

**HEAD OFFICE**

7 Anerley Road,  
Parktown  
Tel: 011 547 2600

**REGIONAL OFFICES**

**Eastern Cape**

King Sabatha Dalindyebo TVET College  
R61 Queenstown Road  
Cicira Village, Mthatha  
5099  
Tel: 087 095 0497

**Mpumalanga**

Nkangala TVET College  
Mpondozamkomo Campus  
1 Moses Kotane Drive  
Ferrobank, Witbank  
Tel: 013 696 8120/8121

**Free State**

Goldfields TVET College  
Tosa Campus  
14107 Ndaki Road  
Thabong, Welkom  
Tel: 087 095 0266

**North West**

Old Shopping Complex  
59 Karee Street  
Mooinooi  
014 555 8860

**Limpopo**

Sekhukhune TVET College  
CN Phathudi Campus  
Stand No. 2659  
Praktiseer  
Tel: 087 095 0267

**Northern Cape**

Northern Cape Rural TVET College  
Kathu Campus  
Hans Coetzee Road  
Kathu, 8446  
Tel: 053 723 0100

Facebook: @Mining Qualifications Authority

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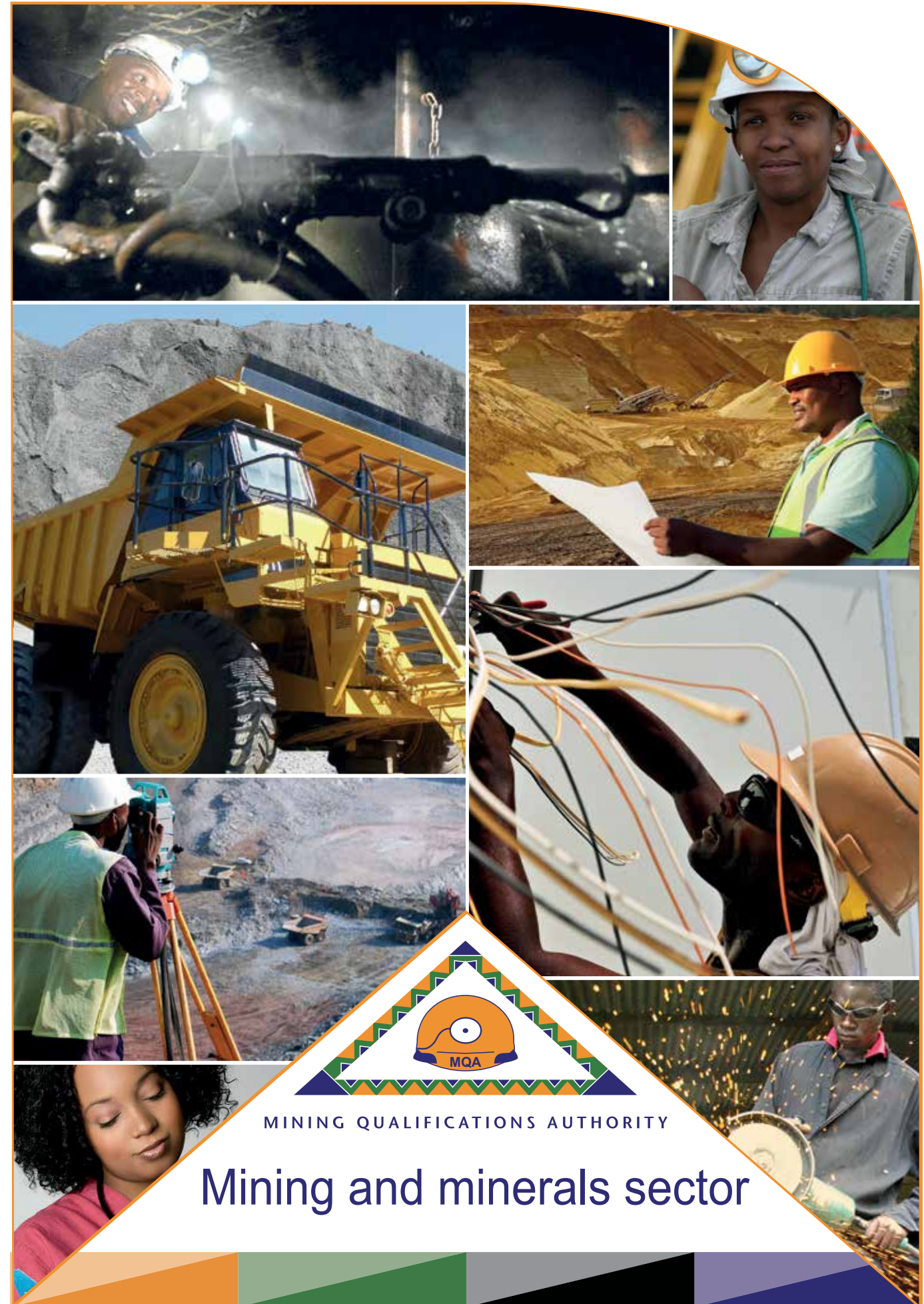
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MINING QUALIFICATIONS AUTHORITY

# Career Guide

Career Guide for mining and minerals sector



MINING QUALIFICATIONS AUTHORITY

## Mining and minerals sector



# Vision

A competent, health and safety orientated mining and minerals workforce.

# Mission

Ensure that the mining and minerals sector has sufficient competent people who will improve health and safety, employment equity and increase productivity standards.

# Values

Continuous Learning

Empowerment

Professionalism

Honesty and Mutual Respect

Service Excellence

# List of Abbreviations and Acronyms

<b>AET</b>	Adult Education and Training
<b>ATR</b>	Annual Training Report
<b>BEE</b>	Black Economic Empowerment
<b>BEng</b>	Bachelor of Engineering
<b>BSc</b>	Bachelor of Science
<b>BTech</b>	Bachelor of Technology
<b>CLAS</b>	Cement, Lime, Aggregates and Sand
<b>DEA</b>	Department of Environmental Affairs
<b>DHET</b>	Department of Higher Education and Training
<b>DTech</b>	Doctor of Technology
<b>DoL</b>	Department of Labour
<b>ECSA</b>	Engineering Council of South Africa
<b>FETC</b>	Further Education and Training Certificate
<b>FOG</b>	Falls of Ground
<b>GDP</b>	Gross Domestic Product
<b>H&amp;S</b>	Health and Safety
<b>HDI</b>	Historically Disadvantaged Individuals
<b>HDSA</b>	Historically Disadvantaged South Africans
<b>HET</b>	Higher Education and Training
<b>HIV</b>	Human Immunodeficiency Virus
<b>HR</b>	Human Resources
<b>MBA</b>	Master of Business Administration
<b>MHSA</b>	Mine Health and Safety Act
<b>MMS</b>	Mining and Minerals Sector
<b>MQA</b>	Mining Qualifications Authority
<b>MTech</b>	Master of Technology
<b>NC</b>	National Certificate
<b>NQF</b>	National Qualifications Framework
<b>NSFAS</b>	National Student Financial Aid Scheme
<b>OFO</b>	Organising Framework for Occupations
<b>PGM</b>	Platinum Group Metals
<b>PWD</b>	People with Disability
<b>QCTO</b>	Quality Council for Trades and Occupation
<b>SA</b>	South Africa
<b>SACNASP</b>	South African Council for Natural Scientific Professions
<b>SAIChE</b>	South African Institute of Chemical Engineers
<b>SAIEG</b>	South African Institute for Engineering and Environmental Geologists
<b>SAIMechE</b>	South African Institute of Mechanical Engineers
<b>SAIMM</b>	South African Institute of Mining and Metallurgy
<b>SAMMS</b>	South African Mining and Minerals Sector
<b>SDA</b>	Skills Development Act, 1998 (Act 97 of 1998)
<b>SDL</b>	Skills Development Levy
<b>SETA</b>	Sector Education and Training Authority
<b>SSP</b>	Sector Skills Plan
<b>Umalusi</b>	Umalusi Council for General and Further Education and Training
<b>WISA</b>	Water Institute of South Africa
<b>WSP</b>	Workplace Skills Plan
<b>WWW</b>	World Wide Web



# CEO Overview

## Introduction

I am very excited about the development of this career guide for the mining and minerals sector. The guide was developed by the Mining Qualifications Authority to encourage learners to identify career opportunities in the sector when making their career choices. Many learners are concerned about transformation and safety in the mines when making career choices so I will start with an overview of transformation and safety.

## The role of the Department of Mineral Resources

The mandate of the Department of Mineral Resources (DMR) is to achieve effective governance and transformation in the mining and minerals sector. This is essential for economic growth and development in order to improve the quality of life for all South Africans.

Due to the hazardous nature of mining activities, the mining and minerals sector is being highly regulated by health and safety legislation. This includes regulations regarding the competencies that workers should have, as well as general health and safety training required. Certain elements of training in the mining and minerals sector are prescribed and have to be prioritised.

The objectives of the Department of Mineral Resources, in terms of its mandate, are to formulate and implement policy that will ensure transformation within the mining and minerals sector.

This department is focused on the global competitiveness of the mining and minerals sector, while making it secure, safe and healthy and environmentally friendly. In its commitment to a secure, safe, healthy and environmentally friendly mining and minerals sector, the Department of Mineral Resources established the Mine Health and Safety Inspectorate, in terms of the Mine Health and Safety Act No.29 of 1996.

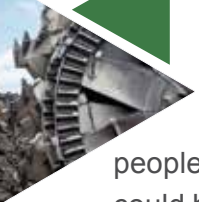
The Mine Health and Safety Inspectorate aims to ensure the health and safety of everyone working at mines, as well as those affected by mining activities.

Their activities are directed to the following strategic objectives:

- reducing occupational injuries and ill-health;
- developing and maintaining an effective policy and legislation framework;
- improving information management; and
- supporting cross-cutting initiatives of government relating to economic empowerment, human resource development, employment equity, poverty alleviation and combating the HIV/Aids pandemic.

## Preamble

South Africa is faced with major economic challenges such as poverty and unemployment. Skills development might serve as the main cure for these challenges. The Mining Qualifications Authority (MQA) is responsible for facilitating skills development in the mining and minerals sector. Unemployed



people, especially the youth, need to be developed to become skilled and productive workers. This could be achieved by making each workplace within South African organisations a place where youth can be trained and obtain workplace experience in pursuit of a qualification in the sector. There are different forms of programmes such as learnership programmes, internship programmes, workplace experience and bursaries for learners to further their studies.

In the mining and minerals sector the skills shortage cuts across all employment categories such as management, professionals, artisans and workers. Through industry participation, the Mining Qualifications Authority has developed qualifications to support skills development in the industry. They also make grants available to employers who offer learnerships, internships, and Adult Education and Training.

## **The Mining Charter**

Historically disadvantaged South Africans are predominant in the workforce of the mining and minerals sector, but have been largely excluded from ownership of mining operations. The Mining Charter endeavours to redress this situation. The Mining Qualifications Authority supports this broad-based socio economic empowerment charter.

## **The Career Guide**

This career guide is an integral part of skills development and is designed to inform people (especially the youth) about the mining and minerals sector. The guide also provides information regarding career choices, the fields of study and learning paths to follow in order to achieve a relevant qualification in this very important sector.

I encourage learners, individuals seeking employment opportunities and those already employed to use this guide as a resource that will assist in furthering their careers in the mining and minerals sector.

**MQA Chief Executive Officer**



# Guide Summary

## About this Guide

The mining and minerals sector is a large and well developed sector within the South African economy, yet even with its magnitude, it has a serious shortage of specialised skills. This guide serves to highlight the scarce skills and qualifications greatly needed by the sector. It also serves as a source of information about the mining and minerals sector.

## The following are emphasised in the guide:

- the history and current state of the mining and minerals sector;
- the Mining Qualifications Authority (MQA), its origin, mandate and initiatives for the development of the sector;
- the skills and qualifications needed by the mining and minerals sector;
- information on careers within the sector, with specific focus on those classified as scarce skills;
- accessing careers in the sector;
- the qualifications required to access careers: and
- how to plan for the career of your choice.

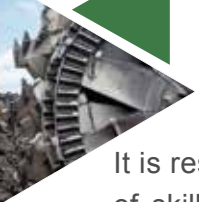
## Who is this guide useful for?

This guide is for:

- a learner who is about to make subject choices which will affect further education and career opportunities;
- a school leaver deciding on a future career path;
- a career guidance counsellor wanting to help learners to choose a career;
- a person already employed within the sector who would like to change careers;
- a skills adviser or skills development facilitator in the mining and minerals sector;
- a member of a skills development committee in a company; and
- an employee of the Mining Qualifications Authority.

## What is the purpose of the Mining Qualifications Authority (MQA)?

The Mining Qualifications Authority is a statutory body established in terms of the Mine Health and Safety Act No. 29 of 1996 and is a registered Sector Education and Training Authority for the Mining and Minerals Sector in terms of the Skills Development Act No. 97 of 1998.



It is responsible for supporting transformation in the mining and minerals sector through the facilitation of skills development in terms of the Skills Development Act. In addition, the Mining Qualifications Authority supports the priorities outlined in the Mining Charter which include redressing the imbalances which were due to the previous dispensation, increased participation of women in mining, and the empowerment of previously disadvantaged communities.

Core functions of the Mining Qualifications Authority include:

- developing and implementing a sector skills plan;
- developing unit standards and qualifications for the sector;
- establishing, registering, administering and promoting learning programmes;
- maintaining the quality of standards, qualifications and learning provision; and
- disbursing grants from the skills development levy.

The Mining Qualifications Authority is also focused on the improvement of health and safety within the sector. It has taken an extremely active role at the forefront of developing programmes and awareness to drive the setting of higher safety standards for the mining and minerals sector.



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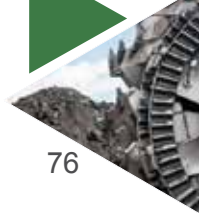


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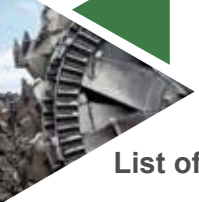
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# 1. About the Mining and Minerals Sector (MMS): Past, Present and Future

## 1.1. Let's go beneath the surface of the mining and minerals sector

Historically the sector has been a divided one. Despite the fact that the vast majority of employees within the mining and minerals sector are historically disadvantaged individuals (HDIs), they have largely been excluded from ownership of mining operations. The Mining Charter is remedying this. Since the acceptance of the Mining Charter, the sector has moved forward in leaps and bounds. It has taken solid steps to achieve an equitable distribution of the benefits derived from our mineral resources and some of the most lucrative Black Economic Empowerment (BEE) deals of our time have been in the sector.

The sector is commonly perceived as if it consists only of dark, dusty mines and dangerous quarries. This is a limited view of the mining and minerals sector. It also produces the most beautiful jewellery and the material for other life enhancement products. The mining and minerals sector offers many diverse career opportunities to the public at large.

## 1.2. Let's learn more about the sector

The "Mining and Minerals Sector" is a term used to identify a number of related industries. These range from the mining (base production) of minerals through to the processing of these minerals and ultimately the export or domestic sales of raw (e.g. coal) and refined/manufactured mineral products (e.g. gold and diamond jewellery).

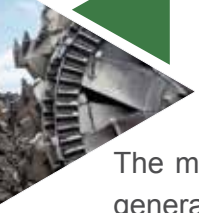
It is a sector consisting of nine major sub-sectors:

- Gold
- Platinum Group of Metals (PMG)
- Diamonds
- Coal
- Cement, Lime, and Aggregates
- Jewellery manufacturing
- Extraction of Petroleum and Gases
- Services incidental to mining
- Other mining such as Vanadium

The mining and minerals sector contributed more than 15% to South Africa's gross domestic product (GDP). The mining and minerals sector accounts for about 25% of employment in the country, and is South Africa's largest industry.

Recently there has been concern about the future economic viability of the industry. The industry, like most other industries around the world, has been affected by the global economic crisis, but because it plays such a vital role in the economy of South Africa, the government is busy putting measures in place to cushion the impact and to ensure stability. The measures of government will ensure the stability of the industry in years and decades to come.





The mining and minerals sector is a major driver of the South African economy. Mining operations are generally very large and outside urban areas. The mining and minerals processing companies usually form partnerships with government to develop essential infrastructure in areas where mining happens and potentially could happen. Mine and mineral processing plants need electricity, sewage and waste water management, as well as transport grids (e.g. road and rail) to do their core business.

Mining operations tend to employ large groups of people who need housing, healthcare and social welfare infrastructure to develop communities. As a by-product, entrepreneurs start businesses which do not directly relate to mining operations; to service these communities and provide even more employment opportunities.

## **2. Why Choose a Career in the Mining and Minerals Sector?**

### **2.1 First let's look at the general opportunities**

The mining and minerals sector provides a variety of career opportunities for candidates within managerial, professional, technician and trade workers, machine operating, administrative and clerical positions. What this means is that learners do not have to pursue only technical careers within the sector, but may find that careers such as accounting, human resources or other clerical roles could suit them better.

#### **Incorporating women in the sector**

For decades the sector has been male dominated. In South Africa, until the 1990s, women were prohibited by law from being employed in operations underground. Mining as a discipline was not seen or marketed as a good career choice for professional women.

At the lower levels, the industry has traditionally drawn its labour from a largely male rural workforce. Women need to take note that due to the physical nature of the industry, conditions may be hard. With a strong drive within the industry to increase the number of women, the sector is now more accommodating towards the needs of women. Women may now find themselves employed at all levels, including professional and managerial positions. The year-on-year increase in woman owning mines has become apparent which highlights the success of women empowerment programmes and other initiatives within the sector.

Overall, the mining and minerals sector is forging ahead to achieve the objectives set out in the Mining Charter. It stipulates 40% of management within the mining and minerals sector must be historically disadvantaged individuals and that the participation of women in the sector should increase to 10%.

### **2.2 What are the working conditions like in the mining and minerals sector?**

Mining is an inherently risky activity. The industry world-wide has a record of recurring accidents (and occasional disasters) as well as a high incidence of occupational disease. South Africa has very large, deep, labour-intensive mines, a workforce with low levels of education and a high degree of illiteracy. This has led to relatively high accident rates. With the implementation of the Mine Health and Safety Act (MHSA), No. 29 of 1996, the mining and minerals sector is committed to positive change in working conditions both above and below ground.





The work environments within the sector differ by occupation. Management executives, scientists, technicians, administrative and clerical workers, work in office building and laboratories. Engineers and managers usually find their time shared between offices and the mines. Geologists may find that they have to travel for extended periods to remote locations, in all types of terrain.

The work schedules within the mining and minerals sector may vary widely. Some sites operate twenty-four hours a day, seven days a week, particularly in underground mines. This results in some mining staff working long shifts, several days in a row, with several days off. Administrative and clerical workers on the other hand, work regular office hours during a five-day week.

When seeking employment within the mining and minerals sector, you must be aware of the environment you could be working in. You could find yourself working within or close to a large metropolitan area, or you could be based in a very remote mine. There are often great financial incentives in both situations.

### **2.3 Health and safety within the sector**

When choosing a career, an important question to ask is: “How safe is my working environment?”

Prior to the late 1990s, there were no proper health and safety guidelines for the sector. Since the advent of the Mine Health and Safety Act in 1996, this has changed dramatically. The Act considers the potential dangers in mining activities which has led to the sector becoming highly regulated in terms of health and safety.

Due to fast changing technologies and processes within the sector, regulation requires companies to conduct health and safety training for their employees on a regular basis. Mining companies are compelled by legislation to conduct more regular safety audits to ensure that a safe environment is achieved and maintained. Safety clothing, such as overalls, hard-hats and safety boots are a requirement when working on-site at any mine or plant.

### **2.4 Are there opportunities for people with disabilities in the mining and minerals sector?**

Due to the physical nature of most of the work in the mining and minerals sector, relatively small numbers of people with disabilities are employed. Employees with disabilities are generally employed offsite in administrative or non-physical roles. Workers with disabilities form less than 2% of the workforce in many organisations within the mining and minerals sector.

In spite of this, the Mining Qualifications Authority (MQA) has the objective of supporting the training and development of employees with disabilities within the sector. This is being achieved by paying grants to employers who can demonstrate that they are providing training and career development to employees with disabilities.

Should learners with disabilities wish to pursue a career in the mining and minerals sector, companies will need to analyse the job and identify abilities that the person has to match. Generally, there are fewer opportunities in the artisan disciplines and more opportunities within the professional (non-artisan) disciplines for people with disabilities.



## 2.5 Employment Sectors

Employees in the mining and minerals sector may be based at very different locations. Some environments are harsher than others, may be more labour intensive and very physically challenging. One thing to remember is that more often the mining companies that are the most remotely located are often the ones that offer the most attractive salary packages. The sector is known for its attractive fringe benefits which often include free housing, vehicle allowances and medical aid.

The mining and minerals sector in South Africa employs approximately 500 000 people who are employed within various subsectors.

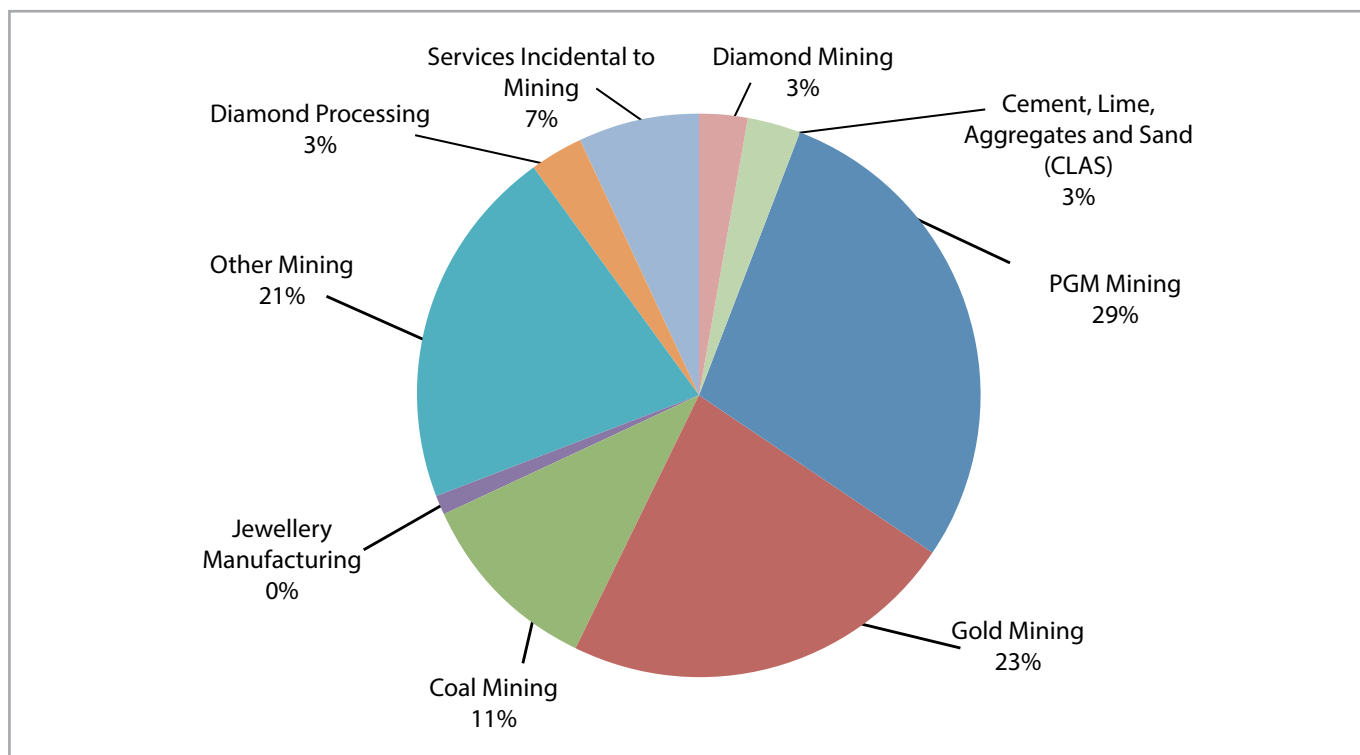


Figure 2-1 Distribution of employees in the subsectors of the mining and minerals sector (Year: 2016)

Due to the diverse nature of the sector, workers with varying expertise are employed in different positions. These positions may be in the form of managers, professionals, clerical and administrative workers, technicians and trades workers, machinery operators and drivers, elementary workers and labourers.

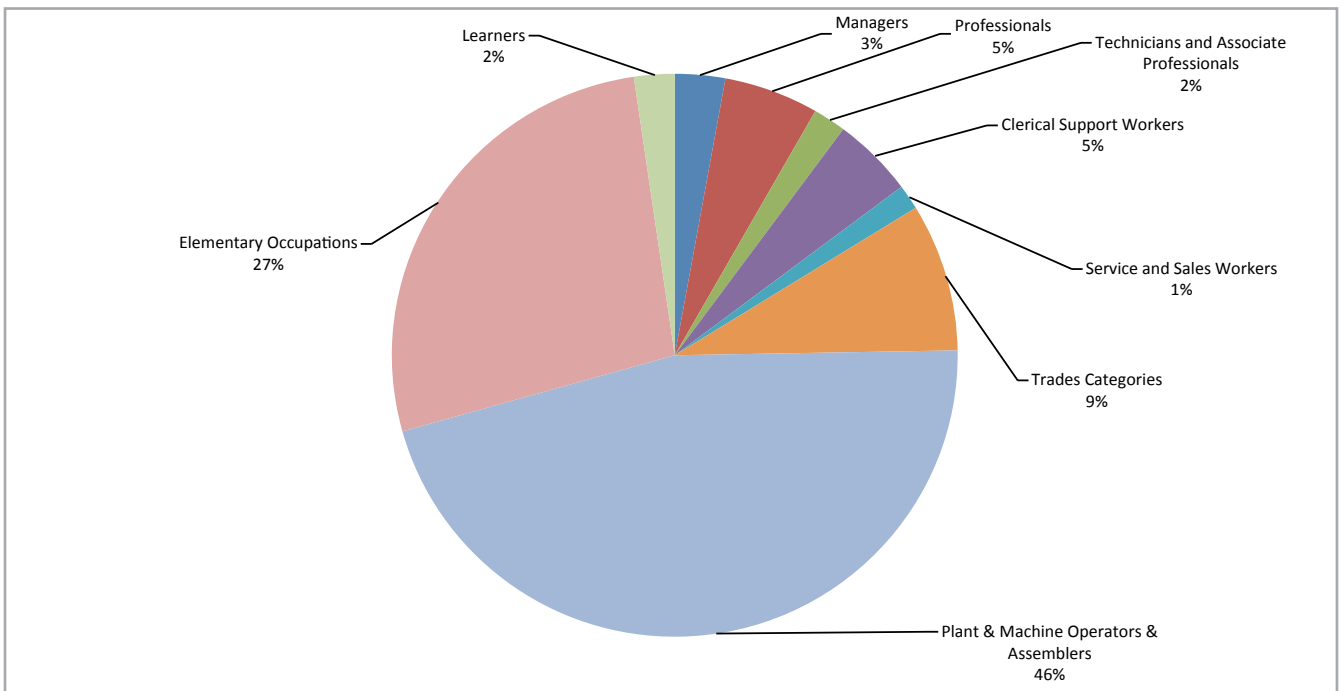


Figure 2-2 Distribution of workforce in the sector by main occupation categories (Year: 2016)

A high level of technical and analytical proficiency is required to excel in the vast majority of occupations. It is extremely important for any candidate, considering a career in the sector, to include mathematics and science in their subject choice as these two subjects are a prerequisite to most fields in the sector.

## 2.6 Distribution of the Workforce

Most of the mining activities within South Africa occur in the North West, Limpopo, Gauteng, Mpumalanga, Free State and Northern Cape provinces with little activity taking place in the KwaZulu-Natal, Western Cape and Eastern Cape provinces.



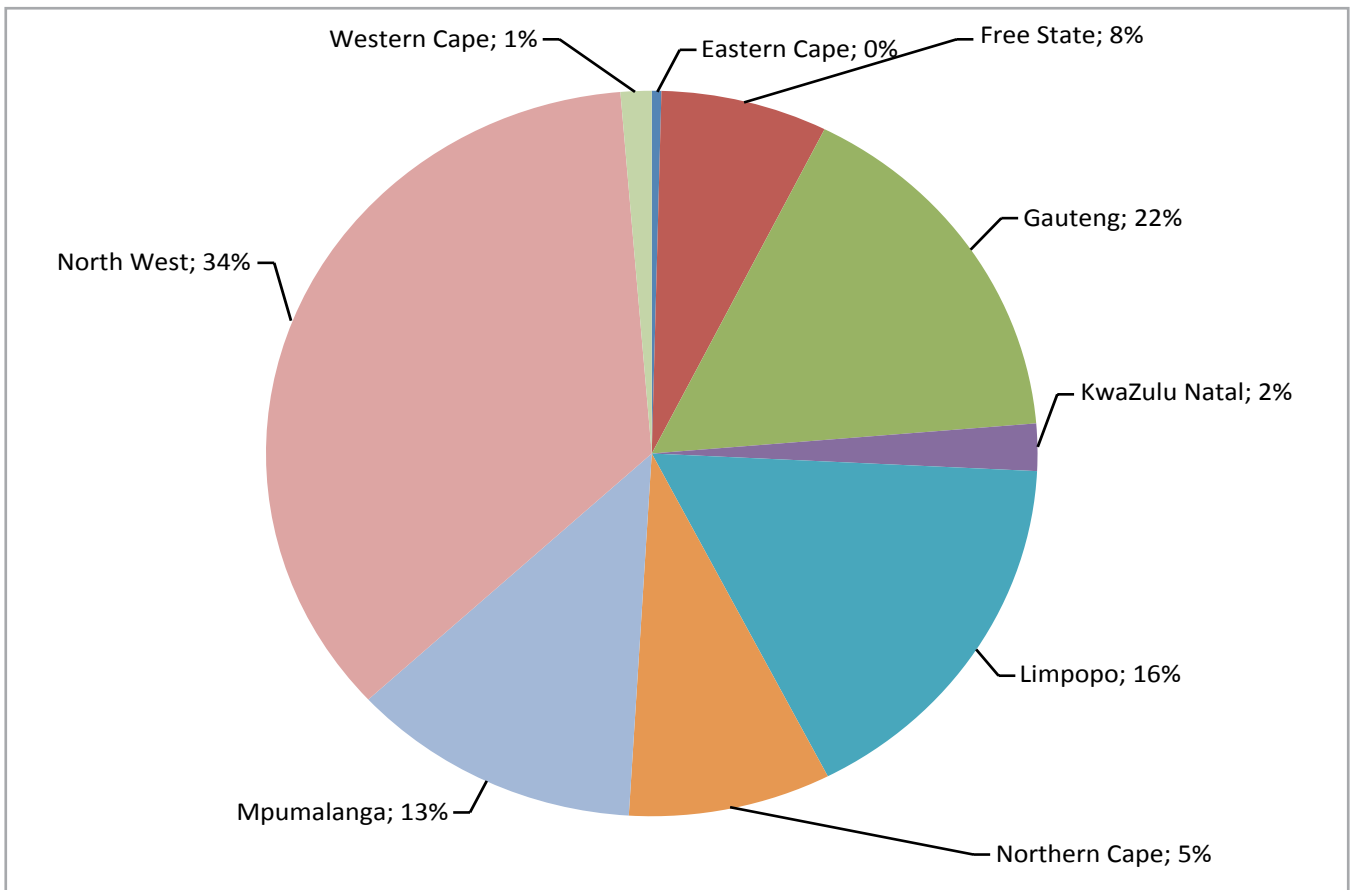


Figure 2-3 Provincial distribution of employees (Year: 2016)

### 3. Careers in the Mining and Minerals Sector

#### 3.1 Choosing a Career

The choice you make concerning your career is probably the most important decision you will have to make in your life. Remember though, that what you choose as your first job won't necessarily be what you do for the rest of your life. How you start your career could have an impact on where you live, the speed at which your career advances and what you earn.

#### 3.2 How to make a career choice

In choosing a career, a number of steps should be followed:

##### Step 1: Know yourself

Don't expect to know what you want to do until you know yourself.

The first step in realising your career dreams and achieving job satisfaction is to have a detailed picture of your desires, goals, strengths and weaknesses. This should provide clear guidance as to what you could pursue as a possible career.



Self-knowledge is developed through:

- Intensive thinking about yourself
- Conversations with relatives, friends and contacts
- Psychometric tests conducted by a psychologist

To develop a better understanding of yourself, simply ask yourself the following questions:

- What are my skills and abilities?
- Which of these skills and abilities prominent?
- What are my strengths and weaknesses?
- What qualifications have I successfully attained?
- What subjects am I doing at school?
- How am I doing in my subjects?
- What activities do I enjoy most?
- Would I prefer working on my own or as a member of a team?
- How will I get along with my supervisor and my co-workers?
- What kind of people would I like to work with?
- Do I prefer to work indoors or outdoors?
- What would give me satisfaction in a career?
- What type of work environment would I be happy in?
- What personal qualities do I possess that will help me in the career I choose?
- How do I deal with high pressure situations?
- How will my personality influence my career choice?

## **Step 2: Identify career options**

In the course of gathering information and researching careers, you will need to start identifying your options.

**Career options entail obtaining knowledge about:**

- Different types of careers
- The type of work in different careers
- The salary and benefits in different careers
- The type of person who will fit the specific occupation
- Subjects required
- Personal characteristics required





### **Information sources that you may use:**

- Read career magazines/books/career supplements in newspapers
- Attend career exhibitions
- Visit work places
- Talk to employees
- Talk to employers
- Visit your nearest career information centre
- Contact professional societies
- Browse the internet

### **Step 3: Evaluate career options**

- Once you have completed your research, evaluate the career options you have identified
- Identify what additional resources and information you will need

### **Questions you should ask yourself at this point are:**

- What are my options as far as my career is concerned?
- Are there any areas of work or careers where I have a specific interest?
- What other types of jobs or careers should I be considering?

### **Step 4: Select one of the career options**


Based on the information you have gathered and analysed, you should now be able to select one of the career options. Career choice is a process. It starts when you are very young and continues into your whole life. It is an ongoing investment in who you are and how you fit into the world of work.

### **How to make the right choice**

- Match your specific characteristics with a specific career
- Choose a career path that has different options and opportunities
- Ask yourself why you have chosen that particular career
- Try to obtain exposure to the career, for example vacation work, voluntary work or an internship
- Is there an economic demand for your chosen career?
- Do you have enough information to choose one career option over another? If not, you may need to do more research

### **Where to get guidance**

- Career centres (there are centres attached to most universities)
- The Department of Labour
- Career exhibitions
- Books on careers

- 
- Newspaper career supplements
  - The internet

**Talk to a career guidance counselor about the following points:**

- Self-knowledge
- Planning a career
- Subject choice
- Academic planning skills
- CV writing

### **Step 5: Design an action plan**

You can now begin to develop and implement a plan of action. Ask yourself:

- What information or resources do I need in order to execute my plan of action?
- Are there any obstacles in pursuing my career decision and how can I overcome them?
- What steps should be taken to implement my career decision?

### **3.3 Let's sum up**

- To make an effective career choice, you need to know your skills, interests and values
- You should investigate what study options are available and how they relate to different careers
- You should think about how you make decisions and also reflect on how the decisions you have made would influence your life
- You should be willing to seek guidance in finalising your list of career options

### 3.4 Career Guidance Counselling Centres

#### 3.4.1 Contact List of Department of Labour (DoL) Provincial Offices

Physical Address	Postal Address	Contact Number
145 Commissioner Street Cnr. Small Street, Nedbank Mall Building Johannesburg	P O Box 7482 Johannesburg, 2000	Tel: 011 223 1000/1 Fax: 011 223 1126
239 Concillium Building Cnr. Nana Sita and Thabo Sehume Streets Pretoria	P O Box 393 Pretoria, 0001	Tel: 012 309 5000 Fax: 012 320 5627/086 6207329
36 Mandela Avenue Cnr. Escombe & Nelson Mandela Streets Emalaheni	Private Bag X27293 Emalaheni, 1035	Tel: 013 653 3800/656 Fax: 013 653 3849
Allied Building C/O Maitland & West Burger Streets Bloemfontein	P O Box 2058 Bloemfontein, 9300	Tel: 051 411 6400 Fax: 051 447 6067
Cnr. Steen and Mandela Roads Rustenburg	P O Box 262 Rustenburg, 0300	Tel: 014 592 8214 Fax: 014 597 1288
Laboria House Cnr. Pniel & Compound Streets Kimberley	Private Bag X5012 Kimberley, 8300	Tel: 053 838 1500 Fax: 053 838 1618
Cnr. Hill and Oxford Street East London	Private Bag X9084 East London, 5200	Tel: 043 702 7500 Fax: 043 702 7569
Thomas Boydell Building 22 Parade Street, Cape Town	P O Box 872 Cape Town, 8000	Tel: 021 468 5500, 021 468 5502/4 Fax: 021 468 5510
Government Buildings Masonic Grove, Durban	P O Box 10074 Marine Parade, 4056	Tel: 031 366 1511 Fax: 031 336 1506





## 4. Critical Cross Field Skills Required in the Mining and Minerals Sector

### 4.1 What are critical cross field skills?

If you want to be successful in your chosen career, you need more than technical skills. There are skills that all people need to develop to carry out their jobs. These are known as critical cross field skills.

These skills are not taught, but rather learnt by working with others. Often, learners entering the working world find that they may not be successful due to a lack of critical cross field skills. Critical cross field skills are often referred to as core competencies by some companies.

#### The critical cross field outcomes are:

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

### 4.2 Do you have the required critical cross fields skills?

If you display the main competencies under a particular critical cross field skill, then you would possess that skill.

#### 4.2.1 Problem identification and evaluation

This skill should enable you to:

- Identify when something is wrong
- Predict when something may go wrong

#### 4.2.2 Problem solving

In order to understand an issue, you should be able to:

- Gather the necessary information
- Interpret it
- Decide on the correct action to take to resolve it





### **4.2.3 Mathematics and numeracy**

This skill enables you to:

- Use mathematics to solve problems
- Perform the basic mathematical functions, quickly and correctly

### **4.2.4 Literacy and language**

This skill should enable you to:

- Read and understand information and ideas presented in written form
- Have knowledge of content and structure of languages, e.g. correct grammar, rules of composition, and correct meaning and spelling of words

### **4.2.5 Interpersonal skills**

This skill enables you to:

- Listen carefully and understand points being made by others
- Pay full attention to what others are saying
- Avoid interrupting at inappropriate times
- Ask appropriate questions

### **4.2.6 Conflict management**

This skill should enable you to:

- Take corrective action to resolve conflict in a way that addresses the issue and maintains the relationship
- Remain non-biased and open to the viewpoints of all persons involved in a conflict
- Ask the correct questions in order to clarify situations in an effective way

### **4.2.7 Teamwork**

This skill enables you to:

- Involve others in team decisions
- Share essential information with the team
- Make key and useful suggestions that help the team to achieve goals
- Make use of the diverse talents within the team



## 5. Planning a Career in the Mining and Minerals Sector

When planning a career in the mining and minerals sector, there are certain things to consider.

### 5.1 Will the career suit my lifestyle?

An important question to ask yourself is whether the careers you have identified will give you the lifestyle you ultimately desire. This means doing some groundwork by speaking to people who are already involved in the careers that interest you. Questions about the intensity of the job and the general demands within it will give you a clearer picture about what would be expected of you. It is also important to find out from the people employed in those careers what they like and dislike about their jobs.

In order to find out what the possible earning potential could be in the careers you are considering, regularly scan through job advertisements in newspapers as well as on the internet. The number of job advertisements being placed for each career is an indication of the number of vacancies available.

### 5.2 What am I good at doing?

Subjects on offer at tertiary level often build on skills and knowledge that you have developed at school. This will serve as a helpful guide in choosing which career path you would like to follow. Engineering studies requires knowledge of mathematics and science. If these subjects are your strengths and you enjoy them, then perhaps a career in engineering would be a good choice. Always remember to use your best school subjects as a guide in identifying what you are good at, but do not limit yourself to that alone.

### 5.3 Do I qualify?

Identifying whether you qualify for a particular programme is essential to avoid wasting precious time. Always consider what the minimum requirements of the programmes are in order to get you aligned to meet the entrance criteria, e.g. if a programme requires science at higher grade and you only have standard grade, you cannot expect to be considered for acceptance into that programme.

If you really want to enter a certain field but do not meet the required criteria, you can consider completing a bridging programme. Many institutions have specially designed access programmes to help learners from disadvantaged schools who do not meet the entry requirements. Contact the institutions you are considering and find out more about applying for their access programmes.

### 5.4 Choosing a qualification

Once you have chosen the field you want to study in, it is important to establish that the skills development and education provider you choose is accredited and offers recognised and accredited training. The skills development providers include occupational or work-based providers, universities and technical colleges.

### 5.5 Choosing the right institution

When choosing where you want to study, different options are at your disposal.





- **Occupational Providers**

Occupation specific certificates and awards based on integrated workplace and institutional learning

- **University**

Higher education, largely academic, with little practical experience; qualifications obtained: degrees

- **University of Technology**

Academic and practical tuition that includes compulsory experiential education in the industry; qualifications obtained: National Diplomas, BTech, MTech and DTech degrees

- **Technical Vocational Education and Training Colleges**

Vocation-specific tuition with a great deal of practical tuition; qualifications obtained: diplomas and certificates.

## 6. Scarce Skills

### 6.1 Understanding Scarce Skills

What are scarce skills? The Department of Labour (DoL) defines scarce skill as those occupations where there is a scarcity of qualified and experienced people, currently or anticipated in the future. This may be either due to the scarcity of such skilled people or where available, do not meet the employment criteria.

#### Why the scarcity?

This scarcity can arise from various factors grouped as relative or absolute scarcity.

#### Absolute scarcity

Absolute scarcity implies that suitably skilled people are not available. Examples of these are:

- The occupation is so new that education and training providers have not developed learning programmes to service the skill requirements and therefore nobody is qualified to fill the posts
- Organisations, sectors and even the country is unable to meet and implement the planned growth strategies and experience, productivity, service delivery and quality problems, because of a lack of skilled people
- There are no learners enrolled or in the process of acquiring these scarce skills

#### Relative scarcity

Relative scarcity implies that suitably skilled people are available but do not meet other employment criteria. There are many reasons why relative scarcity exists.

- The opportunity is in a remote or unpopular location; therefore, individuals are unwilling to work outside of urban areas
- Companies cannot fill the positions in line with their employment equity targets, i.e. there are few if any candidates with the requisite skills (qualifications and experience) from the historically disadvantaged group available



- Even though there are learners currently enrolled and in the process of acquiring the scarce skills (qualification and experience), the lead time before these potential candidates are qualified is so long that the sector will experience a scarcity in the short term.

The Scarce Skills of 2017 - 2016 highlighted that although the industry was growing, there were still key positions to be filled due to a skills shortages.

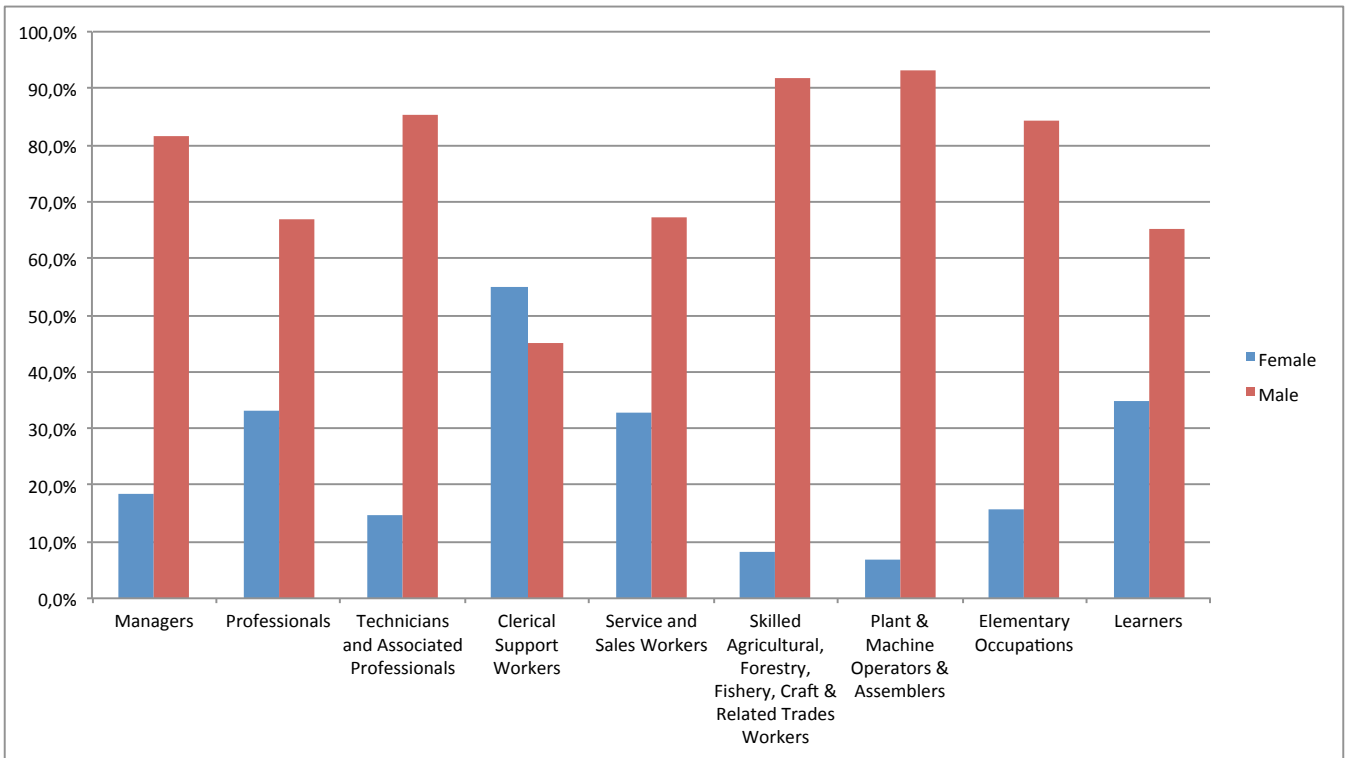
**The ongoing question is why the shortage of skills exists when there are so many students graduating annually?**

It is true that there are many people who complete certificates, diplomas or degrees, but they frequently do not choose a field of study that is in demand by the economy. It is therefore important to identify potential employment opportunities when making a study choice. Knowing what the scarce skills are within a sector definitely helps to make the right career choice.

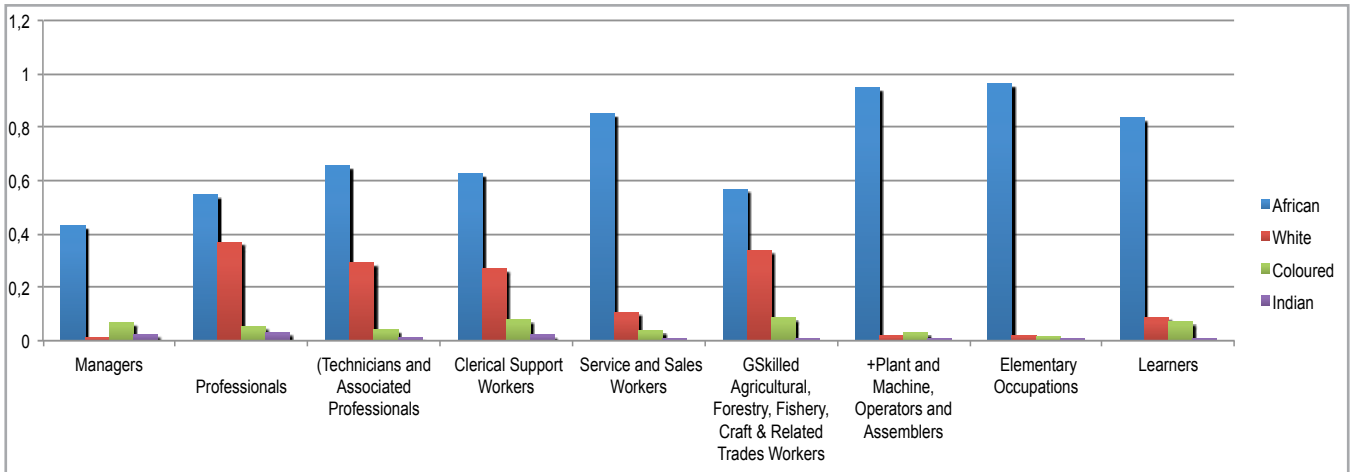
**6.2 Scarce Skills within the Mining and Minerals Sector**

Table 6-1 below shows the mining and minerals sector’s top 10 hard to fill occupations extracted from the 2015-2016 Regional Sector Skills Plan (RSSP). The greatest scarcity in the sector is amongst technicians, trade workers, machine operators, drivers and professionals in various occupations.

Hard to fill occupation	OFO code	Reason(s) / challenge
Mining Manager	132201	Geographic location, high salary, lack of management skills, MMCC
Mine Planner	132202	Lack of planning and sector experience, lack of HDSAs
Mining Engineer	214601	Geographic location, high salary, lack of HDSAs, lack of GCC
Rock Engineer	214601	Geographic location, lack of career awareness at university
Surveyor	216502	Geographic location, lack of experience, lack of GCC
Rigger Ropesman	651501	Lack of roping skills, low interest from learners
Diesel Mechanic	653306	Lack of knowledge and experience in updated technology, lack of electrical knowledge. Becoming scarce.
Boilermaker	651302	Lack of updated technology, declining interest from learners, declining throughput rates at college, low maths levels
Instrumentation Mechanic	672105	Lack of knowledge and experience in updated technology
Fitter	652301	Lack of knowledge and experience in updated technology



6-2: Gender breakdown of employees (in %) by occupational category (Year: 2016)



6-3: Employment equity breakdown (in %) by occupational category (Year: 2016)



## 7. Occupational Categories

### 7.1 Work opportunities in the Mining and Minerals Sector

The Mining Qualifications Authority Scarce Skills list for the mining and minerals sector (2008) identified a number of career opportunities within each of the occupational categories. The core categories together with their respective career opportunities for those occupations where 10 or more employees are needed in the sector are listed in Table 7-1 below.

Occupational Categories indicated with a triangle (▲) refer to the Organising Framework for Occupations (OFO).

NQF level	Occupational category	Ladder	E N T R Y
10 9 8 7	Category 1 and 2 Managers and Professionals	Production Manager; Mining Engineer/ Technologist	
6 5	Category 3 Technicians and Trades Workers	Mining Technician	
4 3	Category 7 Machine Operators and Drivers	Driller; Miner	
2 1	Category 8 Elementary Workers and Labourers	Mining Support Worker	

*Table 7-1 Career development in the mining and minerals sector*

There are many careers to choose from in the mining and minerals sector. The occupations indicated with an asterisk (\*) in this chapter will be discussed in more detail in chapters 10 and 11.

#### 7.1.1 Managers

Managers in the mining and minerals sector often include technical managers such as production, operations, health and safety, site managers as well as non-technical managers who provide financial, legal, medical and other services associated with an industry that has assets worth billions of rands. Most of the managers are current and former professionals such as engineers or accountants who accepted managerial positions in the mining and minerals sector. The managers are:

- Engineering managers
- Financial managers
- Operations managers
- Production/Operations managers (Mining)\*
- Research and Development managers







### 7.1.2 Professionals

The mining and minerals sector has many work opportunities for technical professionals in the mining, mechanical, electrical and metallurgical engineering fields. The sector also employs professionals such as geologists, chemists, surveyors and metallurgists who play a supportive role in the extraction and processing of minerals. This sector also needs many non-technical personnel to provide financial, personnel, legal and other services.

The professionals are:

- Accountants (General)
- Chemical Engineers (\*)
- Chemical Engineering Technologists
- Chemists
- Civil Engineers
- Economists
- Electrical Engineers (\*)
- Electrical Engineering Technologists
- Environmental Health Officers
- Geologists (\*)
- Geophysicists
- Health Promotion Officers
- Human Resources Advisors
- Management Accountants
- Mechanical Engineers (\*)
- Metallurgical Engineers (\*)
- Mining Engineers (excluding Petroleum)\*
- Mining Engineering Technologists
- Occupational Health and Safety Advisors\*
- Surveyors \*
- Training and Development Professionals

### 7.1.3 Technicians and trades workers

Mining engineering technicians and trades worker (artisans) work alongside engineers in overseeing operations at a mine. Mining engineering technicians and artisans can be involved in exploration, production and management. Some specialise in a particular area such as mine development, safety, production, design, ventilation, water supply and maintenance of equipment. They can also specialise in technical activities relating to the mining of a particular mineral or metal.



#### **7.1.4 Machinery operators and drivers**

In the mining and minerals sector, expensive and technologically advanced equipment is used to carry out under ground and surface operations. Safety and cost efficiency are important concerns. Automation, mechanisation and computer technology are used to contain and reduce costs, improve efficiency and maximise production. The operators of equipment play a pivotal role in the smooth running of mining operations.

The operators and drivers are:

- Boiler or Engine Operators
- Bulldozer Operators
- Drillers
- Earthmoving Plant Operators
- Excavator Operators
- Loader Operators
- Miners
- Train and Truck Drivers (General)

#### **7.1.5 Elementary workers/labourers**

Many workers begin their career in the mining and minerals sector in the category of elementary workers/labourers.

The elementary workers/labourers are:

- Construction Rigger
- Driller's Assistant
- Earthmoving Worker
- Handyperson
- Mining Support Worker



## 7.2 Mainstream career paths

Figures 7-2, 7-3 and 7-4 show the typical mainstream career paths that may be followed within a company in the mining and minerals sector; highlighting the educational and experiential requirements for the particular position, as well as the approximate time frames to progress to the next position.

Position	Position Requirements	Time Frame	Mentor
Senior Foreman	Grade 12; Best Management Practices; First Line Management; Drivers License; Coal Preparation Certificate	±4 years	Head or Superintendent
Foreman	Grade 12; Best Management Practices; First Line Management; Drivers License; Coal Preparation Certificate	±2 years	Head or Superintendent
Senior Operations Controller	Grade 12; Best Management Practices; First Line Management	±2 years	Foreman or Head
Operations Controller	Grade 12; Best Management Practices	±12 months	Foreman
Operator	Grade 12; Experience	±12 months	Foreman

Figure 7-2 Mainstream Career Path: Operator to Foreman

Position	Position Requirements	Time Frame	Mentor
Plant Production Manager	B Eng; Metallurgy or BTech; Metallurgy	±4 years	Plant Manager
Foreman	National Diploma	±3–6 years	Plant Production Manager or Plant Manager
Foreman	Grade 12; Best Management Practices; First Line Management; Drivers License; Coal Preparation Certificate	±4 years	Head or Superintendent

Figure 7-3 Mainstream Career Path: Foreman to Plant Production Manager



Position	Position Requirements	Time Frame	Mentor
Plant Manager/Chief Process Engineer	B Eng: Metallurgy or BTech; Masters in Business Administration (MBA) recommended; ECSA registration recommended	±6–8 years	Mining Manager or General Manager
Senior Process Engineer	B Eng: Metallurgy or BTech plus 5 years experience	±5–6 years	Process Development Manager
Process Engineer	National Diploma plus Metallurgy	±3 years Senior Process Engineer or Process Development Manager	Senior Process Engineer or Process Development Manager
Master Technician	National Diploma: Metallurgy	±2 months	Senior Process Engineer or Process Development Manager

Figure 7-4 Mainstream Career Path: Master Technician to Plant Manager

The above career paths are based on traditional learning processes that have largely ignored the knowledge that has been gained through work based (on the job) occupational learning. This is set to change over the next few years as the newly established Quality Council for Trades and Occupations (QCTO) coordinates the development of qualifications and career paths based on work-based learning.

## 8. Understanding Qualifications in the Mining and Minerals Sector

### What qualifications do you need to be employed in the mining and minerals sector?

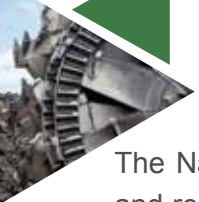
The Mining Qualification Authority and the mining and minerals sector are geared to up-skill all employees, to grow the industry, and to meet social development goals. In order to be employed within the mining and minerals sector, you do not need a formal qualification for all careers. It is however advantageous to have a qualification. Different qualifications will influence career choices. Knowledge about qualifications and how far they can take you is important to furthering yourself in a chosen career. It is very helpful to understand the qualifications framework within the mining and minerals sector that is indicated in the National Qualifications Framework.

#### 8.1 The National Qualifications Framework (NQF)

The National Qualifications Framework Act No. 67 of 2008, which provides for the development and implementation of the National Qualifications Framework, co-ordinates all education and training in the country. The NQF is a means for transforming the education and training in South Africa and has been designed to:

- Implement an integrated national framework for learning achievements
- Facilitate access to, and mobility and progression within education, training and career paths
- Enhance the quality of education and training
- Accelerate the redress of past unfair discrimination in education, training and employment opportunities
- contribute to the full personal development of each learner, as well as and the social and economic development of our nation





The National Qualifications Framework is essentially a quality assurance system with the development and registration of standards and qualifications as a critical outcome in implementing a quality education and training system in South Africa. It adopts the approach that education and training must be outcomes and credits based life-long learning that integrates theory and practice.

**There are two categories of outcomes:**

### **Learning outcomes**

These relate to a learning situation and describe what learners should know and be able to demonstrate at the conclusion of a learning intervention.

### **Critical cross field outcomes**

These are broad and generic outcomes that are applicable to all learning situations. They help to achieve coherence in the education and training system and describe life skills used everywhere, everyday (see page 21).

The National Qualifications Framework is organised as a series of levels arranged in ascending order from level one (1) to level ten (10).



## Understanding Qualifications in the Mining and Minerals Sector

Figure 8-1 illustrates the ten-level structure.

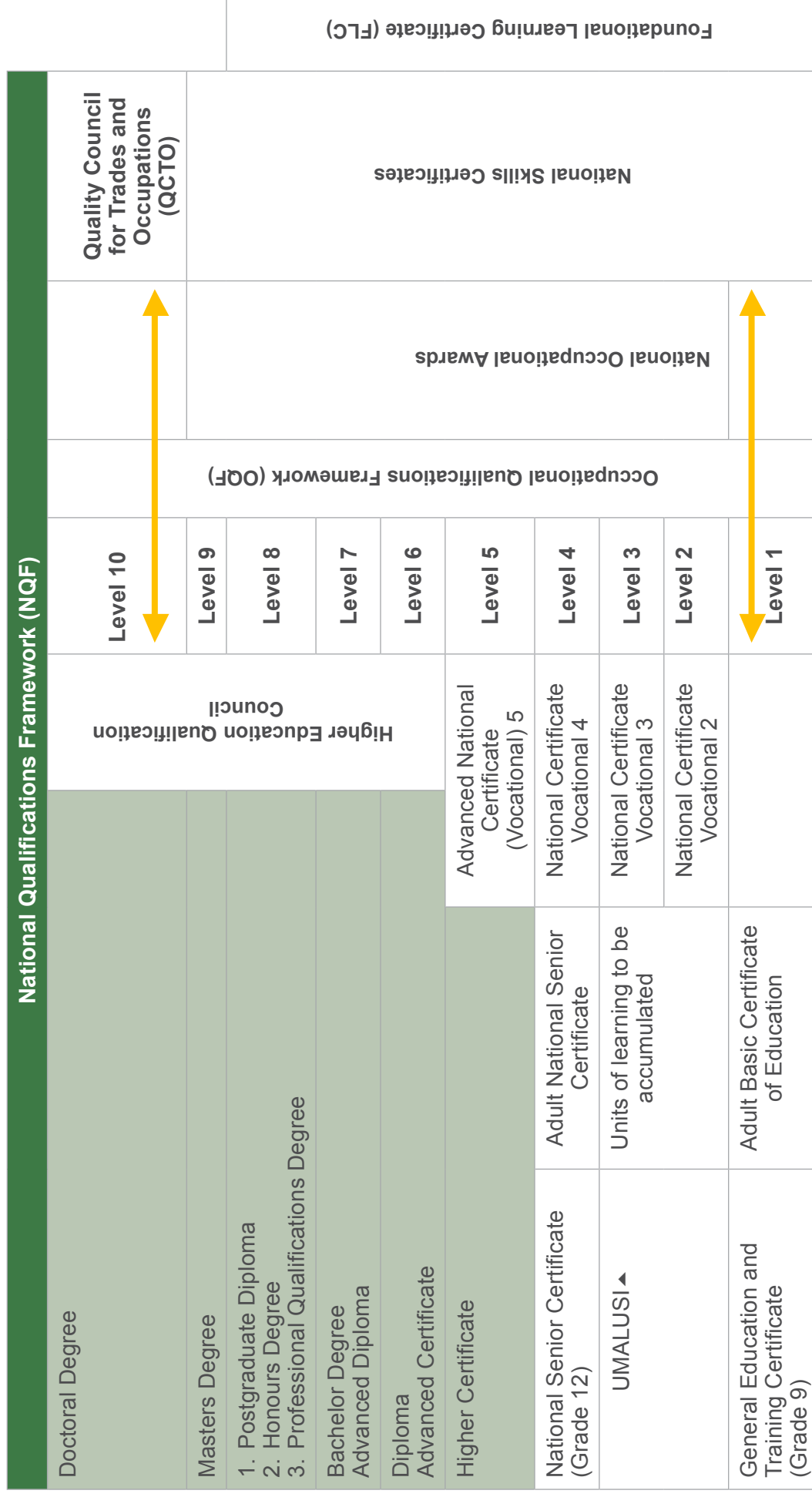


Figure 8-1 The 10-Level National Qualifications Framework (NQF) Architecture

▲ UMALUSI is a statutory organisation which sets and monitors standards for basic education schooling in South Africa with the purpose of continually enhancing the quality of education.



## 8.2 The Organising Framework for Occupations (OFO)

The Organising Framework for Occupations (OFO) identifies the set of occupations covering all jobs in the South African labour market. It defines these according to their attributes and groups them on the basis of similarity in terms of skills level and specialisation into successively broader categories or hierarchical levels.

Skills specialisation is determined on the basis of:

- Field of knowledge required
- Tools and equipment used
- Materials worked on or information worked with and
- Goods or services produced or provided

There are five coding levels defined in the Organising Framework for Occupations (Figure 8-2 illustrates the OFO Structure):

- Major group (first digit) - These are differentiated on the basis of fundamental application of skill specialisation and provide an extremely broad indication of the skill level
- Sub-major group (second digit) - This is made up of minor groups that have a slightly narrower application of skills specialisation. Data collected at this level is generally suitable for analysing of skill level
- Minor group (third digit) - These are distinguished from each other mainly on the basis of the application of the skill specialisation
- Unit group (fourth digit) – These are made up of similar occupations with the same skill level and similar skill specialisations. Data collected on this level provides an accurate reflection of the skill level and most qualifications will be at this level
- Occupation (fifth and sixth digit) – The distinction between occupations amounts to differences between tasks performed.



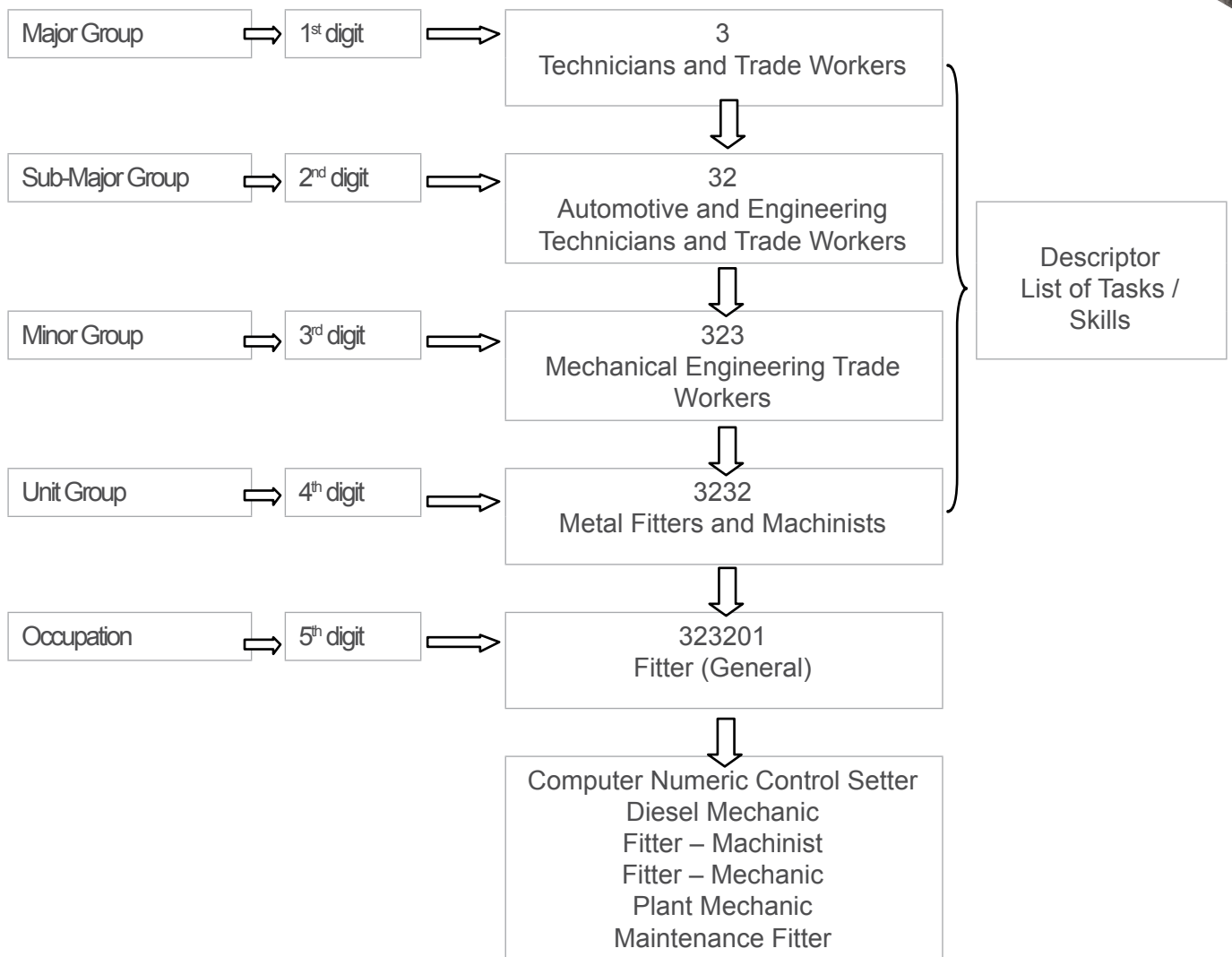


Figure 8-2 Structure of the Organising Framework for Occupations (OFO)

Skills levels are determined by the level or amount of formal education and training, amount of previous experience in a related occupation and/or amount of on-the-job training required to competently perform the set of tasks required for that occupation.

There is a very close correlation between the Organising Framework for Occupations (OFO) and the National Qualifications Framework (NQF). This makes it relatively easy to match jobs and their required skills to qualifications. Figure 8-3 below shows the relationship between the OFO and the NQF.

The five Organising Framework for Occupation Skill Levels are defined in terms of formal education and training, previous experience and on-the-job training. The boundaries between skill levels are defined by:

- Occupations at Skill Level 1 have a level of skill commensurate with an NQF level 1 qualification or compulsory secondary education. For some occupations, a short period of on-the-job training may be required in addition to-or instead of-the formal qualification.
- Occupations at Skill Level 2 have a level of skill commensurate with an NQF level 2 or 3 qualification, or at least one year of relevant experience. This year of experience might substitute for the formal qualification or be required in addition to them.



- Occupations at Skill Level 3 have a level of skill commensurate with an NQF level 4 or 5 qualification or at least three years of relevant experience. In some instances, relevant experience and/or on-the-job-training might be required in addition to the qualification.
- At Skill Level 4, a level of skill commensurate with an NQF level 5 or 6 qualification or at least three years of relevant experience is required. In some cases, relevant experience and/or on-the-job training is required in addition to the formal qualification.
- Occupations at Skill Level 5 require a formal NQF level 7 to 10 qualification or at least five years of relevant experience. Again, relevant experience and/or on-the-job training might be necessary to supplement the qualification.



NCF Level		OFO Skills Level And Experience		Occupational Categories	
10	5 Years experience might substitute formal qualification	5	1 Managers	2 Professionals	3 Technicians and Trades Workers
9					
8					
7					
6	3 Years experience might substitute formal qualification	4	5 Clerical and Administrative Workers	6 Sales Workers	4 Community and Personal Service Workers
5					
4					
3	1 Year experience might substitute formal qualification	2	7 Machinery Operators and Drivers		
2					
1	On the job training sufficient	1			

Figure 8-3 Relationship between the National Qualifications Framework (NQF) and Organising Framework for Occupation (OFO)



## Understanding qualifications in the mining and minerals sector

Table 8-1 shows an example of the Organising Framework for Occupations (OFO) codes used within the mining and minerals sector and their corresponding occupational titles.

OFO Code	Occupational Title
111207	Deputy Chief Inspector of Mines
121206	Safety Manager / Safety, Health and Environmental (SHE) Manager
132104	Engineering Manager / Engineering Manager (Mining)
132201	Production / Operations Manager (Mining) / Mine Manager
132202	Mineral Resources Manager
132202	Chief Surveyor (Mining) / Chief Surveyor / Survey Manager
132203	Rock Engineering Manager
134901	Environmental Manager / Conservation Science Manager / Wild Life Protection Services Manager
211301	Chemist / Industrial Chemist/ Manufacturing Chemist / Laboratory Chemist / Analytical Chemist
211401	Geologist
211402	Geophysicist
211403	Materials Scientist
211404	Gemmologist
211405	Mineralogist
213302	Environmental Scientist / Environmental Research Scientist / Environmentalist
213305	Air Pollution Analyst
214101	Industrial Engineer / Manufacturing Technology Engineer / Manufacturing Technology Engineer
214601	Mining Engineer
214601	Rock Engineer
214601	Marine Mining Engineer
214601	Mine Ventilation Engineer
214602	Mining Engineering Technologist
214603	Metallurgical Engineer
214604	Metallurgical Engineering Technologist
214605	Metallurgist
216502	Surveyor / Mine Surveyor

*Title 8-1: Occupational titles in the mining industry with corresponding OFO codes*



## 9. Learning Programmes

In terms of the Skills Development Act (SDA), No. 97 of 1998, the Mining Qualifications Authority (MQA) must establish, register, promote and administer learning programmes in the mining and minerals sector. Learning programmes include learnerships and skills programmes, as well as any other prescribed learning programme which includes a structured work experience component, such as internships.

### 9.1 Workplace Experience Programmes

#### 9.1.1 What is workplace experience?

This is a programme for unemployed learners who have not concluded their studies successfully with a qualification in a defined scarce and/or critical skill in the mining and minerals sector who then needs work place exposure in order to complete their employment opportunities.

#### 9.1.2 What is expected of a learner?

Learners who enter into this programme may be required to have a written endorsement of completion of the theoretical component of their qualification from their academic institution. They must complete a structured portfolio of evidence which is outlined by the university. Students should be able to meet all the requirements for their practical training component of their studies.

#### 9.1.3 What is expected of an employer?

Host employers will be required to give the learners structured work experience over a one-year period for a national diploma learner or two months for learners requiring vacation work. Learners requiring vacation work should be assigned relevant projects according to the university requirements. The Mining Qualifications Authority will pay a grant per learner to the host company, which should be used to cover the costs for allowances, accommodation, meals, training, coaching and mentoring, medical cover, insurance cover, personal protective clothing and any other costs incurred by the host employer.

#### 9.1.4 Identifying the company

Host employers will be selected on the basis of training and development infrastructure, sufficiently experienced coaches/mentors and the willingness to work within the Mining Qualifications Authority guidelines.

### 9.2 Internship Programmes

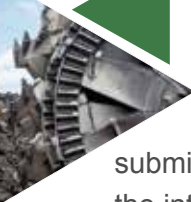
#### 9.2.1 What is an internship programme?

An internship is a programme for unemployed learners who want to improve their employment opportunities. These internship programmes are structured two-year job training, technical skills and soft skills such as teamwork, problem solving and time management.

#### 9.2.2 What is expected of an intern?

Interns are expected to display competence in assessment areas, tested by the employer and monitored by the Mining Qualifications Authority, and meet assessment standards set by the MQA. Interns must





submit reports to their employer on a monthly basis. On successful completion of the two-year programme, the intern could find permanent employment with their host company, but should that not be the case, the intern is expected to find employment in the mining and minerals sector and work in the sector for the same length of time as the internship programme (two years). Should the intern be unable to find work within six months of completion, the intern is released from their contractual obligations. In order to be selected, the candidates must meet certain selection criteria which include the following:

- Candidates must have a completed degree/diploma from a university or university of technology
- Candidates must be South African citizens
- Candidates must indicate an interest and suitability for the mining and minerals sector
- The courses of study which candidates have completed must be in line with the scarce skills list compiled by the Mining Qualifications Authority and
- Must not have benefited from prior internship programmes
- Females from previously disadvantaged communities will be given preference

### **9.2.3 What is expected of an employer?**

The employer is expected to sign a tripartite contract with the MQA and the intern, and is also expected to provide the MQA with quarterly training, financial and status reports signed by both the intern and the employer.

There are recommended guidelines from the Mining Qualifications Authority for the implementation of the internship programmes, such as assessment criteria and establishment of assessment tools, guidelines for initiation and induction of graduates and processes for record keeping and programme management.

### **9.2.4 Identifying the company**

Employers (host companies) are selected by the Mining Qualifications Authority and have to meet certain selection criteria. The criteria are as follows:

- Potential host companies must be paying skills development levies to the MQA
- Companies must also have the infrastructure and financial capacity necessary to deliver the programme according to the MQA requirements
- Companies must have sufficient qualified coaches and mentors in the relevant disciplines

## **9.3 Learnerships**

Learnerships provide training to a wide range of workers, from operators to artisans. Artisan occupations that occur most frequently in the mining and minerals sector are: Diesel Mechanics, Electricians, Fitters, Fitters and Turners, Instrument Mechanics, Millwrights, Plater/Boilermakers, Plater/Welders and Rigging Ropesman. Artisans in the sector receive training via learnerships.

Traditionally artisans were trained in the mining and minerals sector on “apprenticeship” contracts. The Skills Development Amendment Act, No. 37 of 2008, under definitions indicates that an apprenticeship means a learnership, when referring to a listed trade and includes a trade test in respect of a trade. In compliance with this definition, the Mining Qualifications Authority implements learnerships for artisan



development, although they can be considered apprenticeships. This in essence means that for an artisan trade, a “Learnership” is equal to an “Apprenticeship”.

### 9.3.1 What is a learnership programme?

A learnership is a work-based learning programme that combines structured on-the-job learning, practical off-the-job learning and institutional (theoretical) learning, and leads to a NQF registered qualification. It is governed by a contract (learnership agreement) between the employer, an accredited training provider, and the learner. An employer can enter into learnership agreements with existing employees or with learners who are not employees. If the employer enters into a learnership agreement with a learner who is not an employee, the employer is not obliged to employ the learner when the learnership ends.

Learnerships are directly related to an occupation or field of work, for example electrical engineering, jewellery manufacturing or welding. The MQA manages learnerships for the mining and minerals sector.

A learnership programme is required to adhere to the following criteria:

- Be registered with the Department of Higher Education and Training (DHET)
- Have structured practical learning and institutional learning components
- Leads to a qualification registered on the National Qualifications Framework (NQF)
- Have a practical work experience component of a specific nature and duration
- Be related to an occupation that is listed on the Organising Framework for Occupations (OFO)

The end of a learnership will culminate in a qualification registered on the NQF. A learnership provides a learner with an excellent opportunity to gain experience in the labour market while studying towards a qualification.

### 9.3.2 What is expected of a learner?

A learner who enters into a learnership agreement is expected to:

- Participate in induction programmes
- Work for the employer as part of the learning process
- Register with a training provider for the practical and theoretical training
- Participate in all learning and work experience required by the learnership
- Comply with the employer’s workplace policies and procedures
- Complete any timesheets/logbooks or written assessment tools supplied by the employer or the training provider
- Attend all study periods and theoretical learning sessions with the training provider
- Undertake all learning conscientiously and set aside sufficient time for self-study
- Undergo all practical and theoretical assessments for the learnerships





### 9.3.3 What is expected of an employer?

An employer who enters into a learnership contract with one or more learners has to:

- Be accredited as a workplace training provider with the Sector Education and Training Authority (SETA) to which s/he pays his/her skills development levy (SDL)
- Recruit and select learners for the learnership
- Provide the learners with the necessary workplace experience, supervision and mentorship for the particular learnership
- Release the learners to attend training at the training provider or, if the learners study through distance education, to work through the relevant study material
- Ensure that the learners are assessed by a registered assessor

### 9.3.4 Learnership Agreement

The learnership agreement is formally registered by the Mining Qualifications Authority. A learnership agreement is a contractual obligation between a learner, an employer and an accredited training provider. It is signed by all three parties prior to the implementation of the learnership.

### 9.3.5 How to access Mining Qualifications Authority's learnerships

In order to access learnerships, learners need to do the following:

- If employed, learners should contact their company human resource professionals for information
- If unemployed, learners should register with the Department of Labour (DoL) centre as work seekers by completing their area of interest. If the minimum criteria of the learnership of a specific employer have been met, the labour centre will contact the learner

Table 9-1 below contains the list of learnerships designed by the Mining Qualifications Authority which are registered with the Department of Higher Education and Training

Type of learnership	NQF level
Level 2	
Engineering Maintenance for Underground Hard Rock (Metalliferous) – Stoping and Developing	2
Engineering Maintenance for Underground Hard Rock (Metalliferous) – Horizontal Transport	2
Engineering Maintenance for Underground Hard Rock (Metalliferous) – Horizontal Transport Services	2
Diamond Processing – Operator Bottom Makeable	2
Diamond Processing – Operator Bottom Sawn	2
Diamond Processing – Operator Top Sawn	2
Engineering Maintenance for Underground Coal Breaking Services	2
Engineering Maintenance for Underground Coal Wall Mining	2
Engineering Maintenance for Underground Coal Continuous Mining	2
Engineering Maintenance for Underground Coal Conventional Mining	2



Type of learnership	NQF level
Underground Hard Rock Narrow Tabular	2
Surface Mining Rock Breaking	2
Lump Ore Beneficiation: Dense: Medium Separation Coal	2
Lump Ore Beneficiation: Dense Medium Separation: Diamonds	2
Lump Ore Beneficiation: Dense Medium Separation: Heavy Minerals	2
Occupational Safety, Hygiene and Environmental	2
Mining Operations Underground Hard Rock – Conventional Mining	2
Mining Operations for Underground Hard Rock – Mechanised Mining	2
Engineering Fabrication	2
Rock Engineering Strata Control Operations UG Coal Mining	2
Rock Engineering Strata Control Operations Underground Hardrock Mining	2
NC Rock Engineering Strata Control Underground Hardrock Massive Mining	2
Rock Engineering Strata Control Operations – Surface Mining	2
Mineral Processing – Sands	2
Mineral Processing – Gold	2
Mineral Processing – Lump Ore	2
Mineral Processing – Platinum	2
Mineral Surveying	2
Mineral Sampling	2
Metals Production	2
Automotive Repair and Maintenance	2
Mining Technical Support (Geology)	2
Laboratory Practices (General Laboratory Practice)	2
Laboratory Practices (Precious Metal Laboratory Practice)	2
Laboratory Practices (Coal Laboratory Practice)	2
Measurement Control and Instrumentation	2
Chemical Operations	2
Production Management (Cement Manufacturing)	2
Introduction to the Jewellery Production, Environment	2
Mineral Processing (Mineral Sands)	2
Occupational Health and Safety	2
Mineral Surveying	2
Mineral Sampling	2
Metals Production	2
Automotive Repair and Maintenance	2
Mining Technical Support (Geology)	2





Type of learnership	NQF level
Level 3	
Rigging Ropesman (Generalist)	3
Rigging Ropesman (Open Cast)	3
Diesel Mechanic – Underground Diamonds	3
Diesel Mechanic – Coal	3
Diesel Mechanic – Metalliferous	3
Diesel Mechanic – Surface Diamonds	3
Plater Welder (Underground Diamonds)	3
Plater Welder (Coal)	3
Plater Welder (Metalliferous)	3
Plater Welder (Open Cast Diamonds)	3
Rigging Ropesman (Generalist)	3
Rigging Ropesman (Open Cast)	3
Diesel Mechanic – Underground Diamonds	3
Diesel Mechanic – Coal	3
Diesel Mechanic – Metalliferous	3
Diesel Mechanic – Surface Diamonds	3
Plater Welder (Underground Diamonds)	3
Plater Welder (Coal)	3
Plater Welder (Metalliferous)	3
Plater Welder (Open Cast Diamonds)	3
Rigging Ropesman (Generalist)	3
Rigging Ropesman (Open Cast)	3
Diesel Mechanic – Underground Diamonds	3
Plater Boilermaker (Opencast)	3
Plater Boilermaker (Coal)	3
Plater Boilermaker (Metalliferous)	3
Plater Boilermaker (Diamond Opencast)	3
Fitting (Including Machining): Underground Diamonds	3
Fitting (Including Machining): Underground Coal	3
Fitting (Including Machining): Surface Coal	3
Fitting (Including Machining): Hardrock Metalliferous	3
Fitting (Including Machining): Surface Diamonds	3
Fitting and Turning (Underground Diamonds)	3
Fitting and Turning (Underground Coal)	3
Fitting and Turning (Open Cast Coal)	3
Fitting and Turning (Metalliferous)	3
Fitting and Turning (Surface Diamonds)	3





Type of learnership	NQF level
Diesel Mechanic (Open Cast)	3
Continuous Miner Operations Underground Coal	3
Fitting (Including Machining) (Open Cast)	3
Fitting and Turning (Open Cast)	3
Plater / Welder (Open Cast)	3
Diesel Mechanic (Open Cast)	3
Fitting (Including Machining) (Open Cast)	3
Fitting and Turning (Open Cast)	3
Fitting (Including Machining): Hardrock Metalliferous	3
Fitting (Including Machining): Surface Diamonds	3
Fitting and Turning (Underground Diamonds)	3
Fitting and Turning (Underground Coal)	3
Fitting and Turning (Open Cast Coal)	3
Fitting and Turning (Metalliferous)	3
Fitting and Turning (Surface Diamonds)	3
Diesel Mechanic (Open Cast)	3
Fitting (Including Machining) (Open Cast)	3
Fitting and Turning (Open Cast)	3
Plater/Welder (Open Cast)	3
Winding Engine Driving	3
Underground Hard Rock Narrow Tabular	3
Occupational Safety, Hygiene and Environmental	3
Mineral Processing, Gold Extraction	3
Mining Operations Specialisation – Blasting Operation Wall Mining	3
Electro-Mechanics	3
Rockbreaking Underground Hard Rock – Mechanised Mining	3
Rockbreaking Underground Hard Rock – Conventional Mining	3
Engineering Fabrication	3
Diamond Processing – Preparation	3
Diamond Processing – Cutting	3
Diamond Processing – Bottom Polishing	3
Diamond Processing – Top Polishing	3
Diamond Processing – Automatic Polishing	3
Rockbreaking for Underground Hardrock	3
Rock Breaking Surface Excavation – Quarrying Operation	3
Rock Breaking Surface Excavation – Dimension Stone Operations	3
Mineral Processing – Lump Ore	3
Mineral Processing – Platinum	3





Type of learnership	NQF level
Mineral Processing – Gold	3
Mineral Processing – Base Metal	3
Mineral Processing – Mineral Sands	3
Metals Production	3
Rock Engineering (Massive Mining)	3
Rock Engineering (Surface Mining)	3
Rock Engineering (Underground Coal Mining)	3
Mineral Processing (Uranium)	3
Lamproom Operations	3
Underground Hard Rock Narrow Tabular	3
Occupational Safety, Hygiene and Environmental	3
Mineral Processing, Gold Extraction	3
Mining Operations Specialisation – Blasting Operation Wall Mining	3
Electro-Mechanics	3
Rockbreaking Underground Hard Rock – Mechanised Mining	3
Rockbreaking Underground Hard Rock – Conventional Mining	3
Engineering Fabrication	3
Diamond Processing – Preparation	3
Diamond Processing – Cutting	3
Diamond Processing – Bottom Polishing	3
Diamond Processing – Top Polishing	3
Diamond Processing – Automatic Polishing	3
Rockbreaking for Underground Hardrock	3
Rock Breaking Surface Excavation – Quarrying Operation	3
Rock Breaking Surface Excavation – Dimension Stone Operations	3
Mineral Processing – Lump Ore	3
Mineral Processing – Platinum	3
Mining Operations Specialisation: Blasting Operations – Underground Coal	3
<b>Level 4</b>	
Instrumentation Mechanician	4
Lump Ore Beneficiation: Jig Concentration	4
Occupational Safety, Hygiene and Environmental	4
Minerals Surveying	4
Carbonate Materials Manufacturing Process (Lime Manufacturing)	4
Carbonate Materials Manufacturing Process (Cement Manufacturing)	4
Jewellery Manufacturing Operations	4
Gemstone Setting	4
Electro-Mechanics	4





Type of learnership	NQF level
Electro-Mechanics	4
Engineering Fabrication	4
Jewellery Design	4
Metals Production	4
Measurement, Control and Instrumentation	4
Diamond Design and Evaluation (Rough Evaluation)	4
Diamond Design and Evaluation (Basic Marking)	4
Diamond Design and Evaluation (Grading Polished)	4
Diamond Design and Evaluation (Inspection)	4
Diamond Processing (Parting by Sawing)	4
Diamond Processing (Bruting)	4
Diamond Processing (Crossworking)	4
Diamond Processing (Brilliantteering)	4
Diamond Processing (Fancy Stone-Making)	4
Mineral Processing	4
Automotive Repair and Maintenance	4
Measurement Control and Instrumentation	4
Chemical Operations (Mineral Extraction and Refining)	4
Chemical Operations (Sulphuric Acid)	4
Jewellery Manufacturing in a Production Environment	4
Mining Operations (Underground Hardrock)	4
Surface Excavations (Blasted Route)	4
Strata Control Operations	4
Mining Operations – Surface Excavations (Non-Blasted Route)	4
Mining Operations (Underground Coal)	4

*Table 9-1 List of MQA registered learnerships*

## 9.4 Skills Programmes

### 9.4.1 What is a skills programme?

A skills programme is a structured training programme that comprises an agreed cluster of unit standards (credits towards a registered qualification). The design of the programme may specify the sequence in which the unit standard must be achieved and the practical (workplace) experience that forms part of the programme. A skills programme, when completed, may constitute credits towards a NQF registered qualification. This means that some or all of the unit standards in the skills programme form part of the list of unit standards comprising a qualification. Credits obtained during the course of a skills programme will thus constitute credits towards the qualification.



Skills programmes form an important part of the training and development of the occupational groups, namely plant and machine operators, assemblers, labourers and related workers. Many of the skills programmes registered by the Mining Qualifications Authority provide learning towards the competencies specified in the Mine Health and Safety Regulations.

#### 9.4.2 How to access the Mining Qualifications Authority's skills programmes

Employees should contact their human resources professionals for information on skills programmes registered with the Mining Qualifications Authority. If an employee identifies a registered skills programme relevant to their work, they should request of their employer to be trained in the identified skills programme.

Table 9-2 contains the list of skills programmes designed by the Mining Qualifications Authority.

Programme description	Specialisation	OFO code
Competent Person A: To examine and declare a working place safe (Underground Coal Continuous Mining) (Version 2)	Underground Coal Mining	711101
Competent Person B: To install, maintain and remove any support in Underground Coal Mining Operations – Compressed Air/Hydraulic Support (Version 3)	Underground Coal Mining	711101
Competent Person B: To install, maintain and remove any support in Underground Coal Mining Operations – Compressed Air/Hydraulic Support (Version 3)	Underground Coal Mining	711101
Competent Person B: To install, maintain and remove any support unit in Underground Coal Mining Operations – Timber Support (Version 3)	Underground Coal Mining	711101
Skills Programme in Handling of Chemicals (Version 2)	Mineral Processing	711201
Basic Construction Materials Testing	CLAS	831305
Skills Programme in Solvent Extraction (Version 2)	Mineral Processing	711201
Competent Person B: To install, maintain and remove any support in Underground Coal Mining Operations - Roofbolter Machine Support (Version 3)	Underground Coal Mining	711101
Manufacture Indigenous Jewellery	Jewellery Manufacturing	712102
Skills Programme in Ore Reception	Mineral Processing	711201
Skills Programme in Gathering Arm Loader Operation in an Underground Coal Mine	Underground Coal Mining	711101
Continuous Mining Operations	Underground Coal Mining	711101
Tube Set Gemstones into Jewellery	Jewellery Manufacturing	712102





Programme description	Specialisation	OFO code
Chanel Set Gemstones into Jewellery	Jewellery Manufacturing	712102
Pave Set Gemstones into Jewellery	Jewellery Manufacturing	712102
Blasting Assistant Operations in Underground Coal Mines (Version 3)	Underground Coal Mining	711101
Skills Programme in Milling of Material (Version 2)	Metallurgy	711201
Slimes Reclamation (Version 1)	Metallurgy	711201
Skills Programme: Slimes Reclamation	Metallurgy	711201
Secondary Blasting Operations for Underground Hard Rock (Version3)	Underground Hardrock Mining	711101
Competent person A: The Examination and Declaring Safe of a Workplace in Underground Hard Rock Operations (Version 4)	Underground Hardrock Mining	711101
Blasting Assistant within Underground Hard Rock (Version 4)	Underground Hardrock Mining	711101
Operate Mining Machinery in an Underground Coal Mine	Underground Coal Mining	711101
Skills Programme in Crushing and Screening	CLAS	312102
Trackless Mobile Machine Operations – Underground Hardrock	Underground Hardrock Mining	711101
Rock Drill Operator in Underground Hardrock Mines	Underground Hardrock Mining	711101
Skills Programme in Flotation	Metallurgy	711201
Skills Programme for Small and Micro Businesses in the Diamond Processing Industry	Diamond Processing	661302
Skills Programme in Rough Sorting of Diamond Gemstones	Diamond Processing	661302
Skills Programme in Rough Evaluation of Diamond Gemstones	Diamond Processing	661302
Skills Programme in Laser Cutting of Diamond Gemstones	Diamond Processing	661302
Introduction to the Diamond Processing Industry	Diamond Processing	661302
Registry in the Diamond Processing Industry	Diamond Processing	661302
Generic Management for Middle Managers in the South African Mining and Minerals Sector	Generic Management	
Water Analysis in a Laboratory	Analytical Services	134902
Skills Programme in Crushing (Version 2)	Metallurgy	711201
Skills Programme in Crushing (Version 2)	Metallurgy	711201
Skills Programme in Scrubbing and Screening (Version 2)	Metallurgy	711201
Skills Programme in Water Reticulation	Metallurgy	711201
Skills Programme in Electrowinning	Metallurgy	711201
Skills Programme in Gold Elution and Carbon Regeneration	Metallurgy	711201
Skills Programme in Diamond Recovery	Metallurgy	711201
Skills Programme in a Relining of a Mill	Metallurgy	711201
Skills Programme in Grading Room Operator	Metallurgy	711201



Programme description	Specialisation	OFO code
Skills Programme in Backfilling	Metallurgy	711201
Skills Programme in Fabrication and Repair Equipment in Surface Operations	Engineering	671101
Produce mastermodels for re-production and Mass production	Jewellery Manufacturing	712102
Skills Programme in Jewellery Design, Quoting and Pricing	Jewellery Manufacturing	712102
Skills Programme in Mechanical Engineering Maintenance in Surface Operations	Engineering	671101
Skills Programme in Lifting and Moving of a Load in Surface Operations	Engineering	671101
Skills Programme in Clean up Castings and Manufacture Basic Jewellery	Jewellery Manufacturing	712102
Skills Programme in Computer Aided Design	Jewellery Manufacturing	712102
Skills Programme in Identify and Grade a Gemstone	Jewellery Manufacturing	712102
Skills Programme in Creating Moulds for Wax Casting Techniques	Jewellery Manufacturing	712102
Skills Programme in Perform Lapidary Procedures	Jewellery Manufacturing	712102
Skills Programme in Dense Medium Separation (Version 2)	Metallurgy	711201
Skills Programme in Thickening of a Slurry (Version3)	Metallurgy	711201
Skills Programme in Adsorption of Gold onto Activated Carbon (Version 2)	Metallurgy	711201
Skills Programme Primary Sample Preparation in an Analytical Laboratory	Analytical Services	134902
Skills Programme in Small Scale Mining: Quarrying	Small Scale Mining	214602
Skills Programme in Small Scale Mining: Safety, Health and Environment	Small Scale Mining	214602
Skills Programme in Small Scale Mining: Surface Mining	Small Scale Mining	214602
Skills Programme in Small Scale Mining: Underground Coal	Small Scale Mining	214602
Skills Programme in Small Scale Mining: Underground Hardrock	Small Scale Mining	214602
Skills Programme Occupational Health and Safety activities for: Part Time/ Workplace Representatives and Shop Stewards in the mining and minerals sector	Occupational Health and Safety	226302
Skills Programme: Copper Metal Production Process Operator		
Skills Programme: Base Metal Process Controller		
Skills Programme: Platinum Group Metals Process Controller		

Table 9-2 Mining Qualifications Authority (MQA) registered skills programmes



## **9.5. Adult Education and Training (AET) and Foundational Learning**

### **9.5.1 What is AET?**

The Mining Qualifications Authority promotes and incentivises the provision of Adult Education and Training (AET). AET provides learners in the mining and minerals sector, that have little or no formal schooling, an opportunity to achieve higher levels of literacy and numeracy and in so doing improve their general quality of life. It also provides them with the capacity to take advantage of the abundance of training and development opportunities in the mining and minerals sector.

Due to change in organisations and the nature of work within the mining and minerals sector, there is a growing need for a more educated workforce. The AET qualifications framework runs from AET level 1 through to AET level 4 (which is at the same level as an NQF 1 qualification). More than half (61%) of the workers in the mining and minerals sector are at qualification levels lower than AET level 4/NQF level 1. By engaging current employees in AET programmes, organisations can change the educational composition of their workforce.

The Adult Education and Training provides an avenue for the vast majority of employees within the mining and minerals sector to develop themselves and to address the skills shortage within the sector. The Mining Qualifications Authority supports AET through a special AET grant paid to mining and minerals sector organisations.

### **9.5.2 What is Foundational Learning?**

An emerging alternative to AET level 4 is a Foundational Learning Programme that allows a person with AET level 3 to learn and acquire enough mathematics and communication competencies to enter onto a specific occupational learning programme without requiring AET level 4.

The Foundational Learning Programme is designed and developed at NQF level 1 to 4, dependent on the level of occupation that the learner is learning for e.g. Diesel Mechanic = level 3, Millwright = level 4, etc.

## **10. Artisan Career Options in the Mining and Minerals Sector (MMS)**

### **10.1 Artisans**

#### **10.1.1 Overview of Artisans**

An artisan is needed if a tool needs to be made, a platform needs to be hoisted, a part needs to be manufactured and anything that requires welding. Artisans are the skilled technical workers that specialise across a variety of fields and drive industry in terms of engineering. They are seen as the backbone of any engineering or manufacturing based economy.

There is currently a shortage of qualified and experienced artisans across a number of disciplines within the mining and minerals sector.





## **Why is there a shortage of artisans?**

Too few learners enrol in artisan training programmes because of the lack of marketing of this field of work. We very seldom see artisans represented in the media and when they are, artisans are often misrepresented as dirty, unintelligent and badly paid. Another reason for the low numbers of learners applying to train as artisans is that admission into artisan training programmes requires learners to have mathematics and physical science results at the same level required for university admission. The learners who have results at that level, generally choose to study towards a professional qualification at a university because of the perception that this would provide them with the opportunity to attain a higher social status and higher income.

With the current and projected shortage of qualified artisans, new artisans are almost guaranteed to find employment. With the successful completion of their trade test, they will earn a good salary. The sector is therefore on a major drive to increase the number of learners registered in engineering learning programmes such as Fitting and Turning, Diesel Mechanic and Plater (Boilermaker), to name a few.

Traditionally, the artisan trade has been viewed almost as a “boys-only club”, due to it being very physically demanding. This has not stopped women from forging their way into trades, although female artisans are still a small percentage of the workforce.

### **10.1.2 Why choose the artisan career option?**

There are a great number of career opportunities for any learner who decides to pursue a trade qualification. Learners who are suited to become artisans would enjoy applying their knowledge to solve problems and achieve goals in a practical manner. Artisans enjoy working and making things with their hands.

### **What are some of the benefits of following the artisan career path?**

Learners who meet the criteria to become artisans can find valuable practical and theoretical experience. They may also enjoy a high likelihood of employment by registering in a learnership programme. Becoming an artisan does not limit the learner to always work within their specific trade. It is completely possible that an experienced artisan could move into a supervisory role; and from there on into various levels of management.

Due to the immediate and ongoing essential need for the practical skills of artisans in every sector of the economy, artisans are very well equipped to explore entrepreneurial pursuits by starting their own businesses, for example as plumbing or electrical contractors. The potential to start your own small business and join larger ones as a contractor is almost limitless.



## Artisan Career Options in the Mining and Minerals Sector

### Artisan Option: Millwright

#### Case Study

1. All his life, Dumisani enjoyed working with his hands. Whenever there was something to be fixed that involved practical work, Dumisani was first in line. As he grew up, he often admired his uncle who worked as an artisan at a mine. His uncle's stories inspired him and he decided that he too wanted to have a career as an Artisan in the MMS.
2. Due to personal setbacks, Dumisani was forced to leave school before he could matriculate in order to provide for his family. As he was passionate about working in the mining industry, his uncle was able to get him employed as a miner/general labourer at Impala Platinum.
3. Before long, his foreman and supervisor saw his willingness to learn and suggested that he apply for a learnership with the MQA to upskill himself. He applied and was successful. He realised early on that his real passion lay within the Millwright discipline.
4. Dumisani was an astute learner and knew that in order to make a real success of his career he needed to develop his critical cross field skills. Over the years, he honed his problem-solving skills and took part in leadership training programmes for self-development.
5. Once his learnership was completed, Dumisani was able to practice as a qualified and competent Millwright.
6. Dumisani has gone from strength to strength in his career. Currently he holds the position of Millwright Foreman within his team. He has been recognised to be a great leader and problem-solver of note. His duties entail: maintaining, reconstructing and installing heavy machinery, electrically driven machines and electronic control gear, supervising and motivating team members as well as providing apprentices with appropriate guidance and on the job training.

### 10.1.3 List of trade qualifications (artisans) registered on the NQF

The table below lists the Trade Qualifications registered on the National Qualifications Framework (NQF) for the mining and minerals sector.

Qualification	SAQA ID
National Certificate: Diesel Mechanic	23624
National Certificate: Electrical	23625
National Certificate: Fitting and Turning	23626
National Certificate: Fitting (including machining)	23627
National Certificate: Instrumentation Mechanician	23628
National Certificate: Plater/Boilermaker	23630
National Certificate: Plater/Welder	23631
National Certificate: Millwright	23633
National Certificate: Rigger Ropesman	23813

For each of the above “generic” trade qualifications, there are specialisations related to the actual working environment, such as surface, underground, coal, etc.

### 10.1.4 Packages and benefits

Artisan skills are important in all industries and many opportunities exist for permanent positions, freelancing, self-employment or contract work. Due to the nature of the artisan job, additional allowances may be offered over and above the normal base packages. The table below serves as a guideline for salaries within the artisan discipline.

Occupation	Minimum (R)	Maximum (R)
Diesel Mechanic	120,000	320,000
Electrician	120,000	280,000
Fitter and Turner (Incl. Machining)	120,000	270,000
Instrumentation Mechanician	120,000	300,000
Millwright	120,000	290,000
Plater (Boilermaker/Welder)	120,000	280,000
Rigger Ropesman	140,000	350,000

*Please note: packages and benefits vary from company to company. This is often dependent on factors such as company size, experience and qualification of workers.*

### Artisan Career Options in the Mining and Minerals Sector

Though there are many artisan careers that exist, there are seven specific ones that we will be focusing on in this guide, namely, Diesel Mechanic, Electrician, Fitter and Turner, Instrumentation Mechanician, Plater (Boilermaker and Welder), Millwright and Rigger Ropesman.



## 10.2 Diesel Mechanic

In the mining and minerals sector, diesel mechanics repair and maintain the diesel engines that power transportation equipment such as heavy trucks, as well as cranes and bulldozers.

Duties of the diesel mechanic include detecting engine trouble, taking apart an engine when necessary, replacing or repairing defective equipment/machinery parts and repairing mechanical and electrical faults in machinery. Diesel mechanics usually work with hand tools such as wrenches and pliers, as well as power tools such as welding equipment, jacks and hoists. They usually need to inspect, test and listen to defective equipment to identify malfunctions, using test instruments such as handheld computers, motor analysers, chassis charts and pressure gauges.

The experience of the diesel mechanic often helps them to locate a problem by listening to the noise in an engine, although electronic diagnosing equipment is normally used. Working conditions vary according to the place where mechanics are employed, but in most instances you can expect it to be greasy.

## 10.3 Electrician

Electricians provide a specialised skill to support operations and maintenance in the mining and minerals environment. An electrician installs, maintains and repairs electrical wiring, equipment, fixtures and electrical control systems.

They are usually required to assemble, install, test and maintain electrical wiring, equipment, appliances, apparatus and fixtures, using hand/power tools; connect wires to circuit breakers, transformers or other components; inspect electrical systems, equipment and components to identify hazards, defects and the need for adjustment or repair, and to ensure compliance with codes; advise management on whether continued operation of equipment could be hazardous; test electrical systems and continuity of circuits in electrical wiring, equipment and fixtures, using testing devices such as ohmmeters, voltmeters and oscilloscopes, to ensure compatibility and safety of systems; maintain current electrician's license to meet governmental regulations; plan layout and installation of electrical wiring, equipment and fixtures, based on job specifications and manufacturing standards; prepare sketches or follow blue prints to determine the location of wiring and equipment and ensure conformance to building and safety codes.

The skills of an electrician are in great demand and are essential in most industries. Down time or breakdowns on machines mean a loss of production and money. Trade individuals such as the electricians are under pressure to identify and repair faults as quickly as possible. Although in some environments electricians work shifts, usually normal day shift hours apply and the electrician is required to be on standby for callout after hours. This career path is one that is seen as being male-dominated; however, there are some women working in this industry.

## 10.4 Fitter and Turner (including Machining)

Fitters and turners manufacture, construct, assemble and fit components for machinery, vehicles, installations and other apparatus. They are also responsible for maintenance and repair. They select and mark off the material required according to exact measurements on blueprints, drawings or a model; shape the rough piece of metal into its final form with power-operated tools such as milling, drilling and planning







machines; fit the parts to complete the machine or article required; inspect and test the final assembly for true fit. The fitter and turner is a highly skilled craftsperson whose trade is essential to most industries.

The fitter and turner assembles production machinery parts and sub-assemblies. This involves plotting a construction or assembly process for production machinery, assembling and installing machines, troubleshooting, maintenance and repair work. This machinery may include manually or computer numerically controlled hydraulic and pneumatic equipment. Fitters and turners study and interpret blueprints and diagrams, take measurements and carefully draw up shapes of parts for machining. On receipt of machined parts, they then assemble machinery and integrate it into the production line or workshop floor.

Work in this area requires the competent use of hand tools like spanners, ratchets, drills, grinders and rattle guns. The fitters and turners must also be able to interpret the adequacy of joint tensions and operation of parts, and finely adjust or attune parts with grinders, files and chisels if the fit is not perfect.

### **10.5 Instrumentation Mechanician**

An instrument mechanic manufactures and repairs instruments and recalibrates old instruments. The instrument mechanic plays a vital role in ensuring that automatic processes and plant systems operate correctly and efficiently.

The control of nearly all processes depends on instruments that may be electrical, mechanical or hydraulic, which are responsible for measuring the pressure, temperature, position, level, mass or flow of solids, fluids and gases.

Should the plant processes not operate according to specifications, the instrument mechanic diagnoses the fault and carries out repairs as quickly as possible.

Instrument mechanics are trained to design, manufacture and repair almost any kind of instrument, whether electrical, mechanical, hydraulic, chemical or optical. To design specific research instruments, these mechanics work according to sketches and instructions from scientists and engineers.

### **10.6 Plater (Boilermaker and Welder)**

Platers (boilermakers and welders) build and repair structures of steel, plate and piping ranging from boilers for steam engines to mine headgears.

They must be very skilled and responsible when they work. This is because the containers they make or repair are used under high pressure, so any fault in the joints can cause accidents and serious injury. Besides ensuring that the container is built properly, the plater must also make sure it is installed on site properly. It is the plater's duty to attach rigging and to signal crane operators to lift heavy frame and plate sections and other parts into place. Once installed, the plater has to ensure that everything is working properly and that there are no cracks or leaks in the system.

The plater is also responsible for the cleaning and inspection of boilers to ensure that these boilers work effectively. It is estimated that boilers last for a very long time. The work is therefore mostly devoted to maintain and repair boilers.







The work can be noisy, hot and dangerous; it can also mean working in small cramped spaces or near big heavy machinery. The work may be challenging but enjoyable for someone who likes working with their hand and being able to solve problems.

## **10.7 Millwright**

The work of the millwright is both mechanical and electrical. It involves dismantling, fault detection and repairing of, for example, electric motors, which the millwright will dismantle and test, checking wiring and determining power output and consumption. The millwright also maintains, reconstructs and installs heavy machinery, electrically driven machines and electronic control gear. With the trend to automation, this trade also requires knowledge of electronics as applied in the control of heavy electrically driven equipment. A millwright must have thorough knowledge of the manufacturing of machine components and manufacture parts as required.

A millwright usually works in the production section of plants, but sometimes has to perform tasks in the workshop. Conditions and benefits are similar to those of other trades people.

## **10.8 Rigger Ropesman**

A rigger ropesman is traditionally a person who is very strong, physically fit, is extremely responsible and safety conscious. You would have to want to be an artisan who works with cables and ropes in hoisting equipment, scaffolding and platforms. It is important to note that a rigger ropesman's job can be very dangerous if they become careless.

A rigger ropesman's tasks would include the erection of hoisting apparatus, the assembling, installation and maintenance of steel cables used in various ways with pulleys, lifts or cranes. You might become involved in assisting in the erection of chimney-stacks, large buildings, and doing groundwork like the installation of heavy machinery and moving heavy machinery from place to place. On site, you would estimate the weight of an object, determine the best way of securing it and moving it, arrange your equipment and then give instructions to the hoist or crane driver. As it begins to move, your duty would be to watch out for any unwanted knots or tangles. Safety is of utmost importance. Lubrication of all your gear is also essential.

Rigger ropesman sometimes need to work overtime. They may work in a workshop, underground in a mine, on ground level or up in the air when erecting different kinds of structures. Rigger ropesman are seldom stationary while working. They are continually moving about, climbing and working in all possible positions and locations.





## 11. Professional (Non-Artisan) Career Options in the Mining and Minerals Sector (MMS)

### 11.1 About the Professional Career Option

The professional career option within the mining and minerals sector has a strong focus on technical fields such as engineering. There are other very important and professional fields dealing with health and safety. The engineering field requires high level technical ability together with good problem solving skills. A good aptitude for science and mathematics at senior certificate level is essential to pursue studies in engineering.

The scarcity of engineers has an impact on other positions within the industry, such as production/operations managers, as they often come from an engineering background. Due to the national scarcity, a great need for professionals within the sector has arisen. This has led to an increase in the opportunities for employment within the professional (non-artisan) career option.

### 11.2 Packages and benefits

The table below serves as a guideline for annual salaries within the engineering discipline.

Occupation	Minimum (R)	Maximum (R)
Production/Operations Manager (Mining)	240,000	702,000
Mining Engineer	300,000	518,400
Industrial Engineer	200,000	648,000
Metallurgist	216,000	648,000
Surveyor	240,000	518,400
Geologist	220,000	777,600
Mechanical Engineer	300,000	594,000
Electrical Engineer	216,000	388,000
Chemical Engineer	240,000	432,000
Health and Safety Representative and Inspector	120,000	220,000

*Please note: packages and benefits vary from company to company. The salary package is often dependent on factors such as company size, experience and qualification of employees.*

## Professional (Non-Artisan) Career Options in the MMS

### Professional Option: Mining Engineer

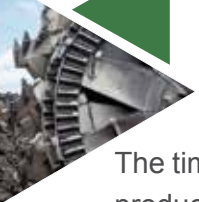
#### Case Study

1. Dieketseng is making major strides forward within the mining and minerals sector. She sees herself as a role model for young women entering the sector. Dieketseng is a prime example, proving that hard work and dedication pays off.
2. Dieketseng has been a hard worker all her life. Her dedication to her school work enabled her to pass matric with excellent mathematics and science results. Her dream has always been to pursue a career as a mining engineer and these results have helped her gain access to university.
3. Dieketseng's family was not well-off, and was unable to pay for her studies. She decided to apply for a bursary at the MQA. She was happy when her bursary application was successful.
4. Dieketseng enrolled for the mining engineering course.
5. Dieketseng successfully completed the mining engineering course.
6. Dieketseng proceeds to obtain workplace experience at AngloGoldAshanti as a mining engineering training.
7. Dieketseng successfully completed her certificates of competency. This enabled her to rightfully oversee and run the proceedings of the mine.
8. Dieketseng was promoted to Junior Mine Manager and due to her dynamic nature and valuable input within the organisation, three years later she moved into the Senior Mine Manager role, with various technicians and engineers reporting to her. Her duties entailed: Designing and resolving safety and production challenges; developing new mining processes/technology; focusing on health and safety of mine workers.

### 11.3 Production/Operations Manager (Mining)

Production managers manage mining operations and devise methods to use the mine's/plant's personnel and capital resources to best meet production goals. They may determine which machines will be used, whether new machines need to be purchased, whether overtime or extra shifts are necessary, and what the sequence of production will be. They monitor the production run to make sure that it stays on schedule and correct any problems that may arise. Production managers are responsible for short and long term production with the mining operation, together with a strong focus on safety and environmental management.

Production managers work closely with the other managers of the company to implement company policies and goals. They also must work with the financial departments in order to come up with a budget and spending plan. Most production managers divide their time between production and their offices. They must follow established health and safety practices and wear the required protective clothing and equipment.



The time in the office usually is spent meeting with subordinates or other department managers, analysing production data, and writing and reviewing reports.

Many production managers work extended hours, especially when production deadlines must be met. In facilities that operate around-the-clock, managers often work late shifts and may be called at any hour to deal with emergencies. This could mean going to the plant/mine to resolve the problem, regardless of the hour, and staying until the situation is under control.

#### **11.4 Mining Engineer**

As a mining engineer, there is a great focus on inspecting and resolving safety and production challenges. Mining engineers may find themselves spending many hours underground daily, while inspecting projects and the routine work being done to ensure that procedures are correctly followed. They meet with the people involved with the core production activities, spending a great deal of time coaching and interacting with the workers. Above ground, mining engineers may spend their time doing mine design and resolving safety and production challenges. At the close of day, mining engineers are often required to report on the safety and production of the day's activities.

Mining engineers can become involved in different activities within the mine, such as working with geologists on new ore deposits, developing new mining processes and technologies, or focusing on the health and safety of mineworkers.

#### **11.5 Industrial Engineer**

An industrial engineer is responsible for the design, implementation, operation, improvement and management of high level systems. Such systems typically consist of chemical, electrical, electronic, mechanical or civil components.

These high level systems are not available as off-the-shelf items and cannot be imported or bought from a supplier. They normally consist within organisations as a mixture of equipment, information, people, capital, processes, etc. Industrial engineers figure out how to do things better and engineer processes and systems that improve quality, productivity and save money.

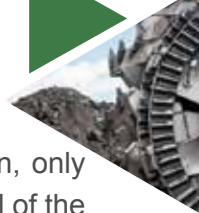
Industrial engineering therefore is a broad professional engineering applied to designing effective systems and procedures for using the basic resources of any system (people, machines, material, IT systems, capital in organisations to achieve specific objectives).

Some of the tasks that an industrial engineer maybe involved in are investigating the placement of equipment and safety precautions, carrying out economic forecasting and feasibility studies to measure operational results in terms of a monetary standard.

#### **11.6 Metallurgist**

The metallurgical profession is diverse, with metallurgists employed in a range of industries and enterprises that produce, buy, sell, refine or manufacture metals and metallic products. Metallurgists develop ways of processing metals and converting them into useful goods.





Extraction metallurgists specialise in the extraction of metals and minerals from mine ores. Often, only tiny amount of the precious metal is deposited in the ore. The metallurgist is expected to remove all of the metal in an efficient and economical way. They also control and design process improvements in order to optimise the recovery of the metals and minerals from the ores.

Often metallurgists inspect metallic materials and equipment for quality or weakness and advise on failure prevention, improvement, repairs and replacement. Metallurgists need to have knowledge of a variety of mineral processing operations, and work closely with geologists and engineers to determine not only the correct treatment route for the mineral, but also to design a processing plant that is efficient and economical to run. Production metallurgists are experts on the treatment process for which they are responsible, and must manage their work force to ensure the smooth operation of the metallurgical plant.

### **11.7 Surveyor**

Surveyors within the mining and minerals sector are experts in mine surveying methods, mine planning, geology, mine valuation and finance. They carry out surveys to gather information for mine planning by measuring and observing, using special surveying equipment and methods and taking ore samples. By carrying out surveys, mine surveyors are able to work out and map the position, structure and size of the most profitable areas as to mine for mineral deposits by mining cartography (mine plans). They assist with the buying, leasing, selling and management of mineral properties.

Mine surveyors are responsible for measuring the areas and volumes blasted by the underground crew on a daily basis and keeping mine plans and information up dated to allow for safe, economical mine planning and management. Their plans help new mines to avoid older ones which may have flooded and allow new connections to be made between underground passages in the mine.

A mine surveyor studies and predicts the effects that mining will have on the environment and plans methods for rehabilitation of the land after it has been mined, in collaboration with government planning authorities.

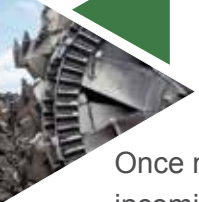
Mine surveyors spend their mornings carrying out routine underground surveys and their afternoons on the surface studying their findings, entering them into the computer, doing calculations and updating the plans of the mine. They are also responsible for measuring how much work the mining contractors have done underground and calculating payments due to them.

### **11.8 Geologist**

Minerals/mining geologists are experts on ways to find and extract minerals, including metalliferous, industrial and bulk minerals and coal. Usually, the geologists' involvement in a project, begins at their desk. They may decide on an area for a new exploration programme by using aerial photographs, field maps, or data from geophysical and geochemical surveys.

Geologists study mineral deposits and the processes leading to their formation. This information is extremely useful to mining companies as it helps them to locate and understand the nature of the resource they are mining. Some geologists use data collected in field work to develop new ways of design to develop and interpret models.





Once mining has begun, geologists are closely involved in the extraction process. They constantly review incoming data e.g. core samples collected by drilling. Geologists frequently check the quality of the mineral and make decisions about unexpected problems like rock faults and groundwater.

Minerals geologists who are highly experienced may go onto work in the financial sector, advising banks and other lenders on proposed mining projects where finance is being sought. Geologists may also work as researchers, teachers and advisers in mining tourism.

### **11.9 Mechanical Engineer**

Mechanical engineers are involved in both surface and underground mining. Pumping plants, winding equipment, ventilation fans, conveyer belts, drilling machines and trackless mining equipment are a few of the devices which involve the input of mechanical engineers. Mechanical engineers use engineering principles to provide efficient solutions to the development of processes, ranging from small component designs to extremely large plant, machinery or vehicles. They work at concept stage on the design, development, installation, operation or maintenance of plant, machinery or products. With regard to research and development, they search for new engineering solutions; and in terms of design, they develop new or existing products and processes. Mechanical engineering is often thought to be one of the most diverse engineering disciplines with opportunities available in a wide range of industries.

Mechanical engineers work on a project from the initial brief, through the design and development stage to the testing of one or more prototypes and onto final implementation. Their working hours typically include regular extra hours, but not usually weekends or shifts. The work is mainly office-based with regular visits to plants/mines/workshop sites. Plant areas and mines can be noisy and work is often to deadlines.

The dress code can vary from suit and tie for office-based work to hard hat and overalls on site. The amount of local and overseas travel and absence from home depends on the employer and the business.

### **11.10 Electrical Engineer**


Electrical engineers are involved in the design, development, testing and installation of electrical equipment, components or systems in the mining and minerals sector. They usually work alongside other engineers and may also supervise the actual manufacture of equipment or components.

The nature of the work may include research and design of new products, the writing of performance requirements and the development of maintenance schedules. Electrical engineers test equipment, solve operating problems and estimate the time and cost of engineering projects. They have various duties which also include consulting with fellow engineers, and others, on existing or potential engineering projects and products; designing, implementing, maintaining and improving electrical instruments, equipment, facilities, components, products and systems; operating computer-assisted engineering and design software and equipment to perform engineering tasks.

They direct and coordinate manufacturing, construction, installation, maintenance, support, documentation and testing activities to ensure compliance with specifications, codes and factory requirements. Electrical engineers are required to perform detailed calculations to compute and establish manufacturing, construction and installation standards and specifications; inspect completed installations and observe operations to







ensure conformance to design and equipment specifications and compliance with operational and safety standards; and supervise and train project team members, as necessary.

An electrical engineer requires knowledge of the practical application of engineering science and technology; of circuit boards, processors, chips, electronic equipment, computer hardware and software, computer applications and programming; of mathematics, including arithmetic, algebra, geometry, calculus and statistics; of physics; of design techniques and tools, and of production and processing.

Working conditions for the engineering occupational fields are similar in terms of environment and hours of work. Extensive involvement with the project implementation is required and this may involve work after hours. Although extra hours are required, this does not mean shiftwork. At this level, the work is mainly office-based with regular visits to the plant.

### **11.11 Chemical Engineer**

The breadth of scientific and technical knowledge inherent in the profession of chemical engineering has caused some to describe the chemical engineer as the “universal engineer”. Despite a title that suggests a profession composed of narrow specialists, chemical engineers are actually extremely versatile and able to handle a wide range of technical problems. Chemical engineers apply principles of physics, mathematics, and mechanical and electrical engineering, as well as chemistry.

Within the mining and minerals sector, chemical engineers often take on the title of mineral processing engineers. Mineral processing engineers primarily focus on the production of various concentrated minerals and metals from mined ore, whereas the mining operation itself is the responsibility of mining engineers. The mined ore is crushed and treated in various processes in order to extract the valuable metals from the concentrated minerals. To design, build and operate such plants, mineral processing engineers have thorough knowledge of unit operations such as crushing, grinding, hydrocyclones, screening, flotation, electrostatic and magnetic separation, gravity separation, particle sorting, hydro-metallurgical leaching and extraction, pyrometallurgical smelting, electroplating and chemical precipitation. These are all processes learnt during the years of study towards the base qualification.

Many chemical/mineral processing engineers eventually operate in areas of business and industry that are no longer directly related to the fundamental chemical engineering industry, where they apply their well-developed skills in logical problem solving, scientific thinking and project management. Chemical engineers may work in office buildings, laboratories or processing plants. Others may spend time outdoors, where they monitor or direct operations or solve onsite problems. Many chemical engineers work a regular office-hour week. At times, deadlines or design standards may bring extra pressure to a job, requiring them to work longer hours.

### **11.12 Health and Safety Representative and Inspector**

The main duty of inspectors is to ensure companies’ adherence to labour laws as well as to ensure that risks to people’s health and safety from work activities are properly controlled. Inspectors share a very important function in the prevention of injuries and losses as a result of accidents. The responsibilities of these inspectors depend on where they work. Those who work for the Department of Labour, ensure that the requirements of the Law on Machinery and Occupational Safety are adhered to.



Within mining companies, they formulate, administer and make the necessary adjustments to accident prevention programmes in order to effectively prevent accidents. They provide daily, weekly or monthly reports on the status of their organisation's accident prevention programmes to management. They also compile standards for the safety of appliances and check them regularly.

One of their most important tasks is to update accident, injury or illness records. They must also investigate and report all accidents and incidents. The conditions that contribute to accidents must be rectified, if possible, so that they do not recur. Inspectors might decide that an organisation could improve the health and safety of employees by making some changes. They might give advice on how to lay out the work place, or the benefits of introducing a new piece of equipment. The inspector may have to be very persuasive in order to convince managers or owners that they need to make certain important changes. In extreme circumstances, inspectors may use their legal powers to issue enforcement notices.

Sometimes, this career may seem demanding when an inspector must ensure that inspections conform to prescribed rules and regulations and keep up-to-date with new developments and technology in this field. However demanding, there are satisfying aspects such as having the chance to work both in an office and outside as well as working with people.

## 12 Learning Paths and Career Paths

### 12.1 A guideline to understanding the learning paths and careers paths

A learning path and career path for the scarce skills within the artisan and professional (non-artisan) career options is outlined in the tables in section 12.2 and 12.3. These tables highlight the following:

- The qualification options for the particular scarce skill
- The minimum entry requirements to access these qualifications
- The possible entry level position to be expected after studying
- The requirements for success in the scarce skill
- The career options beyond the scarce skill, together with the related qualifications

#### Learning Path

The learning path in the tables that follow shows the education and minimum requirements to access the scarce skills. The table starts on the left with the minimum required qualification to get started in the careers.

#### Career ladder

The career ladder follows on from the learning path. After you qualify you may not start work in the scarce skills position. The career ladder shows the different positions you might work in as you move through different stages to acquire a scarce skill. Where you start on this ladder, is dependent on your qualification. With certain qualifications, you may start further along the ladder. Some information is given about the scarce skill position itself, i.e. scope of the job, and qualifications held by a person in this position. This may vary from company to company.







## Requirements for success in this career

The requirements for success in the chosen career highlights skills and attributes that would require you to become fully competent in the chosen scarce skill. Always bear in mind that after studying and working in a scarce skills position, you may not be fully competent. This usually comes with experience.

## Career options

If you are prepared to study and develop further, and once you have achieved a scarce skill, there are many opportunities for you. The career options tables on the following pages show possible careers that maybe pursued. The opportunities in the mining and minerals sector for career growth are huge and depend on what the worker has to offer.

## 12.2 Artisan Career Option Paths

### 12.2.1 Diesel Mechanic

#### Learning path for diesel mechanic

	Qualification options			
	Certificate options	Diploma options	BTech degree options	Degree options
	National Certificate: Diesel Mechanic plus trade test	National Diploma: Mechanical Engineering	BTech Mechanical Engineering	BSc (Eng) Mechanical Engineering
Minimum entry requirements Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 10 certificate (recommended subjects: mathematics; trade theory; technical drawing)	Grade 12 certificate or equivalent with mathematics and physical science on the higher grade (E symbol) or standard grade (D symbol)	National Diploma: Mechanical Engineering	Matriculation certificate with exemption, with mathematics and physical science on the higher grade with a minimum of a D symbol for each subject

#### Career ladder for diesel mechanic

Position	Qualification requirements	Scope of duties
Maintenance assistant/operator	National Certificate 2 complete	Working and semi-skilled, request to be assessed and complete studies at a technical college or complete a learnership
Diesel Mechanic	National Certificate 3 plus trade test	Performing routine maintenance such as changing oil, lubricating equipment and machinery; inspecting, testing and listening to defective equipment to detect malfunctions; raising heavy equipment using hydraulic jacks or hoists; repairing mechanical and electrical faults in machinery





## Requirements for success in the career as a diesel mechanic

In order to make the most of this career, it is beneficial to:

- Enjoy working with your hands
- Have mechanical abilities
- Be able to communicate with people
- Be practical and responsible
- Have good eyesight and hearing
- Have good eye-hand co-ordination
- Have manual handiness/agility
- Have average physical strength, and good health and stamina

## Career options for Diesel Mechanic

Position	Qualification
Technician	National Certificate 4
Maintenance Supervisor	Further Education and Training Certificate (FETC): Generic Management
Mechanical Engineer	N6 plus Government Certificate (GCC) National Diploma: Mechanical Engineering BTech: Mechanical Engineering BSc (Eng) Mechanical Engineering or BEng Mechanical Engineering
Workshop Foreman	National Certificate plus approximately 5 years' experience
Maintenance Manager	National Diploma: Generic Management
Millwright	National Certificate 3 complete in electronics

## Professional registration and association

Associations that a diesel mechanic may want to join are the South African Academy of Engineering and the South African Institution of Mechanical Engineering (SAIMEchE).





## 12.2.2 Electrician

### Learning path for electrician

Qualification options	
Certificate options	
National Certificate 2: Electrical Engineering; National Certificate 3: Electrical Engineering; National Certificate 4: Electrical Engineering	
Minimum Entry Requirements Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	* Grade 9 certificate or level 1 equivalent or an approved bridging programme

### Career ladder to become an electrician

Position	Qualification requirements	Scope of duties
Maintenance assistant/ operator	National Certificate 2 complete	Working and semi-skilled, request to be assessed and complete studies at technical college or complete a learnership
Installation Electrician	National Certificate 3 plus trade test	National Certificate 2 plus trade test plus 18 months' practical experience and a wireman's license (depends on the size of the property); maintain, repair and optimise ancillary electrical equipment
Engineering Electrician	National Certificate 4	Maintain, repair and optimise industrial electrical equipment

### Requirements for success in the career as electrician

In order to make the most of this career, it is beneficial to:

- Have an understanding of electrical principles
- Show initiative and have self-confidence
- Have the ability to work under pressure and solve problems
- Have a steady hand and good eyesight
- Have good hand-eye co-ordination
- Be strong and physically fit
- Be alert and cautious, as the work can be dangerous
- Be able to function under pressure and still make responsible decisions
- Work accurately and be tactful, especially when in a supervisory capacity
- Develop engineering skills which would aid in achieving success in this career



## Career options for Electrician

Position	Qualification
Technician	National Certificate 4 Plus
Maintenance Supervisor	FETC: Generic Management National Certificate Plus
Team Leader	National Diploma: Generic Management
Electrical Engineer	National Diploma: Electrical Engineering BTech: Electrical Engineering BSc (Eng) Electrical Engineering
Millwright	National Certificate 3 complete in electronics
Engineering Manager	National Certificate FETC: Generic Management
Process Artisan	National Certificate 3

### 12.2.3 Fitter and Turner (including machining)

#### Learning path for a fitter and turner

	Qualification options		
	Certificate options	Diploma options	BTech degree options
	National Certificate 3: Fitting and Turning plus trade test; National Certificate 3: Fitting (including machining) plus trade test	National Diploma: Mechanical Engineering	BTech Mechanical Engineering
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 10 or level 2 equivalent with mathematics and physical science or an approved bridging course	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Mechanical Engineering

#### Career ladder for a fitter and turner

Position	Qualification requirements	Scope of duties
Maintenance assistant/operator	National Certificate 2 complete	Working and semi-skilled, request to be assessed and complete studies at technical college or complete a learnership
Fitter and Turner	National Certificate 3 plus trade test	Mechanical maintenance and repairing of machinery and mechanical equipment through manufacturing, assembling and fitting of components



## Requirements for success in the career as a fitter and turner

In order to make the most of this career, it is beneficial to:

- Be thoroughly accurate
- Enjoy working with your hands
- Be practical
- Have mathematical ability
- Be patient and even-tempered when setting up a machine and watching the machine while the turning is in progress
- Able to concentrate under noisy working conditions
- Be responsible
- Be able to read three-dimensional drawings

Position	Qualification
Technician	National Certificate 4
Maintenance Supervisor	FETC: Generic Management National Certificate 4
Mechanical Engineer	National Diploma: Generic Management
Electrical Engineer	National Diploma: Mechanical Engineering BTech: Mechanical Engineering BSc (Eng) Mechanical Engineering BEng Mechanical Engineering
Electrical Engineer	National Certificate plus Government Certificate (GCC) National Diploma: Electrical Engineering BTech: Electrical Engineering BSc (Eng) Electrical Engineering
Millwright	National Certificate 3 complete in electronics
Engineering Manager	National Certificate plus FETC: Generic Management
Project Manager	Honours in Strategic Management Post Grade Qualification in Project Management
Production Manager	BTech: Mechanical Engineering BSc (Eng) Mechanical BEng Mechanical Engineering



## 12.2.4 Instrumentation Mechanician

### Learning path for an instrumentation mechanician

	Qualification options		
	Certificate options	Diploma options	BTech degree options
	National Certificate 4 Instrumentation Mechanician; National Certificate: Engineering	National Diploma: Mechanical Engineering or Electrical Engineering	BTech Mechanical Engineering; BTech Electrical Engineering
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 9 certificate is a minimum requirement or an approved bridging programme	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Mechanical Engineering or Electrical Engineering

### Career ladder for an instrumentation mechanician

Position	Qualification	Scope of duties
Maintenance assistant/operator	National Certificate 2 complete	Working, semi-skilled, providing assistance to a qualified artisan on a production line, request to be assessed and complete studies at a technical college or complete a learnership
Fitter/Electrician/Mechanical artisan/Process artisan	National Certificate 3 plus trade test	Skilled and able to provide fitting or electrical service on a processing equipment. Request to be assessed and complete outstanding requirements at a technical college or learnership
Instrumentation Mechanician	National Certificate 4 Plus	Able to manufacture, repair and install all types of instruments; responsible for measuring the pressure, temperature, position, level, mass and flow of solids, fluids and gases; diagnose the faults and repair them as quickly as possible



## Requirements for success in the career as an instrumentation mechanician

In order to make the most of this career, it is beneficial to:

- Have mechanical insight
- Have a good understanding of physics and mathematics
- Be thorough and precise
- Be accurate and patient in doing complicated work
- Have initiative
- Have dexterity and steady hands
- Have good eye-hand co-ordination
- Have good eyesight

## Career options for an instrumentation mechanician

Position	Qualification
Instrument/Electrical Technician	National Certificate 4
Maintenance Supervisor	FETC: Generic Management National Certificate 4
Mechanical Engineer	National Diploma: Mechanical Engineering BTech: Mechanical Engineering BSc (Eng) Mechanical Engineering or BEng Mechanical Engineering
Electrical Engineer	National Diploma: Electrical Engineering BTech: Electrical Engineering BSc (Eng) Electrical Engineering
Engineering Manager	National Certificate Plus FETC: Generic Management
Project Manager	Honours in Strategic Management Post Graduate Qualification in Project Management
Millwright	National Certificate 3 complete in Electronics

### 12.2.5 Plater (Boilermaker and Welder)

#### Learning path for a pater (boilermaker and welder)

	Qualification options
	<b>Certificate options</b>
	National Certificate 3: Plater/Boilermaker; National Certificate 3: Plater/Welder
Minimum Entry Requirements  * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 9 certificate or level 1 equivalent or an approved bridging programme Note: The plater should be familiar with basic safety precautions applicable to this trade



## Career ladder for a plater (boilermaker and welder)

Position	Qualification requirements	Scope of duties
Maintenance assistant/ operator	National Certificate 2 complete	Working and semi-skilled, request to be assessed and complete studies at a technical college or complete a learnership
Plater/Boilermaker/Welder	National Certificate 3 plus trade test	Constructing and maintaining boilers and related equipment as well as assembling and fitting of components; repair and modify equipment, operate all welding shop machinery and overhead cranes

## Requirements for success in the career as a plater (boilermaker and welder)

In order to make the most of this career, it is beneficial to:

- Be a team player
- Be hard working
- Be creative
- Have good eyesight
- Have good hand to eye co-ordination
- Have good people skills
- Be accurate and practical
- Enjoy working with your hands
- Have physical strength, stamina and flexibility
- Have some insight into electrical engineering
- Be competent in mathematics and science
- Have a solid background in technical drawing

## Career options for a plater (boilermaker and welder)

Position	Qualification
Technician	National Diploma: Mechanical Engineering
Maintenance Supervisor	FETC: Generic Management National Certificate 4
Mechanical Engineer	National Diploma: Mechanical Engineering BTech: Mechanical Engineering BSc (Eng) Mechanical Engineering or BEng Mechanical Engineering
Millwright	National Certificate 3 complete in electronics
Engineering Manager	National Certificate Plus FETC: Generic Management
Process Artisan	National Certificate 3
Production Manager	BTech: Mechanical Engineering BTech: Production Management BSc (Eng) Mechanical Engineering or BEng Mechanical Engineering





## Professional registration and association

An association that a plater may want to join is the South African Institute of Welding (SAIW).

### 12.2.6 Millwright

#### Learning path for a millwright

	Qualification options			
	Certificate options	Diploma options	BTech degree options	Degree options
	National Certificate 3 plus trade test	National Certificate: Mechatronics	National Diploma: Mechanical Engineering	BTech: Mechanical Engineering BSc (Eng) Mechatronics
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 10 or level 2 equivalent with mathematics and physical science or an approved bridging course	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Mechanical Engineering or equivalent qualification	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject

#### Career ladder for a millwright

Position	Qualification requirements	Scope of duties
Maintenance assistant/operator	National Certificate 2 complete	Working, semi-skilled, providing assistance to a qualified artisan on a production line, request to be assessed and complete studies at a technical college or complete a learnership
Fitter/Electrician/ Mechanical artisan/Process artisan	National Certificate 3 plus trade test	Skilled and able to provide fitting or electrical service on a processing line. Request to be assessed and complete outstanding requirements at a technical college or learnership
Millwright	National Certificate 3 plus trade test	Able to maintain production machines, electrical driven machines and control gears

#### Requirements for success in the career as a millwright

In order to make the most of this career, it is beneficial to:

- Be responsible, have initiative and self-confidence
- Have mechanical aptitude and understanding of electrical principles
- Have a good memory for details





- Have manual agility and enjoy working with your hands
- Be healthy and strong
- Have good hand-eye co-ordination
- Be able to work under pressure and to solve problems
- Be able to work high above the ground and in confined spaces
- Have perseverance and the ambition to broaden knowledge
- Be able to read and understand engineering drawings

Note: In order to develop full competence in this career, a minimum of three to five years of experience would be required.

### Career options for a millwright

Position	Qualification
Technician	National Diploma: Mechanical Engineering
Maintenance Supervisor	FETC: Generic Management National Certificate
Mechanical Engineer	National Diploma: Mechanical Engineering BTech: Mechanical Engineering BSc (Eng) Mechanical Engineering or BEng Mechanical Engineering
Electrical Engineer	National Diploma: Electrical Engineering BTech: Electrical Engineering BSc (Eng) Electrical Engineering
Engineering Planner	National Certificate Plus
Engineering Manager	National Certificate Plus FETC: Generic Management
Project Manager	Honours in Strategic Management Post Graduate Qualification in Project Management
Production/Operations Manager	BTech: Mechanical Engineering BTech: Production Management BSc (Eng) Mechanical BEng Mechanical Engineering





## 12.2.7 Rigger Ropesman

### Learning path for rigger ropesman

Qualification options	
Certificate options	
	National Certificate 3: Rigger Ropesman
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 9 certificate or level 1 equivalent or an approved bridging programme

### Career ladder for rigger ropesman

Position	Qualification requirements	Scope of duties
Maintenance assistant/operator	National Certificate 2 complete	Working, semi-skilled, providing assistance to a qualified artisan on a production line, request to be assessed and complete studies at a technical college or complete a learnership
Rigging Ropesman	National Certificate 3 plus trade test	Assist in erecting chimney-stacks, large buildings and heavy machinery; install and maintain steel cables and ropes; installation of machinery and moving heavy machinery from one place to another; responsible for the lubrication of all types of gear
Rigging Foreman	National Certificate 3 plus trade test and at least 5 years rigging experience	To ensure timeous, safe and cost effective rigging and lifting of equipment; ensure adherence to safe working conditions and environment; ensure that subordinates are efficiently skilled and utilised; to implement and ensure adherence to safe working conditions and environment

### Requirements for success in the career as rigger ropesman

In order to make the most of this career, it is beneficial to:

- Be mentally and physically sound and healthy
- Possess endurance and stamina
- Not be afraid of heights
- Be responsible and safety conscious
- Be able to work quickly and efficiently



- Be willing to do heavy physical work
- Be willing to move around a lot and work in different positions

### Career options for rigger ropesman

Position	Qualification
Rigging Foreman	National Certificate 3 with at least 5 years rigging experience
Mechanical Engineer	FETC: Generic Management National Certificate 4
Engineering Manager	National Diploma: Mechanical Engineering BTech: Mechanical Engineering BSc (Eng) Mechanical Engineering or BEng Mechanical Engineering
Maintenance Supervisor	National Certificate 3 complete in Electronics
Millwright	National Certificate Plus FETC: Generic Management
Production Manager	BTech: Mechanical Engineering BTech: Production Management BSc (Eng) Mechanical Engineering or BEng Mechanical Engineering

## 12.3 Professional Career Option Paths

### 12.3.1 Production/Operations manager (mining)

#### Learning path for a production/operations manager

	Qualifications options		
	Diploma options	BTech degree options	Degree options
	National Diploma: Mining Engineering	BTech: Mining Engineering	BSc (Eng) in Mining Engineering or BEng (Mining)
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Mining Engineering	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject



## Career ladder for a production/operations manager

Position	Qualification requirements	Scope of duties
Engineering Technician	National Diploma	Applies theory and principles of mechanical engineering to modify, develop, maintain, repair and test machinery and equipment under direction of engineering staff
Engineer	BTech or degree	Applies theory and principles of mechanical engineering to modify, develop, maintain, repair and test machinery and equipment under direction of engineering staff Performs Engineering duties in planning and designing tools, engines, machines, and other mechanically functioning equipment; oversees installation, operation, maintenance and repair of equipment such as centralised heat, gas, water and steam systems
Production/Operations Manager	BTech or degree (engineering managers typically come from a mechanical rather than an electrical background, although they would need some understanding of the electrical field)	Strategic engineering role that manages technology introduction and capital projects whilst maintaining health and safety and compliance with statutory requirements; planning, organisation, co-ordination and control of production; take part in decisions concerning the design and organisation of the work processes, work standards and compensations of the employees

### Requirements for success in the career as a production/operations manager

In order to make the most of this career, it is beneficial to:

- Be practical and enjoy solving problems
- Be able to make decisions on production matters
- Have the ability to work well with others
- Be willing to continue his education to keep up with the latest developments in the field
- Have good mathematical ability
- Have the ability to visualise three-dimensional objects
- Express ideas clearly in writing and in speech
- Motivate subordinates to bring the best out of them



## Career options for a production/operations manager

Position	Qualification
General Manager	BSc (Eng): Mechanical, Electrical or Chemical engineering or National Diploma: Production Management and additional management qualifications, e.g. MBA (Masters in Business Administration)
Project Manager	BSc (Eng) degree with significant project management experience or qualifications, e.g. MEng (Project Management), MSc or Postgraduate Diploma in Project Management
Professional Engineer	BSc (Eng): Electrical Engineering or Mechanical Engineering and registration with the Engineering Council of South Africa
Development Specialist	BEng: Industrial Engineering

### Professional registration and associations

In some environments, there may be a need for a professional engineer who holds a degree and is registered with the Engineering Council of South Africa (ECSA).

### 12.3.2 Mining Engineer

#### Learning path for a mining engineer

	Qualification options			
	Certificate options	Diploma options	BTech options	Degree options
	National Certificate 4 + 2 years' practical experience	National Diploma: Mining Engineering or National Diploma: Surface Mining	BTech: Mining Engineering	BSc (Eng) in Mining Engineering or BEng (Mining)
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	National Certificate equivalent	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Mining Engineering or National Diploma: Surface Mining	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject



## Career ladder for a mining engineer

Position	Qualification requirements	Scope of duties
Health and Safety Officer	National Diploma	Develop and maintain accident prevention programmes; being responsible for ensuring that the possibility of occupational accidents is reduced to an absolute minimum; need to keep careful records of accidents that do occur, investigate the causes of these accidents and implement measures to prevent such accidents from recurring
Health and Safety Inspector	BA Health Science	Ensures that legal health and safety standards are observed to protect workers; advise employers on methods of safeguarding health, check production equipment, workplace safety and hygiene. As a health inspector, you will conduct thorough routine checks, investigate industrial accidents and may collect evidence for legal cases
Engineer	BTech or degree	Applies theory and principles of mechanical engineering to modify, develop, maintain, repair and test machinery and equipment under direction of engineering staff. Performs engineering duties in planning and designing tools, engines, machines, and other mechanically functioning equipment. Oversees installation, operation, maintenance and repair of equipment such as centralised heat, gas, water, and steam systems

### Requirements for success in the career as a mining engineer

In order to make the most of this career, it is beneficial to:

- Enjoy and have a good aptitude for mathematics and physical science
- have good spatial abilities and be able to picture things in three dimensions
- Be energetic, curious and creative
- Have good judgement and problem-solving skills
- Have good leadership, management and organisational abilities
- Be self-motivated, persistent, responsible and able to make decisions
- Have good communication, people and teamwork skills
- Have good technical writing abilities
- Be interested in and have a good understanding of business, finance and production
- Be physically healthy and strong
- Be able to work under pressure





## Career options for a mining engineer

Position	Qualification
General Manager	BSc (Eng): Mechanical, Electrical or Chemical engineering or National Diploma: Production Management, and additional management qualifications, e.g. MBA (Masters in Business Administration)
Project Manager	BSc (Eng) degree with significant project management experience or qualifications, e.g. MEng (Project Management), MSc or Postgraduate Diploma in Project Management
Professional Engineer	BSc (Eng): Electrical Engineering and registration with the Engineering Council of South Africa (ECSA)
Health and Safety Inspector	BA Health Science
Mine Transport Engineer	BSc Engineering (Mining)

### Professional registration and associations

In some environments there may be a need for a professional engineer who holds a degree and to be registered with the Engineering Council of South Africa (ECSA).

### 12.3.3 Industrial Engineer

#### Learning path for an industrial engineer

	Qualification options		
	Diploma options	BTech degree options	Degree options
	National Diploma: Industrial Engineering	BTech Industrial Engineering	BSc (Eng) Industrial or BEng Industrial Engineering
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institutions additional requirements may be needed	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Industrial Engineering	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject







## Career ladder for industrial engineer

Position	Qualification requirements	Scope of duties
Artisan (Millwright)	National Certificate 4	Skilled and able to provide service on a processing line. Request to be assessed and complete outstanding requirements at a technical college or learnership
Industrial Engineering Technicians	National Diploma	Main function is to assist professional engineers, or act independently to ensure that the best use is made of material, capital and labour
Industrial Engineer	BTech or degree	The work of an industrial engineer includes planning, managing and maintenance of production processes

## Requirements for success in the career as an industrial engineer

In order to make the most of this career, it is beneficial to:

- Have mathematical and scientific ability
- Have an analytical mind and excellent technical skills
- Be innovative and creative
- Be able to think logically
- Be able to solve problems on your own
- Have sound interpersonal skills
- Have good judgement and self-discipline
- Be adaptable and work well with others
- Be practical, orderly and systematic
- Have perseverance
- Be able to accept responsibility

## Career options for an industrial engineer

Position	Qualification
Business Process Analyst	BSc (Eng): Industrial
Logistics Manager	BSc (Eng): Industrial
Manager-Production and Operations	BSc (Eng): Industrial
Productivity Specialist	BSc (Eng): Industrial or Mechanical
Quality Control/Assurance Engineer	BSc (Eng): Industrial

## Professional registration and associations

An industrial engineer may apply for registration as a professional engineer under the auspices of the Engineering Council of South Africa, after gaining at least three years of practical experience.



Other associations that an industrial engineer may join are the South African Institute for Industrial Engineering (SAIIE), South African Society for Professional Engineers (SPE), and the South African Association of Consulting Engineers (SAACE).

### 12.3.4 Metallurgist

#### Learning path for metallurgist

	Qualification options		
	Diploma options	Btech degree options	Degree options
	National Diploma: Metallurgical Engineering	BTech Metallurgical Engineering	BSc (Eng) Metallurgy or BEng Metallurgical Engineering
Minimum Entry Requirements *Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Metallurgical Engineering	Matriculation on certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject

#### Career ladder for metallurgist

Position	Qualification requirements	Scope of duties
Artisan (Metalliferous)	National Certificate 4	Skilled and able to provide service on a processing line. Request to be assessed and complete outstanding requirements at a technical college or learnership
Metallurgical Engineering Technicians	National Diploma	Main function is to assist in the search for metals and alloys with improved, desirable properties
Metallurgist	BTech or degree	Ore preparation where the extraction and separation processes are based on the chemical and physical properties of the material such as density, size, magnetic properties; extract valuable metals from the ores in which they are deposited; determine the cause of defects in metals and suggest repair measures

#### Requirements for success in the career as metallurgist

In order to make the most of this career, it is beneficial to:

- Have mathematical and scientific ability
- Have a thorough knowledge of scientific methods
- Able to think logically and analytically
- Have good judgement and common sense
- Be creative, innovative and have a receptive attitude towards change



- Have good interpersonal relationships and leadership ability
- Be computer literate
- Be self-driven, motivated and some interest in finance

### Career options for metallurgist

Position	Qualification
General Manager	BSc (Eng): Mechanical, Electrical or Chemical engineering or National Diploma: Production Management, and additional management qualifications, e.g. MBA (Masters in Business Administration)
Project Manager	BSc (Eng) degree with significant project management experience or qualifications e.g. MEng (Project Management), MSc or Postgraduate Diploma in Project Management
Chemical Engineer	BSc (Eng): Chemical Engineering and registration with the Engineering Council of SA; BTech Chemical Engineering
Corrosion Engineer	BSc Engineering (Metallurgy and Materials)
Analytical Chemist	BTech Analytical Chemistry National Diploma: Analytical Chemistry
Assayer and Sampler	BSc Natural Sciences and Mathematics
Geologist	BSc Earth Sciences Environmental and Engineering Geology
Process Control Engineer	BSc Engineering (Metallurgy and Materials)
Mine Surveyor	BTech Mine Surveying; BMining and Environmental Geology
Failure Analysis Engineer	BSc Engineering (Metallurgy and Materials)
Metallurgical Plant Designer	BSc Engineering (Metallurgy and Materials)
Tribologist	BSc Engineering (Metallurgy and Materials)

### Professional registration and associations

A metallurgist may apply for registration as a professional engineer under the auspices of the Engineering Council of South Africa (ECSA), after gaining at least three years of practical experience.

After gaining at least two years practical experience, a metallurgist may register with the South African Council for Engineers.

Another association that a metallurgist could join is the Southern African Institute of Mining and Metallurgy (SAIMM).



## 12.3.5 Surveyor

### Learning path for surveyor

	Qualifications options		
	Diploma options	BTech options	Degree options
	National Diploma: Mine Surveying	BTech: Mine Surveying	BMining and Environmental Geology
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Mine Surveying	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject

### Career ladder for surveyor

Position	Qualification requirements	Scope of duties
Miner	National Certificate 3	Work underground where you will supervise drilling, blasting and rock-clearing operations to extract minerals; plan and organise work and safety of mineworkers
Mine Surveying Inspector	Mine Surveyor's Certificate of Competency	Conduct mine surveying inspections to ensure legal compliance of surveying mapping and prescribed mine plans during operations and or mine closure; conduct health and safety audits and check measurements of undermining; make recommendations regarding the safe utilisation of ground where undermining occurs
Surveyor	Degree	Undertake underground and surface surveys to produce information for the construction of mine plans; use advanced surveying techniques and instruments to determine the direction and extent of all the underground workings of a mine

### Requirements for success in the career as surveyor

In order to make the most of this career, it is beneficial to:

- Enjoy and have a good aptitude for mathematics and physical science
- Have good spatial abilities and be able to picture things in three dimensions
- Have high ethical standards and good judgement
- Work accurately and methodically
- Be physically healthy and strong
- Be able to make own decisions
- Be able to work independently and as part of a team



## Career options for surveyor

Position	Qualification
Mineralogist	BEng Chemical Engineering: Mineral Processing
Project Manager	BSc (Eng) degree with significant project management experience or qualifications e.g. MEng (Project Management), MSc or Postgraduate Diploma in Project Management
Mining Engineer	BEng (Mining)
Analytical Chemist	BTech Analytical Chemistry National Diploma: Analytical Chemistry
Assayer & Sampler	BSc: Natural Sciences and Mathematics
Geologist	BSc Earth Sciences, Environmental and Engineering Geology
Mine Surveyor	BTech Mine Surveying; BMining and Environmental Geology

## Professional registration and associations

Certain environments may require surveyors to be professionally registered with the South African Geomatics Council (SAGC), in accordance with the Geomatics Profession Act.

### 12.3.6 Geologist

#### Learning path for geologist

	Qualification options			
	Certificate options	Diploma options	BTech options	Degree options
	National Certificate +2 years' practical experience	National Diploma: Geology	BTech: Geology	BSc (Geology)
Minimum Entry Requirements *Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	National Certificate: Surface Mining; or National certificate: Metalliferous Mining	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Geology	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject





## Career ladder for a geologist

Position	Qualification requirements	Scope of duties
Miner	National Certificate 3	Work underground where you will supervise drilling, blasting and rock-clearing operations to extract minerals; plan and organise work and safety of mineworkers
Metallurgical Engineering Technicians	National Diploma	Main function is to assist in the search for metals and alloys with improved, desirable properties
Geologist	BTech or degree	Study mineral deposits and the processes leading to their formation; apply geological principles to solve practical problems in the mining industry; organise programmes of prospecting in the field

### Requirements for success in the career as geologist

In order to make the most of this career, it is beneficial to:

- Enjoy and have a good aptitude for mathematics and physical science
- Have a love of nature
- Be curious, imaginative and observant
- Have a good aptitude for problem-solving and be able to work accurately, methodically and logically
- Have good visual memory and be able to visualise things in three dimensions
- Be patient and perseverant
- Be flexible and adaptable;
- Have good people, communication and teamwork skills
- Be self-motivated and responsible
- Be physically healthy and strong
- Enjoy travelling

### Career options for geologist

Position	Qualification
Mineralogist	BEng Chemical Engineering: Mineral Processing
Project Manager	BSc (Eng) degree with significant project management experience or qualifications e.g. MEng (Project Management), MSc or Postgraduate Diploma in Project Management
Mining Engineer	BEng (Mining)
Analytical Chemist	BTech Analytical Chemistry National Diploma: Analytical Chemistry
Assayer and Sampler	BSc: Natural Sciences and Mathematics
Mine Surveyor	BTech Mine Surveying BMining and Environmental Geology
Metallurgist	BSc (Eng) Metallurgy



## Professional registration and associations

In some environments there may be a requirement to be registered as a professional natural scientist with the South African Council for Natural Scientific Professions (SACNASP).

Another association that geologists could join is the South African Institute for Engineering and Environmental Geologists (SAIEG).

### 12.3.7 Mechanical Engineer

#### Learning path for a mechanical engineer

Qualification options				
	Certificate options	Diploma options	BTech degree options	Degree options
	National Certificate 3: Mechanical Engineering	National Diploma: Mechanical Engineering	BTech: Mechanical Engineering	BSc (Eng) Mechanical Engineering or BEng Mechanical Engineering
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institutions as additional requirements may be needed	Grade 10 or level 2 equivalent with mathematics and physical science or an approved bridging course	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Mechanical Engineering	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject





## Career ladder for a mechanical engineer

Position	Qualification requirement	Scope of duties
Fitter and Turner	National Certificate 3 plus trade test	Mechanical maintenance and repairing of machinery and mechanical equipment through manufacturing, assembling and fitting of components
Mechanical Engineering Technician	National Certificate 4 plus or National Diploma	Applies theory and principles of mechanical engineering to modify, develop, maintain, repair and test machinery and equipment under direction of engineering staff
Mechanical Engineer	BTech or degree	Applies theory and principles of mechanical engineering to modify, develop, maintain, repair and test machinery and equipment under direction of engineering staff. Performs engineering duties in planning and designing tools, engines, machines and other mechanically functioning equipment. Oversees installation, operation, maintenance and repair of equipment such as centralised heat, gas, water and steam systems

### Requirements for success in the career as a mechanical engineer

In order to make the most of this career, it is beneficial to:

- Have an aptitude and preference for experimenting, planning and research
- Enjoy detailed work
- Enjoy solving problems
- Have above average intelligence and an analytical mind
- Be meticulously accurate in calculations and drawings
- Have mathematical and mechanical aptitude
- Ability to visualise objects three-dimensionally and interpret 3D drawings
- Be a good decision-maker
- Prepared to accept responsibility-defects in designs can affect lives
- Be creative
- Work well with others
- Have managerial qualities







## Career options for a mechanical engineer

Position	Qualification
Plant/General Manager	BSc (Eng): Mechanical or Chemical engineering or National Diploma: Production Management, and/or additional management qualifications e.g. MBA (Masters in Business Administration)
Project Manager	BSc (Eng) degree with significant project management experience or qualifications e.g. MEng (Project Management), MSc or Postgraduate Diploma in Project Management
Maintenance Manager	BSc (Eng): Mechanical, Electrical, Electronic and Government certificate
Industrial Engineer	BSc Industrial Engineering or BEng Industrial Engineering; BTech Industrial Engineering
Mechatronics Engineer	BEng Mechatronics/Mechatronics Engineering; BSc Mechatronics

## Professional registration and associations

In some environments there may be a need for a professional engineer who holds a degree to be registered with the Engineering Council of South Africa (ECSA).

### 12.3.8 Electrical Engineer

#### Learning path for an electrical engineer

	Qualification options			
	Certificate options	Diploma options	BTech degree options	Degree options
	N6 + 2 years 'practical experience	National Diploma: Engineering: Electrical	BTech: Electrical Engineering	BSc (Eng) Electrical Engineering or BEng Electrical and Electronic Engineering
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	National Certificate equivalent	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Engineering: Electrical	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject



## Career ladder for an electrical engineer

Position	Qualification requirements	Scope of duties
Electrician	National Certificate 3 plus trade test	Maintain, repair and optimise ancillary electrical equipment
Electrical Engineering Technician	N6 or National Diploma	Applies theory and principles of mechanical engineering to modify, develop, maintain, repair and test machinery and equipment under direction of engineering staff
Mechanical engineer	BTech or degree	<p>Uses knowledge of the distribution and application of electricity, often acting as a link between the electrical engineer or technologist and the artisan.</p> <p>An electrical engineering technician:</p> <ul style="list-style-type: none"> <li>▪ Helps the electrical engineer with the processes to generate electrical energy</li> <li>▪ Assists in the task of distributing electrical energy to the consumer</li> <li>▪ Tests and maintains existing equipment • Installs new equipment at power plants</li> <li>▪ Tests new equipment to see whether it is functioning effectively</li> </ul>
Electrical Engineer	BTech or Degree	<p>An electrical engineer is involved in the design, manufacture, installation and management of various appliances and installations that generate or use electrical energy. The electrical engineer:</p> <ul style="list-style-type: none"> <li>▪ Tests and maintains electrical subsystems and systems</li> <li>▪ Is involved in analysis and problem formulation</li> <li>▪ Conducts research to better the utilisation of energy resources</li> <li>▪ Designs and develops new components</li> <li>▪ Is responsible for managing projects</li> </ul>

### Requirements for success in the career as an electrical engineer

In order to make the most of this career, it is beneficial to:

- Have trouble-shooting and critical thinking skills
- Be an active learner with an analytical mind
- Have good judgement and be a fast and accurate decision-maker
- Have good communication and time management skills
- Be able to visualise abstract concepts
- Show originality and initiative
- Have a high tolerance for stress and work well in a team
- Have knowledge of engineering and technology, mathematics, physical science, design and computers



## Career options for an electrical engineer

Position	Qualification
Plant/General Manager	BSc (Eng): Mechanical or Chemical engineering or National Diploma: Production Management, and/or additional management qualifications e.g. MBA (Masters in Business Administration)
Project Manager	BSc (Eng) degree with significant project management experience or qualifications e.g. MEng (Project Management), MSc or Postgraduate Diploma in Project Management
Maintenance Manager	BSc (Eng): Mechanical, Electrical, Electronic and Government certificate
Industrial Engineer	BSc Industrial Engineering or BEng Industrial Engineering BTech Industrial Engineering
Mechatronics Engineer	BEng Mechatronics/Mechatronics Engineering; BSc Mechatronics

## Professional registration and associations

In some environments there may be a need for a professional engineer who holds a degree to be registered with the Engineering Council of South Africa. This person would be able to sign off structural changes. Smaller organisations would use engineering consultants to do this.

### 12.3.9 Chemical Engineer

#### Learning path for a chemical engineer

	Qualification options		
	Diploma options	BTech options	Degree options
	National Diploma: Chemical Engineering	BTech: Chemical Engineering	BSc (Eng) Chemical Engineering or BEng Chemical
Minimum Entry Requirements *Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Industrial Engineering	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject





## Career ladder for a chemical engineer

Position	Qualification requirements	Scope of duties
Plant Operator	National Certificate 3 plus trade test	Read, interpret, and adjust meters and gauges to make sure that plant equipment and processes are working properly; monitor operation of the plant
Chemical Engineering Technician	National Diploma	Use their knowledge of engineering and chemistry to operate and improve chemical processes in an efficient, and a safe and profitable way; work in close liaison with chemical engineers to design, develop and operate processes for the large-scale production of minerals and other useful commodities; involved in the building of experimental plants, testing the processes concerned, solving technical problems and could also be involved in determining the economic viability of projects
Chemical Engineer	BTech or Degree	Solve the problems involved in producing high quality products at lowest cost; safety and protection of the environment are key areas of concern; responsible for the testing and commissioning of plant units; the training of operating staff; the start-up of the plant; the efficient and cost-effective running of processes and solving problems

### Requirements for success in the career as a chemical engineer

In order to make the most of this career, it is beneficial to:

- Be creative and able to think on your feet
- Be alert and open-minded
- Show good judgment to avoid hazards that may endanger people's lives
- Be accurate and persistent
- Be able to make decisions
- Have managerial and organisational skills
- Be a team player with sound interpersonal skills as engineering is interdisciplinary and involves other professionals
- Communicate ideas clearly
- Have high energy levels
- Be responsible
- Have good technical writing ability





## Career options for a chemical engineer

Position	Qualification
Plant/General Manager	BSc (Eng): Mechanical or Chemical engineering or National Diploma: Production Management, and/or additional management qualifications e.g. MBA (Masters in Business Administration)
Project Manager	BSc (Eng) degree with significant project management experience or qualifications e.g. MEng (Project Management), MSc or Postgraduate Diploma in Project Management
Analytical Chemist	BTech Analytical Chemistry; National Diploma: Analytical Chemistry
Industrial Engineer	BSc Industrial Engineering or BEng Industrial Engineering BTech Industrial Engineering
Metallurgist	BSc (Eng) Metallurgy

### Professional registration and associations

A learner who has obtained a recognised BSc (Eng), BEng degree or BTech degree is eligible for registration as a Candidate Engineer.

After gaining at least three years of appropriate practical experience, a chemical engineer may apply for registration as a professional engineer under the auspices of the Engineering Council of South Africa (ECSA). Other associations that a chemical engineer could join are the South African Institute of Chemical Engineers (SAChE), Water Institute of Southern Africa (WISA) and the Southern African Institute of Mining and Metallurgy (SAIMM).

### 12.3.10 Health and Safety Representative and Inspector

#### Learning path for a health and safety representative and inspector

	Qualification options			
	Certificate options	Diploma options	BTech degree options	Degree options
	<b>Certificate Options</b> National Certificate: Occupational Health, Safety and Environment*	National Diploma: Safety and Security Management; Environmental Health	BTech: Environmental Health	BA Health Sciences
Minimum Entry Requirements * Minimum requirements may vary and must therefore be checked with the relevant institution as additional requirements may be needed	Grade 10 or level 2 equivalent with mathematics and physical science or an approved bridging course	Grade 12 certificate or equivalent with mathematics and physical science on higher grade (E symbol) or standard grade (D symbol)	National Diploma: Safety and Security Management; Environmental Health	Matriculation certificate with exemption, with mathematics and physical science on higher grade with a minimum pass of a D symbol for each subject

\*Before being appointed as an inspector of occupational safety, a prescribed practical training course has to be completed. Note: Often Mining Engineers are being trained to become inspectors.



## Career ladder for a health and safety representative and inspector

Position	Qualification requirements	Scope of duties
Trainee Health and Safety Inspector	National Certificate	Ensure that the company meets legal obligations by providing advice, support and guidance in the implementation of related policies and procedures; assist Senior Health and Safety Inspector
Health and Safety Representative and Inspector	National Diploma/BTech or Degree	Ensure that risks to people's health and safety from work activities are properly controlled; enforce complex health and safety laws, promote and regulate the safety and well-being of all employees and others; examining all aspects of the workplace

### Requirements for success in the career as a health and safety representative and inspector

In order to make the most of this career, it is beneficial to:

- Have good interpersonal relations
- Have scientific and technical knowledge and interest
- Be very responsible and conscientious
- Be decisive
- Have good verbal and written knowledge
- Be able to negotiate
- Have sound judgement
- Have investigating ability
- Be analytical and tactful

### Career options for a health and safety representative and inspector

Position	Qualification
Environmental Health Officer (EHO)	BSc Environmental Health BSc Environmental Management BTech Environmental Health National Diploma: Environmental Health



## 13. Financing Your Studies

### 13.1 Ways to finance your studies

In today's current economic climate, studies are often tough to self-finance. However, many funding/financing options are available in order to make it possible for anyone to study. Each option usually has its own requirements and it is therefore important to understand these when choosing a financing option. The different options are summarised below.

#### Bursaries

Tertiary institutions have bursaries financed by donations and/or companies. Learners are often interviewed to make sure they suit the future employment requirements of the sponsoring company. The learner might be required to work for that company for a specific period after completion of the course. Note that bursaries are not always given to the neediest learner.

#### Bank Loans

All major banks offer a student loan package to those who meet their criteria. A parent or friend in employment will usually be responsible for ensuring that the loan is paid back, as they often would sign a surety.

#### Student Financial Aid

The National Student Financial Aid Scheme (NSFAS) provides student loans and writes off a certain percentage if the candidate passes their subjects each year. The rest is paid off once the candidate starts working. NSFAS operates from the financial aid offices on the campuses of recognised universities and universities of technology.

#### Scholarships

Scholarships are usually awarded on merit to students with top academic results. Advice is available from the admissions offices of the universities and colleges.

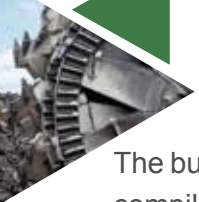
### 13.2 Obtaining a bursary

#### 13.2.1 What is a bursary?

Bursaries are financial assistance packages sponsored by companies or institutions. They are awarded to learners who meet the selection criteria, through excellence and/or financial need, wishing to study towards a degree or diploma at a Higher Education and Training (HET) institution. Bursaries are generally aligned to specific courses of study and/or institutions, and all bursaries have to be registered with the Department of Education (DoE).

#### 13.2.2 Where can you find bursaries?

The Mining Qualifications Authority (MQA) has established a bursary scheme to create and support a pool of high level technical and management talent in the mining and minerals sector.



The bursaries in this scheme are awarded to students enrolled in courses which service the scarce skills list compiled by the Mining Qualifications Authority, with a specific emphasis on mining disciplines. Learners wishing to apply for bursaries for studying mining disciplines can contact the MQA directly. There are also a variety of bursaries financed by private and public companies and individuals, or by the educational institutions themselves which could also apply to the areas of study required in the mining and minerals sector.

Comprehensive lists of bursaries are generally available from educational institutions or from the Department of Education.

### **13.2.3 What are the selection criteria for bursaries?**

Every bursary has criteria which an applicant must meet in order to be awarded a bursary. These criteria differ from bursary to bursary, however, a strong focus is on a learner's academic excellence and financial need.

The Mining Qualifications Authority Bursary Scheme applies to learners currently registered or planning to register with academic institutions that are accredited with the Department of Education within South Africa. The MQA Bursary Scheme, more specifically, only applies to learners who are compliant with the requirements of qualifications specified by the mining and minerals sector.

The scheme is available to learners who meet the entry requirements of an accredited academic institution, and are South African citizens. Preference is given to historically disadvantaged individuals and those in financial need, as well as learners who live in regions where the mining and minerals sector is most active. Preference is also given to learners who are female, live in rural areas and have applied in the past and qualified for the bursary but were unsuccessful.

The Mining Qualifications Authority bursaries are granted for one academic year, and bursary holders will be required to re-apply for funding by completing a Bursary Continuation Form.

## **Financing your studies**

### **13.2.4 In which study disciplines are bursaries offered at the MQA?**

The MQA bursary supports the following mining disciplines:

- Mining Engineering
- Mine
- Geology





### 13.2.5 How does one apply for an MQA bursary?

The MQA opens the application process twice during the year whereby qualifying learners are invited to apply for possible funding for their studies through an MQA bursary. Learners are therefore encouraged to visit the MQA website [www.mqa.org.za](http://www.mqa.org.za) regularly for an announcement on applications or alternatively enquire via e-mail at [info@mqa.org.za](mailto:info@mqa.org.za). When available, application forms can be requested via e-mail, or from the MQA offices in Parktown or the Regional Offices.

## 13.3 Company grants

There are a variety of grants available to companies in order to finance the development and training of existing employees as well as the development of potential candidates in line with the scarce skills requirements of the mining and minerals sector.

There are two types of grants, namely Mandatory grants and Discretionary grants.


### 13.3.1 Mandatory grants

A Mandatory grant is a grant payable to levy paying companies upon submission of a Workplace Skills Plan (WSP) and Annual Training Report (ATR). The Sector Education and Training Authority (SETA) will pay 50% of the total levies paid, back to the employer upon approval of the WSP and ATR. Payments for Mandatory grants will be made quarterly and any Mandatory grants not claimed in one year will be transferred to the Discretionary fund reserve.

A Mandatory grant is paid once the workplace skills plans and annual training report have been received, assessed and approved by the Skills Development and Research Unit, based upon the following criteria\*:

- The workplace skills plan and annual training report (WSP-ATR) must conform to the format prescribed by the MQA
- The WSP and ATR must be fully completed, inclusive of all signatures by the required date
- In the case of large and medium sized organisations, proof of consultation by an employer with employee representatives/trade unions is required as per the MQA guideline
- The employer has submitted a WSP and ATR that includes the most recent national occupational codes as contained in the Organising Framework for Occupations (OFO) in support of the annual sector skills planning process
- The employer has submitted a self-evaluation report in the format prescribed by the MQA of the relevant WSP against the current ATR. If the alignment is less than 60%, the employer must submit reasons for the misalignment to the MQA
- The WSP and ATR are received on or before 30 April annually
- The employer has submitted only one application per SDL number and the employer name correlates with information received from the South African Revenue Services (SARS) and the Department of Higher Education and Training (DHET); applications for the SDL number of a particular organisation must be submitted by the required date
- The employer must be paying levies to SARS against the MQA SETA (Code 16)
- The employer must not be in arrears with their SDL contributions to the SETA





\*These criteria may change from year to year, if the MQA Board considers it necessary.

### **13.3.2 Discretionary grants**

A Discretionary grant is a grant paid to applicants, at the discretion of the Mining Qualifications Authority, for skills development projects linked to scarce and critical skills in the sector. Discretionary grants may be disbursed as grants or projects. Availability of funding for projects and grants is subject to Board discretion and may be reduced, withdrawn and/or cancelled upon informing the industry of the Mining Qualifications Authority's intentions to do so.

### **13.3.3 Criteria for Discretionary grants**

Discretionary grants may only be paid to employers paying levies to the Mining Qualifications Authority. In the case of Adult Basic Education and Training (ABET), employers may pay a specified portion of the ABET grant to successful ABET learners.

The Mining Qualifications Authority will be making Discretionary grant funding available to the mining and minerals sector levy paying companies for each financial year.

### **13.3.4 Who may apply?**

All companies registered with the Mining Qualifications Authority may apply for learnerships and AET grants.

Only companies who are accredited or are in the process of finalising their accreditation with the Mining Qualifications Authority may apply for the ISO 9001:2008 certification, and Assessor and Moderator registration grants.

For standards setting grants, only members from small companies or individuals ratified by the MQA stakeholder convener, will be funded.

### **List of Mining Qualifications Authority Accredited Providers**

For a list of MQA Accredited Training Providers in all provinces, visit the MQA website at [www.mqa.org.za](http://www.mqa.org.za) or call the MQA on 011 547 2600 for a list. The lists are updated on a continuous basis.



