engin	eering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS	
Undefined	Regular	Level 4	6	

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

SPECIFIC OUTCOME 1

Explain the purpose of pressure testing of pipes and pipe systems.

SPECIFIC OUTCOME 2

Plan and prepare for pressure testing.

SPECIFIC OUTCOME 3

Perform a test procedure and conduct a pressure test.

SPECIFIC OUTCOME 4

Care for and store tools and equipment.

	ID ·	QUALIFICATION TITLE	LEVEL
Core	59769	Further Education and Training Certificate: Mechanical Engineering: Pipe-Fitting	Level 4



UNIT STANDARD:

Perform piping off-set calculations

SAQA US ID	UNIT STANDARD TITLE				
253588	Perform piping off-set calculation	ons			
ORIGINATOR	PROVIDER				
SGB Generic Manufact	SGB Generic Manufacturing, Engineering& Technology				
FIELD		SUBFIELD			
6 - Manufacturing, Eng	ineering and Technology	Manufacturing and Assembly			
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS		
Undefined	Regular	Level 3	5		

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

SPECIFIC OUTCOME 1

Use specific information and explain scientific concepts.

SPECIFIC OUTCOME 2

Perform right-angle trigonometry.

SPECIFIC OUTCOME 3

Calculate take-outs using trigonometry.

	ID	QUALIFICATION TITLE	LEVEL
Core	59750	National Certificate: Mechanical Engineering: Pipe-Fitting	Level 3



UNIT STANDARD:

Identify, interpret and produce working pipe drawings

SAQA US ID	UNIT STANDARD TITLE			
253592	Identify, interpret and produce v	working pipe drawings		
ORIGINATOR	PROVIDER			
SGB Generic Manufactu	GB Generic Manufacturing, Engineering& Technology			
FIELD	· · · · · · · · · · · · · · · · · · ·	SUBFIELD		
6 - Manufacturing, Engi	neering and Technology	Fabrication and Ext	action	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS	
Undefined	Regular	Level 4	6	

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
14492	Identify, interpret and produce working piping drawings	Level 4	6	Will occur as soon as 253592 is registered

SPECIFIC OUTCOME 1

Demonstrate an understanding of pipe drafting.

SPECIFIC OUTCOME 2

Identify and draw schematic drawings.

SPECIFIC OUTCOME 3

Identify, describe and draw isometric layouts and flow diagrams.

	ID	QUALIFICATION TITLE	LEVEL
Core	59769	Further Education and Training Certificate: Mechanical	Level 4
		Engineering: Pipe-Fitting	



UNIT STANDARD:

Maintain steam traps

SAQA US ID	UNIT STANDARD TITLE			
253599	Maintain steam traps			
ORIGINATOR	PROVIDER			
SGB Generic Manufact	SGB Generic Manufacturing, Engineering& Technology			
FIELD		SUBFIELD		
6 - Manufacturing, Engi	neering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS	
Undefined	Regular	Level 3	4	

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

SPECIFIC OUTCOME 1

Identify and discuss the applications of steam traps.

SPECIFIC OUTCOME 2

Plan and prepare for the maintenance of steam trap/s.

SPECIFIC OUTCOME 3

Maintain steam trap/s.

SPECIFIC OUTCOME 4

Care for and store system maintenance tools and equipment.

	ID	QUALIFICATION TITLE	LEVEL
Elective	59769	Further Education and Training Certificate: Mechanical Engineering: Pipe-Fitting	Level 4
Elective	59750	National Certificate: Mechanical Engineering: Pipe-Fitting	Level 3



UNIT STANDARD:

Identify and apply insulation methods and materials for pipes and pipe systems

SAQA US ID	UNIT STANDARD TITLE			
253634	Identify and apply insulation me	thods and materials f	for pipes and pipe systems	
ORIGINATOR	PROVIDER			
SGB Generic Manufacturing, Engineering& Technology				
FIELD		SUBFIELD		
6 - Manufacturing, Engi	neering and Technology	Manufacturing and	Assembly	
ABET BAND UNIT STANDARD TYPE		NQF LEVEL	CREDITS	
Undefined	Regular	Level 4	8	

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

SPECIFIC OUTCOME 1

Identify insulation methods and materials used for pipes.

SPECIFIC OUTCOME 2

Plan and prepare insulation the pipe.

SPECIFIC OUTCOME 3

Insulate pipes and/or pipelines.

	ID	QUALIFICATION TITLE	LEVEL
Elective	59750	National Certificate: Mechanical Engineering: Pipe-Fittir	ng Level 3



UNIT STANDARD:

Cut materials using plasma cutting

SAQA US ID	UNIT STANDARD TITLE			
253734	Cut materials using plasma cut	ting		
ORIGINATOR		PROVIDER		
SGB Generic Manufactu	ring, Engineering& Technology			
FIELD		SUBFIELD		
6 - Manufacturing, Engin	eering and Technology	Fabrication and Extraction		
ABET BAND UNIT STANDARD TYPE		NQF LEVEL	CREDITS	
Undefined Regular		Level 4	4	

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
14698	Cut materials using plasma cutting	Level 4	4	Will occur as soon as 253734 is registered

SPECIFIC OUTCOME 1

Describe and explain the plasma cutting process of ferrous and non-ferrous materials.

SPECIFIC OUTCOME 2

Prepare for the plasma cutting operation.

SPECIFIC OUTCOME 3

Cut material to job requirements.

SPECIFIC OUTCOME 4

Confirm quality of the completed cut.

SPECIFIC OUTCOME 5

Care and storage of cutting equipment, tools, and materials.

	ID	QUALIFICATION TITLE	LEVEL
Core	59750	National Certificate: Mechanical Engineering: Pipe-Fitting	Level 3



UNIT STANDARD:

Plan and schedule workflow

SAQA US ID	UNIT STANDARD TITLE			
253735	Plan and schedule workflow			
ORIGINATOR	PROVIDER			
SGB Generic Manufactu	SGB Generic Manufacturing, Engineering& Technology			
FIELD SUBFIELD				
6 - Manufacturing, Engin	eering and Technology	Engineering and Related	l Design	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS	
Undefined	Regular	Level 4	3	

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
14474	Plan and schedule workflow	Level 4	3	Will occur as soon as 253735 is registered

SPECIFIC OUTCOME 1

Obtain and evaluate data to facilitate the workflow process.

SPECIFIC OUTCOME 2

Demonstrate an understanding of the planning and scheduling of workflow processes.

SPECIFIC OUTCOME 3

Plan and schedule workflow according to organisational requirements.

SPECIFIC OUTCOME 4

Monitor the achievement of the workflow plan.

	ID	QUALIFICATION TITLE	LEVEL
Elective	59769	Further Education and Training Certificate: Mechanical	Level 4
		Engineering: Pipe-Fitting	



UNIT STANDARD:

Use welding definitions and symbols

SAQA US ID	UNIT STANDARD TITLE			
253736	Use welding definitions and syn	nbols		
ORIGINATOR		PROVIDER		
SGB Generic Manufactu	ring, Engineering& Technology			
FIELD		SUBFIELD		
6 - Manufacturing, Engin	eering and Technology	Engineering and Related	Design	
ABET BAND UNIT STANDARD TYPE		NQFLEVEL	CREDITS	
Undefined	Regular	Level 2	5	

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
14713	Use welding definitions and symbols	Level 2	5	Will occur as soon as 253736 is registered

SPECIFIC OUTCOME 1

Know the basics of welded joints and their terminology.

SPECIFIC OUTCOME 2

Identify and apply welding symbols used by industry.

SPECIFIC OUTCOME 3

Sketch and describe welding symbols used in the industry.

	ID	QUALIFICATION TITLE	LEVEL
Core	59750	National Certificate: Mechanical Engineering: Pipe-Fitting	Level 3

GOVERNMENT GAZETTE, 22 FEBRUARY 2008



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Gouge material with air-carbon-arc gouging process

SAQA US ID	UNIT STANDARD TITLE			
253737	Gouge material with air-carbon-arc gouging process			
ORIGINATOR		PROVIDER		
SGB Generic Manufacturing, Engineering& Technology				
FIELD		SUBFIELD		
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS	
Undefined	Regular	Level 3	10	

This unit standard replaces:

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
14707	Gouge material with air-carbon-arc gouging process	Level 3	10	Will occur as soon as 253737 is registered

SPECIFIC OUTCOME 1

Describe the air-carbon-arc gouging process.

SPECIFIC OUTCOME 2

Prepare for the air-carbon-arc gouging operation.

SPECIFIC OUTCOME 3

Prepare for the air-carbon-arc gouging operation.

SPECIFIC OUTCOME 4

Gouge material.

SPECIFIC OUTCOME 5

Apply quality check on cut materials.

SPECIFIC OUTCOME 6

Care and storage of air-carbon-arc gouging equipment, tools, and materials.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	59750	National Certificate: Mechanical Engineering: Pipe-Fitting	Level 3

Page 1