




	Curriculum Document			
<b>Occupational Code</b>	<b>Qualification Title</b>	<b>NQF Level</b>		
734212-000	<i>Railway Track Master</i>	4		
	<b>Name</b>	<b>Email</b>	<b>Phone</b>	<b>Logo</b>
<b>Development Quality Partner</b>	Transport Education and Training Authority			
<b>Assessment Quality Partner</b>	Transport Education and Training Authority			

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**Learner QDF Signature**

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**Date**

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**QDF Signature**

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**Date**

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**DQP Representative Signature**

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**Date**

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## **SECTION 1: CURRICULUM SUMMARY**

### **1. Occupational Information**

#### **1.1 Associated Occupation**

734212: Railway Track Master

#### **1.2 Occupation or Specialisation Addressed by this Curriculum**

734212-000-00-00: Railway Track Master

#### **1.3 Alternative Titles used by Industry**

- Railway Track Worker

### **2. Curriculum Information**

#### **2.1 Curriculum Structure**

This qualification is made up of the following compulsory Knowledge and Practical Skill Modules:

##### **Knowledge Modules:**

- 734212000-KM-01 Fundamental principles and theories of welding, NQF Level 2, Credits 15
- 734212000-KM-02 Concepts and principles of per-way construction and maintenance, NQF Level 3, Credits 72
- 734212000-KM-03, Railway Track Diagnostics, NQF Level 4, Credits 33
- 734212000-KM-04, Concepts of managing and supervising per-way construction and maintenance, NQF Level 4, Credits 66

Total number of credits for Knowledge Modules: 186

##### **Practical Skill Modules:**

- 734212-000-PM-01 Operate and care for engineering hand and power tools within a railway construction and maintenance environment, NQF Level 2, 32 Credits;
- 734212-000-PM-02 Execute basic per-way maintenance and construction work, NQF Level 2, Credits 32;
- 734212-000-PM-03 Execute basic grinding and welding work to install and repair railway lines, NQF Level 3, Credits 18;
- 734212-000-PM-04 Execute generic railway maintenance and construction tasks, NQF Level 3, Credits 32;
- 734212-000-PM-05 Join and repair railway rails using welding techniques, NQF Level 3, Credits 32;
- 734212-000-PM-06 Build and construct specialised railway lines and related infrastructure, NQF Level 4, Credits 32;
- 734212-000-PM-07 Execute advanced rail joining, repair and maintenance work, NQF Level 4, Credits 48;
- 734212-000-PM-08 Supervise and oversee the execution of rail construction and maintenance activities, NQF Level 4, Credits 19.

Total number of credits for Practical Skill Modules: 245

##### **Work Experience Modules:**

- 734212-000-WM-01 Apply generic processes and procedures of constructing and maintaining a Railway Lines, NQF Level 2, Credits 16;
- 734212-000-WM-02 Execute basic track joining and welding duties, NQF Level 2, Credits 16;
- 734212-000-WM-03 Execute generic railway maintenance and construction tasks, NQF Level 2, Credits 16;

- 734212-000-WM-04 Execute specialised railway track of joining, welding tasks, NQF Level 3, Credits 16;
- 734212-000-WM-05 Execute specialised railway track construction and maintenance tasks, NQF Level 3, Credits 32;
- 734212-000-WM-06 Execute advanced rail joining, repair and maintenance work, NQF Level 4, Credits 32;
- 734212-000-WM-07 Rail construction and maintenance management processes, NQF Level 4, Credits 32.

Total number of credits for Work Experience Modules: 160

<b>TOTAL CREDITS FOR THE QUALIFICATION</b>		<b>591</b>
<b>KNOWLEDGE</b>	31.47%	<b>186</b>
<b>PRACTICAL SKILLS</b>	41.46%	<b>245</b>
<b>WORK EXPERIENCE</b>	27.07%	<b>160</b>

<b>NQF LEVEL 2</b>	<b>127</b>	<b>21.49%</b>
<b>NQF LEVEL 3</b>	<b>202</b>	<b>34.18%</b>
<b>NQF LEVEL 4</b>	<b>262</b>	<b>44.33%</b>
<b>TOTAL</b>	<b>591</b>	

## 2.2 Entry Requirements

NQF level 2 with communication, science and maths literacy; Compliance with the medical fitness requirements for employment as a railway worker.

## 3. Assessment Quality Partner Information

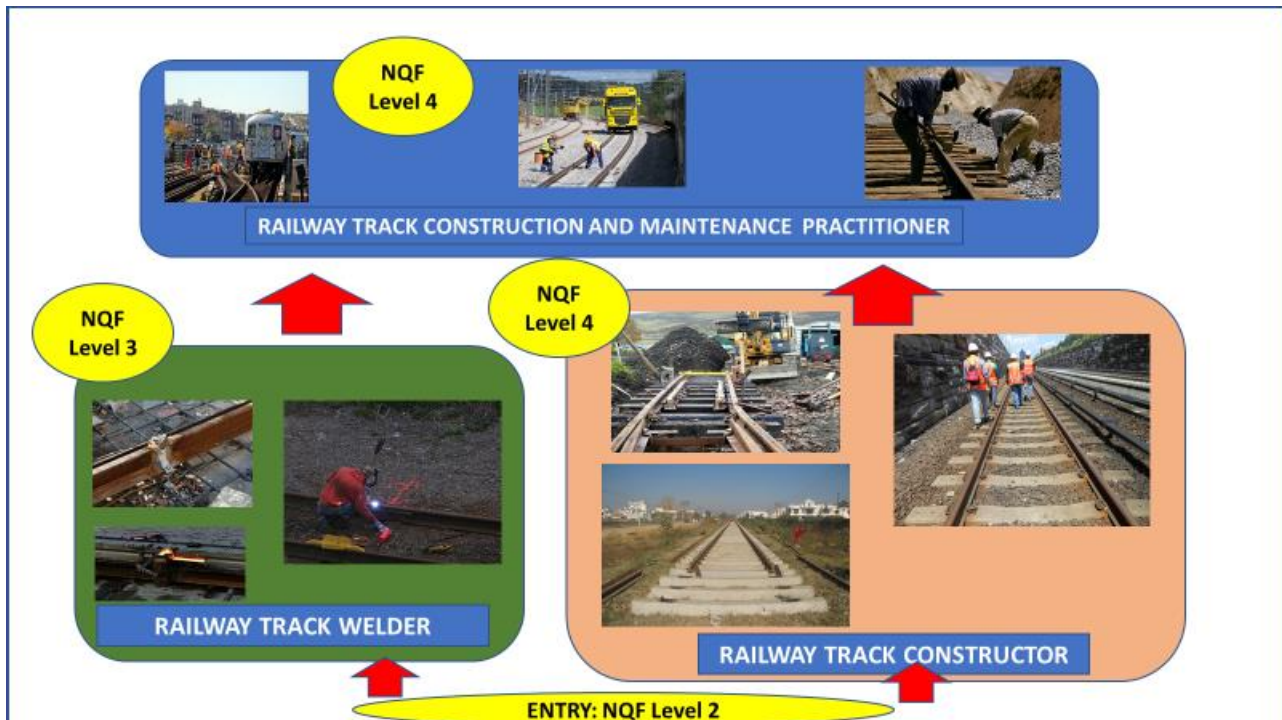
**Name of body:** National Artisan Moderating Body (NAMB).

**Address of body:** vanstaden.G@dhet.gov.za

**Contact person name:** G van Staden

**Contact person work telephone number:** 011 2061123

#### 4. Part Qualification Curriculum Structure



#### **FULL TRADE: 734212-000-00-00 Railway Track Master, NQF Level 4, Credits 591**

##### **Part Qualification 1:**

##### **Title:**

734212-000-00-01 **Railway Track Welder**, NQF Level 3, Credits 281

##### **Purpose:**

To refurbish rail lines and assets using specific welding and grinding processes and to join rails of various sizes to extend the lifespan of the railway lines.

##### **Entry Requirement**

NQF level 2 with communication, science and maths literacy; Compliance with the medical fitness requirements for employment as a railway worker.

##### **Applicable Modules (Rules of Combination)**

##### **Knowledge Modules:**

- 734212000-KM-01 Fundamental principles and theories of welding, NQF Level 2, Credits 15
- 734212000-KM-02 Concepts and principles of per-way construction and maintenance, NQF Level 3, Credits 72

Total number of credits for Knowledge Modules: 87

##### **Practical Skill Modules:**

- 734212-000-PM-01 Operate and care for engineering hand and power tools within a railway construction and maintenance environment, NQF Level 2, 32 Credits;
- 734212-000-PM-03 Execute basic grinding and welding work to install and repair railway lines, NQF Level 3, Credits 18;
- 734212-000-PM-04 Execute generic railway maintenance and construction tasks, NQF Level 3, Credits 32;

- 734212-000-PM-05 Join and repair railway rails using welding techniques, NQF Level 3, Credits 32;

Total number of credits for Practical Skill Modules: 114

#### **Work Experience Modules:**

- 734212-000-WM-01 Apply generic processes and procedures of constructing and maintaining a Railway Lines, NQF Level 2, Credits 16;
- 734212-000-WM-02 Execute basic track joining and welding duties, NQF Level 2, Credits 16;
- 734212-000-WM-04 Execute specialised railway track of joining, welding tasks, NQF Level 3, Credits 16;
- 734212-000-WM-06 Execute advanced rail joining, repair and maintenance work, NQF Level 4, Credits 32;

Total number of credits for Work Experience Modules: 80

#### **Part Qualification 2:**

##### **Title:**

734212-000-00-02 **Railway Track Constructor**, NQF Level 4, Credits 392

##### **Purpose:**

To maintain rail track infrastructure to ensure the optimum availability and reliability thereof.

##### **Entry Requirement**

NQF level 2 with communication, science and maths literacy; Compliance with the medical fitness requirements for employment as a railway worker.

##### **Applicable Modules (Rules of Combination)**

##### **Knowledge Modules:**

- 734212000-KM-01 Fundamental principles and theories of welding, NQF Level 2, Credits 15
- 734212000-KM-02 Concepts and principles of per-way construction and maintenance, NQF Level 3, Credits 72
- 734212000-KM-03, Railway Track Diagnostics, NQF Level 4, Credits 33

Total number of credits for Knowledge Modules: 120

##### **Practical Skill Modules:**

- 734212-000-PM-01 Operate and care for engineering hand and power tools within a railway construction and maintenance environment, NQF Level 2, 32 Credits;
- 734212-000-PM-02 Execute basic per-way maintenance and construction work, NQF Level 2, Credits 32;
- 734212-000-PM-04 Execute generic railway maintenance and construction tasks, NQF Level 3, Credits 32;
- 734212-000-PM-06 Build and construct specialised railway lines and related infrastructure, NQF Level 4, Credits 32;
- 734212-000-PM-07 Execute advanced rail joining, repair and maintenance work, NQF Level 4, Credits 48;

Total number of credits for Practical Skill Modules: 176

#### **Work Experience Modules:**

- 734212-000-WM-01 Apply generic processes and procedures of constructing and maintaining a Railway Lines, NQF Level 2, Credits 16;

- 734212-000-WM-03 Execute generic railway maintenance and construction tasks, NQF Level 2, Credits 16;
- 734212-000-WM-05 Execute specialised railway track construction and maintenance tasks, NQF Level 3, Credits 32;
- 734212-000-WM-06 Execute advanced rail joining, repair and maintenance work, NQF Level 4, Credits 32;

Total number of credits for Work Experience Modules: 96

### **Part Qualification 3:**

#### **Title:**

734212-000-00-03 **Railway Track Maintenance and Construction Practitioner**, NQF Level 4, Credits 117

#### **Purpose:**

To oversee and manage the total track maintenance and construction activities and to guide and coordinate the delivery of quality track maintenance and construction work.

#### **Entry Requirement**

Successful completion of Part Qualification 1 or 2 (Railway Track Welder or Railway Track Constructor).

#### **Applicable Modules (Rules of Combination)**

Knowledge Modules:

- 734212000-KM-04, Concepts of managing and supervising per-way construction and maintenance, NQF Level 4, Credits 66

Total number of credits for Knowledge Modules: 66

#### **Practical Skill Modules:**

- 734212-000-PM-08 Supervise and oversee the execution of rail construction and maintenance activities, NQF Level 4, Credits 19.

Total number of credits for Practical Skill Modules: 19

This qualification also requires the following Work Experience Modules:

- 734212-000-WM-07 Rail construction and maintenance management processes, NQF Level 4, Credits 32.

Total number of credits for Work Experience Modules: 32

## **SECTION 2: OCCUPATIONAL PROFILE**

### **1. Occupational Purpose**

Constructs, aligns, repairs and maintains permanent way infrastructure and associated works in the field of Civil Engineering to ensure the safe running of trains.

### **2. Occupational Tasks**

- **TASK 01:** Execute basic construction, maintenance and rehabilitation tasks on railway lines. NQF Level 2;
- **TASK 02:** Execute specialised railway construction and maintenance work NQF Level 3;
- **TASK 03:** Ensure the ongoing upgrading of the railway tracks, NQF Level 4;
- **TASK 04:** Managing rail construction and maintenance projects and processes, NQF Level 4.

### **3. Occupational Task Details**

#### **3.1. TASK 01: Execute basic construction, maintenance and rehabilitation tasks on railway lines.**

##### **Unique Product or Service**

- New railway lines built and aligned according to the required standards, existing lines inspected and maintained, and rehabilitation executed where required.

##### **Occupational Responsibilities**

- Operate and care for engineering hand and power tools within a railway construction and maintenance environment
- Execute basic per-way maintenance and construction work
- Execute basic grinding and welding work to install and repair railway lines

##### **Occupational Contexts**

- Apply generic processes and procedures of constructing and maintaining a Railway Lines
- Execute basic track joining and welding duties

#### **3.2. TASK 02: Execute specialised railway construction and maintenance work**

##### **Unique Product or Service**

- Inspect rail lines, identify potential problems and repair the lines according to standard

##### **Occupational Responsibilities**

- Execute generic railway maintenance and construction tasks
- Join and repair railway rails using welding techniques
- Build and construct specialised railway lines and related infrastructure

##### **Occupational Contexts**

- Execute generic railway maintenance and construction tasks
- Execute specialised railway track of joining, welding tasks
- Execute specialised railway track construction and maintenance tasks

#### **3.3. TASK 03: Ensure the ongoing upgrading of the railway tracks**

##### **Unique Product or Service**

- Existing lines upgraded to meet required standards or deal with changing conditions.

##### **Occupational Responsibilities**

- Execute advanced rail joining, repair and maintenance work



**Occupational Contexts**

- Execute advanced rail joining, repair and maintenance work

**3.4. TASK 04: Managing rail construction and maintenance projects and processes.****Unique Product or Service**

- Provide supervisory and management services for permanent staff and contractors and all materials and resources

**Occupational Responsibilities**

- Supervise and oversee the execution of rail construction and maintenance activities

**Occupational Contexts**

- Rail construction and maintenance management processes

## **SECTION 3: CURRICULUM COMPONENT SPECIFICATIONS**

### **SECTION 3A: KNOWLEDGE MODULE SPECIFICATIONS**

List of Knowledge Modules for which Specifications are included

- 734212000-KM-01 Fundamental principles and theories of welding, NQF Level 2, Credits 15
- 734212000-KM-02 Concepts and principles of per-way construction and maintenance, NQF Level 3, Credits 72
- 734212000-KM-03, Railway Track Diagnostics, NQF Level 4, Credits 33
- 734212000-KM-04, Concepts of managing and supervising per-way construction and maintenance, NQF Level 4, Credits 66

Total number of credits for Knowledge Modules: 186

## 1. 734212000-KM-01            Fundamental principles and theories of welding, NQF Level 2, Credits 15

### 1.1 Purpose of the Knowledge Modules

The focus of the learning in this knowledge module is to build the knowledge and understanding of learners regarding the theoretical principles that underpin welding and joining activities within a rail construction and maintenance environment.

The learning will enable learners to demonstrate an understanding of:

- 734212-000-KM-01:01 Demonstrate an understanding of materials and components used in rail construction and maintenance; and
- 734212-000-KM-01:02 264115 Demonstrate knowledge of introductory principles of metallurgy.

### 1.2 Guidelines for Topics

#### 1.2.1. 734212-000-KM-01:01            Demonstrate an understanding of materials and components used in rail construction and maintenance

**Topic elements to be covered include:**

- KT0101:** Purpose, properties and application of ballast and Sleepers;
- KT0102:** Purpose, properties and application of different rail types;
- KT0103:** Purpose, properties and application of turnouts and turnout components; and
- KT0104:** Purpose, properties, application and combination of fastening components

#### **Internal Assessment Criteria**

- IAC0101: **Demonstrate an understanding of the purpose, properties and application of ballast and sleepers:** a. The purpose of ballast in a railway track is explained with examples; b. Quality requirements in relation to ballast stone are identified carefully; c. Minimum requirements regarding the ballast profile are identified according to organisational requirements; d. The purpose and function of sleepers in a railway track are explained with examples; d. Different types of sleepers and their application are identified correctly; e. Requirements with regards to the handling of sleepers are explained according to organisational procedure.
- IAC0102: **Demonstrate an understanding of the purpose, properties and application of different rail types:** a. Different types of rails and their function are identified and explained with examples; b. The composition of rails and different classes of rails are explained with examples; c. Rail profiles and properties are listed accordingly; d. Factors to consider when selecting rails for specific applications are explained with examples; e. Principles for the handling of rails are explained with examples; f. Factors to consider in the re-use of rails are explained in detail; g. Basic principles pertaining to rail defects are explained with examples.
- IAC0103: **Demonstrate an understanding of the purpose, properties and application of turnouts and turnout components:** a. The purpose of turnouts in a railway track is explained with examples; b. Different types of standard turnouts and turnout components and their functions are identified and explained with examples; c. The composition of turnouts is described with examples; d. An understanding of the basic principles of rail wear on turnout components is demonstrated with examples; e. Principles for the handling of turnouts and turnout components are explained clearly; f. The application of different turnout sleeper types is explained with examples.
- IAC0104: **Demonstrate an understanding of the purpose, properties, application and combination of fastening components:** a. The purpose, properties, application and combination of fastening components for rails are explained with examples; b. The purpose, properties, application and combination of fastening components for turnouts and turnout components are explained with examples; c. The purpose, properties, application and combination of fastening components for different types of sleepers are explained with examples.

1.2.2. 734212-000-KM-01:02:                    **Demonstrate knowledge of introductory principles of metallurgy.**

**Topic Elements to be covered include:**

- KT0201:**            Role of metals in industry;
- KT0202:**            Building blocks of metals;
- KT0203:**            Structure of metals on an atomic as well as on a microscopic scale;
- KT0204:**            Physical properties and behaviour of metals;
- KT0205:**            Mechanical properties of metals;
- KT0206:**            Effects of adding another element to a metal;
- KT0207:**            Commonly used engineering metals.

**Internal Assessment Criteria:**

IAC0201:            ***Demonstrate an understanding of the role of metals in industry. RANGE Engineering materials include wood, leather, ceramics, rubber, plastics, and metals.***

- a. Types of engineering materials and examples of their application in manufactured products are discussed according to material theory.
- b. General characteristics of a metal are described according to material theory;
- c. Advantages of metals over other engineering materials are described according to material theory.

IAC0202:            ***Demonstrate basic knowledge of the building blocks of metals.***

- a. Understanding of the classic (Bohr) atom model is shown according to material science.
- b. The notions cations and anions are explained according to material science.
- c. Metallic elements are named as per the Periodic Table.

IAC0203:            ***Demonstrate knowledge and understanding of the structure of metals on an atomic and a microscopic scale.***

- a. The general arrangement of the atoms in a metal crystal is shown according to material science.
- b. The metallic bond and associated electron cloud are discussed according to Physical science.
- c. The main crystal structures that occur in metals are described according to material science.
- d. Main crystal structures include Body-Centred Cubic (BCC), Face-Centred Cubic (FCC) and Hexagonal.
- e. The influence of temperature on the crystal structure of iron is discussed according to physical science.
- f. The notions "poly-crystal", "grain boundary" and "fine grain" are explained according to metallurgical principles.
- g. The correct handling of a metallurgical microscope is shown, and the grain size of suitable samples measured according to standard operating procedures.

IAC0204:            ***Demonstrate understanding of the physical properties and behaviour of metals. RANGE Physical properties and behaviours include conductivity, density, magnetism, melting point.***

- a. Electrical conductivity and thermal expansion of metals in general are compared with other engineering materials according to principles of metallurgy.
- b. Distinction is made between "light" and "heavy" pure metals according to metallurgical principles.
- c. Pure metals that are magnetic are identified according to the Periodic Table.
- d. Melting point(s) of common pure metals are identified according to the Periodic Table.

IAC0205: ***Demonstrate a basic understanding of the mechanical properties of metals. OUTCOME RANGE Mechanical properties include hardness, strength, ductility, impact toughness.***

- a. "Hardness" and strength are defined according to mechanical properties.
- b. Principles and advantages of the Brinell, Rockwell, Vickers and rebound methods of hardness testing are discussed according to mechanical properties.
- c. The basic principle of the tensile test is discussed, and an example of a result sketched according to standard operating procedures.
- d. The notion "ductility" and how this is measured in the tensile test are discussed according to standard operating procedures.
- e. Notched bar impact test and its purpose are explained according to standard operating procedures.

IAC0206: ***Demonstrate understanding of the effects of adding another element to a metal.***

- a. Distributions of solute atoms in the lattice of the solvent are discussed according to principles of metallurgy.
- b. Phase diagram of two mutually fully soluble elements is sketched according to principles of metallurgy.
- c. Effects of relative atom size on the lattice of a solution and on mechanical properties is shown according to principles of metallurgy.
- d. The notions "partial solubility" and "solubility limit" and the formation of inter-metallic compounds are discussed according to principles of metallurgy.
- e. General effects of inter-metallic compounds on mechanical properties are discussed according to principles of metallurgy.

IAC0207: ***Demonstrate understanding of commonly used engineering metals. OUTCOME RANGE Discussion includes each object main element, major alloying element(s) if any, how it is produced, and why that material is used for that specific object and production route. Objects include tin cans, brass screws, aircraft wings, window frames, electric wires, car parts such as springs, bonnet, engine block, wheel hub and prop shaft, kitchen sink, 3-leg pot, cold chisel and church bell.***

- a. Main element and major alloying element(s) are discussed according to principles of metallurgy.
- b. Production route are explained according to foundry processes.
- c. Production routes include casting, rolling, forging, pressing, spinning, drawing, heat treating.
- d. The reasons for using a specific metal for the object and its associated production route, are explained according to principles of metallurgy.

### **1.3. Provider Accreditation Requirements for the Module:**

#### **Physical Requirements:**

- Normal lecture facilities and access to a simulated or controlled work environment

#### **Human Resources Requirements:**

- Facilitators of learning must have a proven track record of management work within the rail maintenance and construction area.
- Facilitator/learner ratio must not exceed 1/20

#### **Legal Requirements:**

- Compliance with all applicable regulatory requirements.

## 2. 734212000-KM-02: Concepts and principles of per-way construction and maintenance, NQF Level 3, Credits 72

### 2.1 Purpose of the Knowledge Modules

The focus of the learning in this knowledge module is to build the knowledge and understanding of learners regarding the theories and principles associated with the construction of railway tracks and related infrastructure.

The learning will enable learners to demonstrate an understanding of:

- 734212-000-KM-02:01: Demonstrate an understanding of rail technology
- 734212-000-KM-02:02: Apply occupational health, safety and environmental principles
- 734212-000-KM-02:03: Read and interpret construction drawings and specifications
- 734212-000-KM-02:04: Demonstrate an understanding of Occupational Health, Safety and Environmental Legislations
- 734212-000-KM-02:05: Explain basic health and safety principles in and around the workplace
- 734212-000-KM-02:06: Demonstrate basic knowledge of pneumatic components
- 734212-000-KM-02:07: Demonstrate basic knowledge of hydraulic components
- 734212-000-KM-02:08: Demonstrate an understanding of the "permanent way" context and related operations

### 2.2. Guidelines for Topics

#### 2.2.1: 734212-000-KM-02:01: Demonstrate an understanding of rail technology

**Topic Elements to be covered include:**

- KT0101: Demonstrating an understanding of composition of rail;
- KT0102: Explaining rail-wheel interaction on life of the rail and wheel;
- KT0103: Monitoring and controlling the condition of Continuously Welded Rail (CWR).

**Internal Assessment Criteria:**

IAC0101: ***Demonstrate an understanding of composition of rail.***

- a. This history of rail technology is explained in terms of the different production phases.
- b. Roll marks are identified to establish the hardness of the rail.
- c. The effects of joining different rail harnesses are explained in terms of track geometry.
- d. The materials to be used to join the rail track are identified according to specifications.
- e. Neutral axis and stress concentration points are explained in terms of rail safety.
- f. Causes of rail defects are explained in terms of adhering to safe maintenance methods.  
ASSESSMENT CRITERION RANGE Causes may include but are not limited to overheating, hammering, drilling, cutting, handling, bending, derailment damage, grinding, welding, lubrication, joint plates, sabotage.
- g. Classification of running lines is explained with examples in order to establish the correct rail requirements.

IAC0102: ***Explain rail-wheel interaction on life of the rail and wheel.***

- a. The reason why the rail profile must match the wheel profile is explained in order to optimise rail and wheel wear.
- b. How track geometry affects rail-wheel interaction is described in terms of track standards.
- c. Damage mechanisms that influence rail-wheel interaction are explained in terms of the effects on it.
- d. Damage mechanisms may include poor elasticity, poor track maintenance, worn/damaged track components, train handling, tilting of rails, transposing of rails.
- e. Methods of extending the life-span of the rail and wheels are explained with examples. ASSESSMENT CRITERION RANGE Methods may include but not limited to lubrication, check-rails, re-profiling.
- f. The purpose of corrective and preventative grinding is explained in terms of extending the life-span of the rail and wheel.

IAC0103: **Monitor and control the condition of Continuously Welded Rail (CWR).**

- a. Rail to sleeper fastening are inspected for compliance. ASSESSMENT CRITERION RANGE Compliance includes clamping force, damage to fastenings, missing fastenings, worn fastenings.
- b. Sleeper spacing is checked against standard.
- c. Ballast profile is inspected against standard.
- d. Track maintenance activities are explained in terms of specified temperature ranges.
- e. Track deviations on original design are observed and recorded in accordance with standard operating procedures.
- f. Conditions under which de-stressing takes place are explained in given scenarios. ASSESSMENT CRITERION RANGE Conditions include but are not limited to rail wear, maintenance activities, stress measurements, kick-outs, horizontal and vertical alignment.
- g. The effects of tonnage on rail stress is explained with examples.

## 2.2.2: 734212-000-KM-02:02: Apply occupational health, safety and environmental principles

### Topic Elements to be covered include:

- KT0201. Identifying hazards
- KT0202. Evaluating hazards
- KT0203. Controlling hazards
- KT0204. Explaining and using relevant legislation and regulations
- KT0205. Gathering and organising occupational health, safety and environmental information from the workplace
- KT0206. Carrying out occupational health and safety training

### Internal Assessment Criteria:

IAC0201: **Identify hazards.**

- a. Different hazards are identified and categorised according to specific area, job category, work procedure, machinery or substances used.
- b. Workplace inspections are undertaken in specific work areas/procedures.
- c. Information on specific Occupational Risk Exposure Profiles is contributed (OREP) in reports.
- d. Individual and categories of employees are assisted in contributing to their OREPs.
- e. Employees are assisted in hazard identification (informal on the job hazard education/training for other employees).
- f. Hazard identification is communicated in specific areas and jobs with employees and management.
- g. The links between work, health, safety and the environment are explained (public safety).

IAC0202: ***Evaluate and report hazards.***

- a. Hazards are evaluated and prioritised (in particular area, work procedures and job categories) according to the risk of exposure and the risk of detrimental health outcome (occupational injury or disease).
- b. Recommendations on hazards drafted in H&S structures are reported on and discussed.
- c. Participation in incident investigations is secured.
- d. Incident investigation outcomes are communicated with employees.
- e. A rudimentary knowledge of Risk Assessment (R.A.) and ability to contribute information to R.A is displayed.
- f. Employees are informed of hazard evaluation activities, results and R.A. reports.

IAC0203: ***Apply preventative measures (including training) in the workplace.***

- a. Control measures in place are identified and explained.
- b. The principle of the hierarchy of control measures to the workplace are applied.
- c. Hazard control measures are communicated, in specific areas and jobs with employees and management.
- d. The control measures in place for an area, work procedure, machinery or substance are described, evaluated and reported on.
- e. Informal, on the job peer learning is facilitated from shared experiences.
- f. Useful OH&S training materials and resources are identified and evaluated.
- g. Relevant OH&S training is undertaken.
- h. OH&S training needs are identified.

IAC0204: ***Explain, use and comply with relevant legislation and regulations.***

- a. The responsibilities, duties and rights of individuals in the workplace and the relevant internal and external bodies are described correctly.
- b. The OH&S information relevant to the workplace are located and explained.
- c. Relevant COID Act rights and procedures are explained and interpreted.
- d. Employees are informed of their OH&S rights.
- e. Employees are advised of the duties, functions and responsibilities of the employer and the H&S role players in the workplace.
- f. Information is utilised from the legislation to perform responsibilities/duties to engage.
- g. Employers` representatives on OH&S related issues are identified.
- h. The Department of Labour (DoL) representatives, OH practitioners and occupational hygienists responsible for measuring or undertaking surveillance programmes are engaged with
- i. Workplace compliance with regulations and legislation is assessed and reported on.

IAC0205: ***Gather and organise OHS information from the workplace.***

- a. Meetings and interviews with employees are conducted to gather OH&S needs and information.
- b. Information from reports, meetings and inspections is summarised to address H&S issues with affected employees.

**2.2.3: 734212-000-KM-02:03: Read and interpret construction drawings and specifications**

**Topic Elements to be covered include:**

- KT0301: Explain the role of drawings and specifications

**Internal Assessment Criteria:**

IAC0301: ***Explain the role of drawings and specifications***



- a. The role of drawings in relation to project specifications, contract documentation, quantities and construction is explained.
- b. The role of specifications in relation to quantities, quality of work, contract documentation and payment to contractors is explained.

IAC0302: ***Identify drawings and symbols used on a construction***

- a. Drawings are identified in terms of type and application for a construction process.
- b. Key functions of the drawing are explained in terms of the finished product.
- c. Key users of the drawing are identified in terms of work responsibilities.
- d. Specifications and notes are explained in terms of work requirements.
- e. Symbols and abbreviations are interpreted in terms of their functions and meanings.
- f. The layout is interpreted in terms of the different views shown.
- g. The purpose of each view is explained in terms of the result of the end product.

IAC0303: ***Safeguard, store and issue construction drawings***

- a. The purpose of drawing and revision numbers is explained in terms of utilisation of the correct drawing.
- b. Consequences of using the wrong drawing are explained in terms of the potential hazardous results on the finished product.
- c. Drawings are stored in a secure place in accordance with company procedures.
- d. Latest amendments of drawings are issued to the relevant people in accordance with company procedures.
- e. A drawing register is maintained in accordance with company procedures.

IAC0304: ***Apply information from drawings in construction activities***

- a. Drawings are oriented in terms of site landmarks and the north indicator.
- b. Information is extracted from the drawings in terms of the setting out requirements on site.
- c. Scales are interpreted, and measurements converted in terms of actual dimensions required.
- d. Dimensions are interpreted from the drawings in terms of site requirements.
- e. Information supplied in the notes section is interpreted in terms of the engineers designed purpose.
- f. Materials are identified in terms of ordering requirements.
- g. Limiting and/or guiding criteria are obtained from stated specifications.

**2.2.4: 734212-000-KM-02:04: Demonstrate an understanding of Occupational Health, Safety and Environmental Legislations**

**Topic Elements to be covered include:**

- KT0401: Basic principles of the Act and Regulations.
- KT0402. Minimum compliance stipulated in the Act.
- KT0403. Inspections and hazard identification.
- KT0404. National Environment Management Act.
- KT0405. Environment Conservation Act.

**Internal Assessment Criteria:**

IAC0401: ***Demonstrate knowledge and understanding of the basic principles of the Act and Regulations.***

- a. The site-specific safety report must conform to the OHS Act in terms of compliance criteria.
- b. The principles of OHS Act are described with reference to Act Regulations.
- c. The consequences of non-compliance are described within the generic framework of the Act relative to the duties of employer, employees and contractors.
- d. The accountability of the Chief Executive Officer or person deemed to be the Chief

Executive Officer under the Act is described in terms of the legal implications of non-compliance.

- e. Inspection progress and scope coverage is monitored and documented in accordance with written instructions.

IAC0402: **Explain the requirements for minimum compliance stipulated in the Act.**

- a. The Health and Safety structure conforms to the OHSA written instruction.
- b. The Health and Safety appointments must conform as indicated in the Act.
- c. Responsibilities and accountability are described in terms of the duties of the three designated appointments.
- d. Explain the obligation of the employer to provide the means to comply with the Act with reference to resources and financing.

IAC0403: **Conduct inspections to identify hazards.**

- a. Pre-use and audit inspections reports are conducted in accordance with specified requirements for the intended type of inspection.
- b. The potential life, safety and damage hazards are identified in accordance with specified requirements during the pre-use and audit inspection report.
- c. Hazard identification is carried out according to site specified safety requirements.
- d. Unsafe Conditions observed are compared to specified ACT requirements and identified deviations are recorded accurately.
- e. Workplace is inspected, and a report is generated on workplace hazards and associated risks as prescribe by OHSA inspections list.

IAC0404: **Demonstrate knowledge and understanding of the National Environment Management Act.** OUTCOME NOTES To provide for co-operative environmental

governance by establishing principles for decision- making on matters affecting the environment, institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state, and to provide for matters connected therewith

- a. To demonstrate knowledge and understanding of the National Environment Management Act, the concept of duty of care is explained with reference to pollution, environmental damage and remediation.
- b. A workplace inspection is carried out to determine conformance to prescribed standards of the National Environment Management Act and results are recorded in a prescribed manner.
- c. Liability relating to environmental damage is explained with reference to the company, directors and employees.
- d. Extension of liability is explained in terms of peoples legal standing and type of liability.
- e. The concept of civil liability is explained with reference to NEMA.
- f. The concept of criminal liability is explained with reference to NEMA.
- g. Offences that could result in extension of liability under NEMA are named with reference to related legislation dealing with air, water and environmental cover.

IAC0405: **Demonstrate knowledge and understanding that conforms to set criteria of the Environment Conservation Act.** OUTCOME NOTES To provide for the effective protection and controlled utilization of the environment and for matters incidental thereto.

- a. Requirements for waste management are explained with reference to the Act.
- b. Criminal liability for non-compliance is explained with reference to the Act.
- c. The relationship between this Act and NEMA is explained with reference to extension of liability.
- d. Activities that require environmental impact assessments are named with examples.
- e. The basic requirements for conducting environmental impact assessments are explained for a specific scenario.

**2.2.5: 734212-000-KM-02:05: Explain basic health and safety principles in and around the workplace**

**Topic Elements to be covered include:**

- KT0501. Employer and employee duties regarding occupational safety and health in the workplace.
- KT0502. General safety rules in a workplace.
- KT0503. Use and application of Personal Protective Equipment in a workplace.
- KT0504. Housekeeping in the workplace.
- KT0505. Emergency procedures in the workplace.

**Internal Assessment Criteria:**

IAC0501: ***Explain both employer and employee duties regarding occupational safety and health in the workplace.***

- a. The employer's duties are described regarding occupational safety and health in the
- b. workplace.
- c. The employee's duties are described regarding occupational safety and health in the workplace.
- d. The occupational health and safety representation structure and activities are described in terms of legislative requirements.
- e. Hazards and associated risks in the workplace are identified and addressed to ensure the health and safety of themselves and other persons.
- f. The importance of identifying hazards and risks in the working environment is explained in terms of the consequences to the employer and employees.
- g. The reporting procedure of hazards and risks is described in terms of organisational policies and procedures.

IAC0501: ***Explain the general safety rules in the workplace.***

- a. The requirements that apply to persons that may be medically and non-medically intoxicated are explained in terms of the consequences to general safety in the workplace.
- b. Authorised access requirements to the workplace are explained in terms of legal and organisational requirements.
- c. The use of motorized and mobile equipment in the workplace is explained in terms of legal and organisational requirements.
- d. Lock out procedures in the workplace are explained in terms of legal and organisational requirements.
- e. Symbolic and other signage applicable to the workplace is explained in terms of legal and organisational requirements.
- f. Symbolic and other signage may include but is not limited to mandatory, information, warning signs and colour coding.

IAC0503: ***Explain the use and application of Personal Protective Equipment in the workplace***

- a. Specific workplace Personal Protective Equipment (PPE) requirements are explained in terms of the correct usage and application.
- b. Maintenance and storage practices for PPE are explained to ensure functionality.
- c. Reporting and replacement procedures of substandard PPE are explained to ensure functionality.
- d. The importance of wearing PPE and the consequences of non-compliance are explained with in terms of the effects on employer and employees.
- e. The limitations of PPE used in and around the workplace are explained in terms of its protective restrictions.

IAC0504: ***Explain good housekeeping in the workplace.***

- a. The need for good housekeeping in the workplace is explained in terms of the impact on

health and safety to people and the immediate environment.

- b. Specific requirements pertaining to stacking and storage of materials are explained in terms of health and safety.
- c. Demarcation and colour coding practices in the workplace are explained in terms of health and safety.

IAC0505: ***Explain and apply emergency procedures in the workplace.***

- a. Emergency escape routes, assembly points and refuge bays in the work area are explained according to the organisational emergency plan.
- b. Emergency communication procedures in the workplace are explained according to the organisational emergency plan.
- c. A simulated exercise of an emergency is planned and carried out to assess the response/reaction of all employees.

## **2.2.6: 734212-000-KM-02:06: Demonstrate basic knowledge of pneumatic components**

### **Topic Elements to be covered include:**

- KT0601. Operation of basic air service components.
- KT0602. Operation of pneumatic valves.
- KT0603. Operation of pneumatic actuators.
- KT0604. Operation of pneumatic accessories.

### **Internal Assessment Criteria:**

IAC0601: ***Explain the operation of basic air service components.*** OUTCOME RANGE Basic air service components include filters, regulators and lubricators (FRL). Component symbols are identified from a circuit diagram in accordance with ISO 1219.

- a. Components are identified based on physical characteristics and appearance.
- b. Graphical representation of symbols is explained in terms of the relationship to the component.
- c. Port numbering, flow direction and function.
- d. The functionality of components is explained in terms of their operation.
- e. The operation of the components is explained in relation to the function they perform in the system.

IAC0602: ***Explain the operation of pneumatic valves.*** OUTCOME RANGE Valve types (glandless, soft seal, poppet), In-line & sub-base mounted, valve configuration (2/2, 3/2, 5/2, 5/3), valve operators (pilot, solenoid, mechanical & manual).

- a. Component symbols are identified from a circuit diagram in accordance with ISO 1219.
- b. Representation of symbols is explained in terms of the relationship to the component. Port numbering, flow direction, actuation and function.
- c. The functionality of components is explained in terms of their operation.
- d. The operation of the components is explained in relation to the function they perform in the system.
- e. Mechanical mounting interfaces of valves are recognised in terms of international standards.

IAC0603: ***Explain the operation of pneumatic actuators.*** OUTCOME RANGE Actuator types include rotary, linear, compact, rod-less, guided, grippers.

- a. Component symbols are identified from a circuit diagram in accordance with ISO 1219.
- b. Representation of symbols is explained in terms of the relationship to the component. Port numbering, flow direction and function.
- c. The functionality of components is explained in terms of their operation.
- d. The operation of the components is explained in relation to the function they perform in the system.
- e. Mechanical mounting interfaces of actuators are recognised in terms of international

standards.

- f. The forces produced by an actuator are calculated in accordance with fluid physics.

IAC0604: **Explain the operation of pneumatic accessories.** OUTCOME RANGE These include quick exhaust valves, flow controls, check & pilot operated check valves, function valves ("OR", "AND", "NOT") soft start valves, lock out valves, velocity fuses and fittings (push-on, push-in and compress.

- a. Component symbols are identified from a circuit diagram in accordance with ISO 1219.  
b. Representation of symbols is explained in terms of the relationship to the component.  
c. The functionality of components is explained in terms of their operation.  
d. The operation of the components is explained in relation to the function they perform in the system.

### 2.2.7: 734212-000-KM-02:07: Demonstrate basic knowledge of hydraulic components

#### Topic Elements to be covered include:

KT0701. Types of hydraulic components and their application.

KT0702. Hydraulic circuit diagrams and symbols.

KT0703. Adjustments on fluid power components.

#### Internal Assessment Criteria:

IAC0701: **Demonstrate understanding of the different types of hydraulic components and their application.**

- a. Components are identified by name and their common uses explained.  
b. The purpose of the component is explained in relation to the hydraulic circuit.  
c. Alternative components that perform the same or similar function are identified from a given list.  
d. Differences in component types are identified and explained in relation to the method of functioning.

IAC0702: **Demonstrate knowledge of hydraulic circuit diagrams and symbols.**

- a. Hydraulic circuit diagrams are interpreted to indicate the type and sequence of components.  
b. Symbols used are related to specific components in accordance with ISO 1219.  
c. Flow rates and direction are identified in relation to the hydraulic circuit.  
d. A parts list is compiled of all components required to assemble the circuit.

IAC0703: **Describe the effect of various adjustments on fluid power components.**

- a. The effect of changing settings on one component is described in terms of the impact on other components.  
b. Effects include speed, pressure, temperature and flow.  
c. The resultant impact on components is described in relation to the overall performance of the hydraulic system.  
d. Situations are described in which various adjustments should be made to balance the requirements of the system.

IAC0704: **Describe safety aspects related to hydraulic systems.**

- a. Consequences of creating excessive pressure in a hydraulic system are explained in relation to personal safety and damage to the system.  
b. Consequences of insufficient back-pressure in a hydraulic system are explained in relation to motion control.  
c. Procedures for isolating components are explained in relation to safe operation and maintenance of the hydraulic system.  
d. The effects of hydraulic fluids are explained in terms of safety, health and environmental requirements.

### 2.2.8: 734212-000-KM-02:08: Demonstrate an understanding of the "permanent way" context and related operations

**Topic Elements to be covered include:**

- KT0801. The organisational context.
- KT0802. The permanent way context.
- KT0803. Rail construction and maintenance operations.
- KT0804. Cost, statutory and regulatory considerations in relation to permanent way operations.

**Internal Assessment Criteria:**

- IAC0801: ***Demonstrate an understanding of the organisational context.***
- a. The organisational structure at both macro and micro level is described with examples.
  - b. Interactions required between different disciplines and or departments are explained with the emphasis placed on their importance.
  - c. The purpose of organisational policies and procedures is explained and the learner can access such policies and or procedures correctly.
  - d. Relevant documentation is completed legibly and correctly in accordance with organisational procedures.
  - e. The concept and impact of diversity in the workplace are explained fully.
  - f. Relevant learning and career pathways within the learner's context are described with examples.
- IAC0802: ***Demonstrate an understanding of the permanent way context.***
- a. The disciplines within permanent way are identified and explained with examples.
  - b. The importance and purpose of each discipline as an integral part of permanent way are explained according to their types.
  - c. The significance and contribution of permanent way within the broader rail industry are explained with appropriate examples.
- IAC0803: ***Demonstrate an understanding of rail construction and maintenance operations.***
- a. Preparatory processes preceding rail construction are explained with examples.
  - b. Rail construction is defined and the technologies and working conditions involved explained with examples.
  - c. Rail maintenance is defined and the technologies and working conditions involved described clearly.
  - d. The purpose of the track test laboratory is explained with examples.
  - e. The impact of different traffic conditions on line classification and maintenance standards is explained with examples.
  - f. The purpose of and procedures regarding permanent way and associated works inspections are explained with examples.
  - g. Terminology used within the rail construction and maintenance context is explained with examples.
  - h. Various stakeholders within rail construction and maintenance are identified and their role explained clearly.
- IAC0804: ***Demonstrate an understanding of the cost, statutory and regulatory considerations in relation to permanent way operations.***
- a. The relation between track revenue generation and track maintenance standards is explained clearly.
  - b. The concepts of capital expenditure versus operating costs in the context of a railway track are defined accordingly.
  - c. Cost implications of technologies and materials in relation to the operational environment are described with examples.
  - d. The possible impact of self and team members actions on costs is explained fully.
  - e. The concepts of quality management, risk management, occupational health and safety and environmental awareness are described, and the importance thereof explained clearly.
  - f. Legislation, Codes of Practice and Regulations relevant to permanent way are identified and

the purpose thereof explained in detail.

### **2.3. Provider Accreditation Requirements for the Module:**

#### **Physical Requirements:**

- Normal lecture facilities and access to a simulated or controlled work environment

#### **Human Resources Requirements:**

- Facilitators of learning must have a proven track record of management work within the rail maintenance and construction area.

- Facilitator/learner ratio must not exceed 1/20

#### **Legal Requirements:**

- Compliance with all applicable regulatory requirements

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### **3. 734212000-KM-03: Railway Track Diagnostics, NQF Level 4, Credits 33**

#### **3.1. Purpose of the Knowledge Modules**

The focus of the learning in this knowledge module is to build the knowledge and understanding of learners regarding the theoretical principles associated with rail diagnostics and specialised rail construction

The learning will enable learners to demonstrate an understanding of:

- 734212-000-KM-03:01 Concepts and principles of radiographic testing;
- 734212-000-KM-03:02 Demonstrate an understanding of ultrasonic testing of rail track;
- 734212-000-KM-03:03 Measure track geometry to determine track condition;
- 734212-000-KM-03:04 Evaluate and apply electronically measured track geometry

#### **3.2. Guidelines for Topics**

##### **3.2.1. 734212-000-KM-03:01 Concepts and principles of radiographic testing;**

#### ***Topic elements to be covered include:***

- KT0101. Use of radiographic testing;
- KT0102. Identifying exothermic welding defects;
- KT0103. Causes of defects; and
- KT0104. Processes to prevent welding defects

#### ***Internal Assessment Criteria***

IAC0101: Given the results of radio graphic testing learners will be able to identify the defects indicated on the results and describe the cause of the defects and the required preventative actions

##### **3.2.2. 734212-000-KM-03:02 Demonstrate an understanding of ultrasonic testing of rail track;**

#### **Topic Elements to be covered include:**

KT0201. Demonstrating an understanding of the principles of ultrasonic testing.  
KT0202. Gathering field data on the rail.  
KT0203. Reading ultrasonic reports.  
KT0204. Taking appropriate remedial action.

#### **Internal Assessment Criteria:**

IAC0201: ***Demonstrate an understanding of the principles of ultrasonic testing.***  
a. The purpose of ultrasonic testing on the rail is explained in terms of its importance to preventative maintenance.  
b. The propagation of ultrasonic sound in the rail is described in order to understand its

limitations.

- c. Conditions which may affect the effectiveness of the ultrasonic test are described in terms of penetration.
- d. Conditions may include but are not limited to the shape of rail, the surface condition and excessive lubrication.
- e. Areas of the rail not covered by the ultrasonic test are described by pointing them out on a diagram.
- f. The use of a couplant in ultrasonic testing is explained in terms of its importance to ensure propagation of ultrasonic sound.

IAC0202: ***Gather field data on the rail.***

- a. The data required is described to inform remedial action to be taken.
- b. Data required may include but is not limited to the type of rail, properties of the rail and wear.
- c. Data is collected using a rail wear gauge and by visual inspection.
- d. Data collected is recorded in accordance with policy and procedures.

IAC0203: ***Read ultrasonic reports.***

- a. The content of the ultrasonic rail test report is described to read and interpret the report
- b. The type of defect indicated is explained in terms of remedial action.
- c. The size of the defect indicated is explained in terms of remedial action.
- d. The defects are categorised in terms of seriousness and urgency.

IAC0204: ***Take appropriate remedial action.***

- a. Types of remedial action to be taken are explained with an example of each.
- b. Types of remedial action is determined by the size and type of the defect.
- c. The urgency of the remedial action is determined by the size and type of the defect.
- d. Notification of remedial action is communicated to all role players according to organisational policy and procedure.
- e. Field data collected is communicated to role players to facilitate repairs.

### **3.2.3. 734212-000-KM-03:03 Measure track geometry to determine track condition;**

#### **Topic Elements to be covered include:**

- KT0301: Purpose of track standards and measurements.
- KT0302. Prepare to measure track geometry.
- KT0303. Perform vertical and horizontal alignment deviation measurements.
- KT0304. Measure curves.
- KT0305. Interpret measurements to determine track condition.
- KT0306. Complete post-measurement operations.

#### **Internal Assessment Criteria:**

IAC0301: ***Demonstrate an understanding of the purpose of track standards and measurements.***

- a. The purpose of track standards and specifications are explained with examples.
- b. The purpose of track measurements is explained with examples.
- c. Possible track deviations and causes thereof are identified and explained correctly.
- d. The purpose, properties and safe application of the range of measurement tools are explained according to specifications.

IAC0302: ***Prepare to measure track geometry.***

- a. Job instruction is obtained and interpreted from relevant information.
- b. Relevant role-players including team members are informed and made available.
- c. Measurement tools are obtained and verified for correctness.
- d. Relevant personal protective equipment is identified and applied correctly.



- e. Appropriate protection is afforded in accordance with procedures.
  - f. Work environment is safe-guarded in accordance with regulations and procedures.
- IAC0303: ***Perform vertical and horizontal alignment deviation measurements.***
- a. Measurements must be performed on tangents, curves and turnouts.
  - b. Deviation area is identified correctly.
  - c. Possible deviations and/or track standards for the allocated work area are identified for correctness.
  - d. Appropriate measurements are performed accurately.
  - e. Measurement tools are ensured to comply with specifications.
  - f. Appropriate measurement tools are utilised for correctness.
  - g. Measurements are recorded legibly and in accordance with specific instructions.
  - h. Safe working methods are applied always.
- IAC0304: ***Measure curves.*** (RANGE Includes horizontal and vertical measurements).
- a. Fixed points of curve are identified correctly.
  - b. The middle offset is measured correctly.
  - c. Can't on curve is measured accurately.
  - d. Gauge is measured accurately.
- IAC0305: ***Interpret measurements to determine track condition.***
- a. Appropriate formulas are utilised correctly.
  - b. Calculations are done accurately.
  - c. Calculations include; (Radius Cant Gauge Off sets Tangent track)
  - d. Standards are calculated where required.
  - e. Calculation is compared with required standard and track condition and deviations are classified accurately.

### 3.2.4. 734212-000-KM-03:04 Evaluate and apply electronically measured track geometry

#### Topic Elements to be covered include:

- KT0401: Terminology of track geometry reports.
- KT0402: Assessing track conditions from reports to determine the extent and location of immediate priorities.
- KT0403: Locate immediate priority/ies on track.
- KT0404: Resource requirements to rectify deviations.

#### Internal Assessment Criteria:

- IAC0401: ***Demonstrate an understanding of the terminology of track geometry reports.***
- a. The layout of a strip chart is described in terms of headings and events.
  - b. The parameters on a strip chart are identified and described in accordance with industry specific definitions.
  - c. Parameters may include but are not limited to vertical alignment, twist, super elevation, gauge, horizontal alignment.
  - d. The scaling of the data on a strip chart is applied in order to determine the magnitude and location of the deviation.
  - e. Track standards are explained in accordance with laid down specifications. Track standards may include but are not limited to parameters, thresholds, fixed points, and vehicle structure gauge.
- IAC0402: ***Assess track conditions from reports in order to determine the extent and location of immediate priorities.***
- a. Reports may include but are not limited to strip charts, written reports, electronic copies, exception reports, track quality index, ADA II.
  - b. Reports are interpreted to determine the extent and location of immediate priorities.
  - c. Extracted information is prioritised in terms of the extent of the deviation.
  - d. The effects of deviations are explained with examples.

- e. Deviations are prioritised by applying the set parameters.
- IAC0403: ***Locate immediate priority/ies on track.***
- a. The methods of locating immediate priorities on track are described by using strip chart features.
  - b. The physical location of the deviation is pointed out in a given scenario.
  - c. The magnitude of the deviation is determined by using standard measurement procedures.
  - d. The cause of the deviation is determined in order to establish possible resource requirements.
- IAC0404: ***Determine the resource requirements to rectify deviations.***
- a. Resource requirements may include but are not limited to labour, material, cost machines, and equipment.
  - b. Local conditions which may have an impact on rectification actions are described in order to
  - c. optimise resources.
  - d. Local conditions may include security situation, access to works Mite, type and number of lines and communication availability.
  - e. Requirements are identified to match each individual deviation.
  - f. Emergency measures which must be taken are explained when resources are not immediately available.
  - g. Time frames of the repairs are explained in terms of different types of repair.
  - h. Role-players are communicated with regarding the actions being taken to rectify deviations.

### **3.3. Provider Accreditation Requirements for the Module:**

#### **Physical Requirements:**

- Normal lecture facilities and access to a simulated or controlled work environment

#### **Human Resources Requirements:**

- Facilitators of learning must have a proven track record of management work within the rail maintenance and construction area.
- Facilitator/learner ratio must not exceed 1/20

#### **Legal Requirements:**

- Compliance with all applicable regulatory requirements
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## **4. 734212000-KM-04: Concepts of managing and supervising per-way construction and maintenance, NQF Level 4, Credits 66**

### **4.1 Purpose of the Knowledge Modules**

The focus of the learning in this knowledge module is to build the knowledge and understanding of learners regarding the theories and concepts that underpins management and supervisory work within a rail construction and maintenance environment.

The learning will enable learners to demonstrate an understanding of:

- 734212-000-KM-04:01 Describe and apply the management functions of an organization
- 734212-000-KM-04:02 Identify responsibilities of a team leader in ensuring that organisational standards are met
- 734212-000-KM-04:03 Manage the operation of railway on track maintenance machines
- 734212-000-KM-04:04 Identify and describe disaster related risks and threatening situations utilizing basic disaster management concepts and indigenous knowledge
- 734212-000-KM-04:05 Apply a range of project management tools and techniques
- 734212-000-KM-04:06 Manage Expenditure against a budget
- 734212-000-KM-04:07 Manage safety and emergency incidences

- 734212-000-KM-04:08 Solve problems, make decisions and implement solutions
- 734212-000-KM-04:09 Manage contracts and contractors

## 4.2. Guidelines for Topics

### 4.2.1. 734212-000-KM-04:01 Describe and apply the management functions of an organization

#### Topic Elements to be covered include:

- KT0101: Describing the management activities involved in running a successful business.  
 KT0102: Explaining the basic activities involved in the management process.  
 KT0103: Identifying and explaining the main tasks required of managers.  
 KT0104: Applying the decision-making process to make a management decision.  
 KT0105: Analysing the application of the general management functions in a selected organisation.

#### Internal Assessment Criteria:

IAC0101: ***Describe the management activities involved in running a successful business***

- The business functions of an organisation are analysed, and the main business functions are identified for a specific organisation.
- The resources used in a business are analysed and the role of management in ensuring that resources of the business are used to best advantage is explained with examples from a specific organisation.
- The responsibilities of employees in ensuring that resources are used to best advantage is explained with examples.

IAC0102: ***Explain the basic activities involved in the management process***

- The basic activities involved in the management process are named with examples.
- The planning function in an organisation is identified and an indication is given of who in the organisation is responsible for the planning function.
- An example of the planning required in the learner's own situation is produced and an indication is given of how this fits into the organisations business plan.
- The organising function in an organisation is identified and an indication is given of who in the organisation is responsible for the organising function.
- The organising function in the learner's own position is identified with examples.
- The leading function in an organisation is identified and an indication is given of who in the organisation is responsible for the leading function.
- The leading function applicable to the learner is identified and an indication is given of the learner's own leadership style.
- The control function in an organisation is identified and an indication is given of who in the organisation is responsible for the control function.
- The control function in the learner's own situation is identified and an indication is given of what the learner controls and how s/he exercises control
- The difference between responsibility and accountability is explained with reference to delegation.

IAC0103: ***Identify and explain some of the tasks required of managers.***

- The decision-making task of managers is explained with examples.
- The communication task of managers is explained with examples and suggestions are made as to how cultural diversity can be accommodated in communications.
- The importance of trust in an organisation is explained and an indication is given of how trust affects communication.
- The coordinating task of managers is explained, and an indication is given of how the learner is responsible for co-ordinating based on a position description.
- The motivating task of managers is explained with examples.

- f. The delegating task of managers is explained, and an indication is given of what tasks can and may not be delegated in a specific organisation.
- g. The disciplinary task of managers is explained, and an indication is given of the role of the team leader/low level manager in the disciplinary process.
- h. The evaluating task of managers is explained, and an indication is given of the role of the junior manager in the assessing worker performance.

IAC0104: ***Apply the decision-making process to make a management decision***

- a. The steps to be followed in deciding are explained with reference to an authentic workplace situation.
- b. The decision-making process is used to make a management decision.

IAC0105: ***Apply the general management functions to a selected organisation.***

- a. The management functions in an organisation are listed and an indication is given of who in the organisation is responsible for each function.
- b. The way in which each management function is addressed in a specific organisation is explained with reference to the organogram of a selected organisation.
- c. The role of a team leader or low-level manager in the management of an organisation is outlined with reference to the basic management functions and tasks.

#### **4.2.2. 734212-000-KM-04:02 Identify responsibilities of a team leader in ensuring that organisational standards are met**

**Topic Elements to be covered include:**

- KT0201: Explaining the role of a team leader.
- KT0202: Explaining the purpose of a team.
- KT0203: Contracting with a team to obtain commitment.
- KT0204: Monitoring the achievement of team objectives.

**Internal Assessment Criteria:**

IAC0201: ***Explain the role of a team leader in an organisation.***

- a. The role of a team leader in an organisation is explained with reference to their job description.
- b. The responsibilities of a team leader are explained within the context of a work environment.
- c. The concepts of authority, responsibility and accountability are explained with reference to the team leaders own position in an organisation.
- d. The organising of workers in teams is explained in terms of recognised theory and practice.

IAC0202: ***Explain the purpose of the team.***

- a. The concept of a team is explained according to accepted theory and practice.
- b. The purpose of the team is explained to the team members according to organisational requirements.
- c. The role and expected outputs of each member of the team are identified in relation to the purpose.

IAC0203: ***Contract with the team members to obtain commitment to achieve organisational standards.***

- a. Tasks, performance plans, targets and standards are discussed and agreed according to organisational requirements.
- b. Time allocations for achieving individual and team objectives are agreed through a process of consultation.

IAC0204: ***Implement, monitor and evaluate performance against team objectives and organisational standards.***

- a. Agreed plans are implemented according to Standard Operating Procedures.
- b. Potential difficulties in achieving the plan are anticipated through reflection and feedback.
- c. Team outputs are monitored against agreed targets and time allocations.
- d. Variances to required outputs are identified and corrective action is taken where necessary.

#### **4.2.3. 734212-000-KM-04:03            Manage the operation of railway on track maintenance machines**

##### **Topic Elements to be covered include:**

- KT0301:**            Demonstrating an understanding of railway on track maintenance machines.
- KT0302:**            Explaining the duties and responsibilities of the person in charge of railway on track maintenance machines
- KT0303:**            Explaining the cost and production implications when using on track maintenance machines.
- KT0304:**            Explaining safety pertaining to on track maintenance machines

##### **Internal Assessment Criteria:**

- IAC0301:**            **Demonstrate an understanding of railway on track maintenance machines.**
- a. Different types of on track machines are identified according to their purpose and specification.
  - b. The purpose and application of different types on track maintenance machines are explained with examples.
  - c. The physical working of the different types of the on-track maintenance machine is explained in terms of their use.
- IAC0302:**            ***Explain the duties and responsibilities of the person in charge of railway on track maintenance machines.***
- a. Planning to be done before machines arrive on site is described in order to facilitate the
  - b. execution of the work.
  - c. Planning to be done may include but is not limited to physical inspection, site inspection, staging points, pre-maintenance, Technical Officers involvement, contract content and specifications, policies, rail directives, addendums, special conditions, fixed points and unique areas or circumstances.
  - d. Meetings with role players are conducted in order to clarify issues surrounding the contract. Role-players may include but are not limited to contractor/s, train control, Electrical
  - e. Department, Signals, Technical Officer and operator.
  - f. Rail worthiness of machines is ascertained before the commencement of work. Rail worthiness may include but is not limited to safety compliance, certification, suitability of personnel, and site access certificates.
  - g. Quality control is continuously monitored to ensure compliance to specifications Quality control may include but is not limited to rail temperature, rail stress caused with aligning, clearances, protection, communicating with operations, fire hazards, environmental concerns, principle of block working, site diary, and site instruction books.
  - h. Final inspection is conducted to assess finished product against specifications and standards.
  - i. Administration procedures are implemented according to organisational policies and procedures.
  - j. The actual output being produced is monitored in terms of contractual requirements and technical specifications.
- IAC0303:**            ***Explain the cost and production implications when using on track maintenance machines.***

- a. The implications of using either on track machines or manual workings are explained with examples of the pros and cons.
- b. The application of organisational specific policies and strategies regarding mechanisation are explained in terms of time frames and priorities.
- c. The relationship between production and cost is explained in order to optimise decisions.

IAC0304: ***Explain safety pertaining to on track maintenance machines.***

- a. Specific safety regulations that must be complied are listed in tabular form. Complied with refers to prior, during and finalisation of the contract.
- b. Methods for ensuring compliance to safety regulations are explained with examples.
- c. Actions to be taken in situations of non-compliance are explained in terms of organisational policies and procedures.
- d. The consequences of not adhering to safety regulations is explained in terms of its impact on the organisation.

#### **4.2.4. 734212-000-KM-03:04 Identify and describe disaster related risks and threatening situations utilizing basic disaster management concepts and indigenous knowledge**

**Topic Elements to be covered include:**

**KT0401:** Concepts related to disaster risk management.

**KT0402:** Hazards and conditions of vulnerabilities in a specific environment.

**KT0403:** Local capacity to deal with hazards and vulnerabilities.

**Internal Assessment Criteria:**

IAC0401: ***Define and explain concepts related to disaster risk management.***

- a. Disaster risk related terms are explained in accordance with local conditions. Related terms include but are not limited to:
- b. Hazard, natural phenomenon, vulnerability, capacity, disaster, incident, risk reduction, relief, response, significant event, community resilience, mitigation, recovery.
- c. Local conditions include indigenous knowledge.
- d. The interaction between components of disaster risk are explained to show their relation to each other.
- e. Components include but are not limited to hazards, vulnerabilities, risks and capacities.
- f. The relationship between disaster risk and development is explained to minimise disaster risk and vulnerability.
- g. The concept of community resilience is explained to minimise disaster risk and vulnerability.

IAC0402: ***Describe and compare hazards and conditions of vulnerabilities in a specific environment.***

- a. Local hazards are identified and described in order to determine the nature of disaster risk.
- b. The identification process includes the use of indigenous knowledge.
- c. Local hazards are evaluated and prioritised in terms of threats they pose in a specific context.
- d. Local vulnerabilities are identified and compared to determine the nature of risks.
- e. Local vulnerabilities are evaluated and prioritised in terms of threats posed.
- f. The role of stakeholder participation is described in hazard and vulnerability identification.

IAC0403: ***Identify local capacity to deal with hazards and vulnerabilities.***

- a. Local capacity is inclusive of indigenous knowledge.
- b. An inventory of local skills and capacities that are found within a specific context are identified and compiled in terms of its relevance to disaster risk management.

- c. The resources are identified and categorized for use in a specific disaster response environment.
- d. The role of communities and local stakeholders is explained in terms of its relevance to disaster risk management.
- e. Communities and local stakeholders include but are not limited to volunteers, Non-Governmental Organisations (NGOs), Community Based Organisations (CBOs), ward committees.
- f. Community resilience is explained to show its effects on the reduction of vulnerability.
- g. Community resilience includes but is not limited to networking, problem solving, structures, involvement programmes.
- h. Natural and human induced hazards are identified in order to determine the procedures that should be followed to minimise the consequences.

#### **4.2.5. 734212-000-KM-04:05: Apply a range of project management tools and techniques**

##### **Topic Elements to be covered include:**

- KT0501:** Demonstrating an understanding of project management tools.
- KT0502:** Using a range of project management tools.
- KT0503:** Applying corrective action steps where project management tools and techniques usage problems occur.

##### **Internal Assessment Criteria:**

- IAC0501: *Demonstrate an understanding of project management tools and techniques.***
- a. A range of tools and techniques used on a project are identified and explained in accordance with project requirements.
  - b. Limitations and advantages of project management tools and techniques are explained using examples.
  - c. Examples of the usage of the project management tools and techniques are provided in a hard copy format.
- IAC0502: *Use a range of project management tools and techniques.***
- a. A range of project management tools and techniques are used in accordance with established standards and procedures.
  - b. Output of project management tools and techniques meet individual, team and organisational needs/requirements.
- IAC0503: *Apply corrective action steps where project management tools and techniques usage problems occur.***
- a. Problems with the usage of project management tools and techniques are identified against project requirements.
  - b. Possible solutions are identified and discussed in consultation with higher authority.
  - d. Authorised / agreed solutions are implemented according to agreed steps.

#### **4.2.6. 734212-000-KM-04:06: Manage Expenditure against a budget**

##### **Topic Elements to be covered include:**

- KT0601:** Concept of budgeting pertinent to an area of responsibility.
- KT0602:** Elements of a budget relevant to an area of responsibility.
- KT0603:** Monitoring and controlling actual expenses (and revenue), against projected budget.

### **Internal Assessment Criteria:**

IAC0601: ***Explain the concept of budgeting pertinent to an area of responsibility.***

- a. The concept of a budget is explained with reference to expenditure in an area of responsibility.
- b. The budgeting technique employed is explained by means of worked examples.
- c. Budgeting techniques may include, but are not limited to, forecasting based on historic data, and zero-based budgeting.

IAC0602: ***Determine the elements of a budget in an area of responsibility.***

- a. The elements of the budget are identified for the resources required to meet the objectives.
- b. Internal and external constraints on a budget are identified in terms of an own organisational context.
- c. Monitor and control actual expenses against budget.
- d. Actual expenses are monitored according to Standard Operating Procedures.
- e. Variances are identified, and corrective measures are proposed and/or taken according to
- f. Standard Operating Procedures.

#### **4.2.7. 734212-000-KM-04:07:**

#### **Manage safety and emergency incidences**

##### **Topic Elements to be covered include:**

**KM0701:** Implement policy to promote the prevention of safety and emergency incidents.

**KM0702:** Manage incidents which affect the safety of an Individual, group or crowd.

**KM0703:** Manage emergency incidents which affect an individual, group or crowd.

**KM0704:** Manage the reaction of an individual, group or crowd to a safety or emergency incident.

### **Internal Assessment Criteria:**

IAC0701: ***Implement policy to promote the prevention of safety and emergency incidents. Policy is fully understood and implemented to promote the prevention of safety and emergency incidents.***

- a. Natural and unnatural emergencies have been considered and a plan is put in place to assist in either situation.
- b. Issues relating to incidents which may arise from faulty or misused property or equipment have been considered and can be appropriately dealt with.
- c. Human error and medical emergencies unrelated to the facility have been considered and are adequately catered for.
- d. Relevant legislation is complied with to prevent safety and emergency incidents.
- e. Manage incidents which affect the safety of an individual, group or crowd. Incidents are dealt with in an appropriate time frame and manner.
- f. Medical and/or security support is requested as soon as either or both are required.
- g. The safety incident is responded to according to policy and procedure and in an appropriate manner.
- h. The safety of the individual, group or crowd becomes an immediate focus.
- i. A thorough investigation follows the handling of the incident within a relevant time frame and authority.

IAC0702: ***Manage emergency incidents which affect an individual, group or crowd.***

- a. Incidents are dealt with in an appropriate time frame and manner.
- b. Medical and/or security support is requested as soon as this either or both are required.



- c. The emergency is responded to according to policy and procedure and in an appropriate manner.
- d. Reaction to the emergency and the manner in which it has affected, or may affect, an individual, group or crowd, becomes an immediate focus.
- e. A thorough investigation follows the handling of the incident within a relevant time frame and authority.

**IAC0703: Manage the reaction of an individual, group or crowd to a safety or emergency incident.**

- a. The person or group reaction is handled appropriately and quickly during a safety or emergency incident.
- b. Crowd control measures are implemented that are appropriate to the situation.
- c. Individuals, groups or crowds affected, or likely to be affected, by a safety or emergency incident are given due care, dignity and leadership.

#### **4.2.8. 734212-000-KM-04:08: Solve problems, make decisions and implement solutions**

**Topic Elements to be covered include:**

- KM0801:** Defining a problem.
- KM0802:** Investigating the problem.
- KM0803:** Generating problem solutions.
- KM0804:** Implementing problem solution.
- KM0805:** Evaluating the effectiveness of the solution.

**Internal Assessment Criteria:**

**IAC0801: *Define the problem.***

- a. Problems are defined according to the verified information.
- b. Information includes, but is not limited to, facts and opinions (positive or negative), future implications of no action, and emotions.
- c. The rationale for consulting with stakeholders and role-players is explained to ensure that they contribute to the various stages of the problem-solving process.
- d. Techniques in the formulation of the problem definition are explored and explained, according to theory and practice.
- e. A technique is selected in line with the context of the problem.

**IAC0802: Investigate the problem.**

- a. A problem is investigated to ascertain the various components.
- b. Further information is obtained, if required, and all information is critically examined for its relevance to the problem.

**IAC0803: Generate problem solutions.**

- a. Possible solutions are generated by using a range of problem-solving techniques. Includes, but is not limited to: Delphi Technique, Mapping, Computer Modelling, Observation, Questionnaires, Experiments, Brainstorming and other creative thinking techniques.
- b. Criteria are identified and weighted to enable the ranking of proposed solutions Includes, but is not limited to: Feasibility, time, cost, resource implications, stakeholder commitment, and logistics.
- c. Possible solutions are evaluated against the established criteria in order to determine suitability.

IAC0804: **Implement solution(s).**

- a. The optimum solution(s) is (are) selected in accordance with given criteria.
- b. Stakeholders are consulted prior to implementation, to obtain commitment.
- c. The selected solution (s) is (are) implemented, according to organisational constraints.

IAC0805: **Evaluate the effectiveness of the solution.**

- a. Criteria for the measurement of the effectiveness of the solution are identified according to the problem definition.
- b. Criteria include, but is not limited to, feasibility, suitability, acceptance, return on investment and alignment to role or strategy.
- c. The effectiveness of the solution is evaluated against the criteria.
- d. Corrective action is identified and applied, where possible.

**4.2.9. 734212-000-KM-04:09: Manage contracts and contractors**

**Topic Elements to be covered include:**

**KM0901:** Demonstrating an understanding of contract requirements.

**KM0902:** Verifying that work and safety inductions have been completed.

**KM0903:** Monitoring the work and safety practices of contractors and provide feedback.

**KM0904:** Resolving issues of non-compliance and poor performance by the contractors.

**KM0905:** Compiling progress reports and verifying completion of contract.

**Internal Assessment Criteria:**

IAC0901: ***Demonstrate an understanding of contract requirements.***

- a. Requirements may include different types of construction and maintenance work and a range of different contractors.
- b. The components of the contract are identified and explained with specific examples relating
- c. to the contract.
- d. Difficulties which may be faced implementing the contract are explained with examples.
- e. Specifications of the contract are examined in order to determine the outcomes and service to be delivered.
- f. Consequences of not establishing and understanding the contract requirements are explained with examples of their impact on the organisation.

IAC0902: ***Conduct safety inductions for contractors.***

- a. The responsibilities of all parties are identified regarding safety procedures.
- b. Reporting relationships are explained with examples of reporting structures.
- c. Safety induction process is performed in accordance with organisational procedures and safety requirements.
- d. Worksite induction documentation is completed according to worksite procedures.

IAC0903: ***Monitor the work and safety practices of contractors and provide feedback. The organisations health and safety measures are disseminated to the contractor and their workforce before work commences.***

- a. Contractors workforce is assessed for understanding of health and safety standards before work commences.
- b. Checks are carried out throughout the contract to ensure that health and safety procedures are applied by all contractors on site.

- c. Availability and visibility of first aid materials, equipment and tools are maintained throughout the contract.
- d. Unsafe working practices are dealt with in accordance with legislation and organisational procedures.

IAC0904: ***Resolve issues of non-compliance and poor performance by the contractors. Noncompliance performance is identified for individual contractors against the contract specifications.***

- a. Contractors are advised of undesirable performance following organisational procedures.
- b. Contractors are given the opportunity to discuss the sub-standard performance.
- c. A course of remedial action is developed with the contractor for implementation.
- d. Further remedial actions are carried out according to agreed procedures and in line with contract specifications.
- e. Confidentiality and respect for individuals is maintained throughout the process.

IAC0905: ***Compile progress reports and verify completion of contract.***

- a. Report information requirements are ascertained in accordance with contract and organisational requirements.
- b. All information relevant to the report is extracted and collated in the required format and time frame.
- c. Report is produced in accordance with organisational procedures and standards.
- d. Report is dispatched to meet agreed deadlines and to all authorised recipients.
- e. Confidentiality and security of information is maintained always.

### **4.3. Provider Accreditation Requirements for the Module:**

#### **Physical Requirements:**

- Normal lecture facilities and access to a simulated or controlled work environment

#### **Human Resources Requirements:**

- Facilitators of learning must have a proven track record of management work within the rail maintenance and construction area.
- Facilitator/learner ratio must not exceed 1/20

#### **Legal Requirements:**

- Compliance with all applicable regulatory requirements.
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### **SECTION 3B: PRACTICAL SKILL MODULE SPECIFICATIONS**

#### List of Practical Skill Module Specifications

- 734212-000-PM-01 Operate and care for engineering hand and power tools within a railway construction and maintenance environment, NQF Level 2, Credits 32;
- 734212-000-PM-02 Execute basic per-way maintenance and construction work NQF Level 2, Credits 18;
- 734212-000-PM-03 Execute basic grinding and welding work to install and repair railway lines, NQF Level 3, Credits 32;
- 734212-000-PM-04 Execute generic railway maintenance and construction tasks, NQF Level 3, Credits 32;
- 734212-000-PM-05 Join and repair railway rails using welding techniques, NQF Level 4, Credits 32;
- 734212-000-PM-06 Build and construct specialised railway lines and related infrastructure, NQF Level 4, Credits 32;
- 734212-000-PM-07 Execute advanced rail joining, repair and maintenance work, NQF Level 4, Credits 48;
- 734212-000-PM-08 Supervise and oversee the execution of rail construction and maintenance activities, NQF Level 4, Credits 19.

**Total Practical skills credits 245**

## **1. 734212000-PM-01, Operate and care for engineering hand and power tools within a railway construction and maintenance environment, NQF Level 2, Credits 32;**

### **1.1 Purpose of the Practical Skill Modules**

The focus of the learning in this module is on providing learners the opportunity to practice the skills required to use various tools and equipment within a railway construction and maintenance environment.

The learner will be required to:

- PM01-01: Select, use and care for engineering hand tools
- PM01-02: Select, use and care for engineering power tools
- PM01-03: Select, use and maintain per-way tools and equipment
- PM01-04: Cut rails of various profiles and grades
- PM01-05: Operate rail disc-cutting machine

### **1.2 Guidelines for Practical Skills**

#### **1.2.1. PM-01-PS01: Select, use and care for engineering hand tools**

##### ***Scope of Practical Skill***

Give a simulated or controlled work environment where engineering hand tools must be selected, used and cared for as well as all the required materials, tools and equipment, learners are able to:

- PA0101 Select and use Engineering hand tools.
- PA0102 Care for and maintain engineering hand tools.
- PA0103 Work safely with due care for self, fellow workers, equipment, materials and the environment.

##### ***Applied Knowledge***

- AK0101 Learners can explain the names & functions of:
  - Relevant personal protective equipment
  - Engineering hand tools
- AK0102. Learners can describe the purpose of:
  - Various engineering hand tools
  - Cleaning and care of engineering hand tools
- AK0103. Learners can describe processes, events, causes and effects, implications of:
  - Causes of injury and damage to materials
  - Implications of incorrect or inappropriate use of tools
- AK0104. Learners can apply procedures and techniques:
  - Safety
  - Storage
  - Cleaning
  - Maintenance
  - Use of various engineering hand tools
- AK0105. Learners can apply regulations, legislation, agreements, policies, standards for:
  - Applicable safety, health and environmental protection legislation and standards
- AK0106. Learners understand theory: rules, principles, laws:
  - Basic concepts of leverage, force and torque
- AK0107. Learners can explain relationships, systems:
  - Role of engineering hand tools in the field of manufacturing engineering and technology.
  - Inspection techniques including analysis and investigation techniques;

### ***Internal Assessment Criteria***

- IAC0101 Observe and evaluate the extent to which learners comply with the appropriate procedures and operational protocols;
- IAC0102 Observe and evaluate compliance with regulatory requirements;
- IAC0103 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0104 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0105 Evaluate the effectiveness of problem-solving;
- IAC0106 Evaluate the accuracy and timeliness of reporting and records.

### **1.2.2. PM-01-PS02: Select, use and care for engineering power tools**

#### ***Scope of Practical Skill***

Give a simulated or controlled work environment where engineering power tools must be selected, used and cared for as well as all the required material, tools and equipment learners will be able to:

- PA0201 Select and use engineering power tools
- PA0202 Care for and maintain engineering power tools
- PA0203 Check on power supply connections to equipment
- PA0204 Recognise and report problems, changes and/or malfunctions while working
- PA0205 Work safely with due care for self, fellow workers, machines, equipment, materials and environment
- PA0206 Inspect total work and perform line up operations

#### ***Applied Knowledge***

- AK0201 Inspection techniques including analysis and investigation techniques;
- AK0202 Risk assessment techniques;
- AK0203 Field work techniques;
- AK0204 Operating techniques;
- AK0205 Problem solving techniques and processes
- AK0206 Record keeping and log writing techniques;
- AK0207 Reporting, teamwork and communication techniques;
- AK0208 Organising and big picture thinking techniques.

### ***Internal Assessment Criteria***

- IAC0201 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0202 Observe and evaluate compliance with regulatory requirements;
- IAC0203 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0204 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions

- IAC0205 Evaluate the effectiveness of problem-solving
- IAC0206 Evaluate the accuracy and timeliness of reporting and records.

### 1.2.3. PM-01-PS03: Select, use and maintain per-way tools and equipment

#### **Scope of Practical Skill**

Give a simulated or controlled work environment where Perway tools and equipment must be used.

#### **Perway hand tools include:**

- Tamping tools include but are not limited to ballast forks, beaters and shovels.
- Carrying tools include but are not limited to rail tongs and sleeper carrying rods.
- Drilling tools include but are not limited to Augers and drill bits.
- Cutting tools include but are not limited to axes, chopping knife, two hand-saw, hand-saw, adze, hacksaw, sickles, cold chisel.
- Moving and pulling tools include but are not limited to slewing bar, tommy bar, rail hand slewing bar, claw bar, creep pulling machine, slewing jack and mini rollers.
- General tools include but are not limited to screw drivers, combination pliers and hammers.
- Lifting equipment include but are not limited to Perway jack, destressing jack, sighting boards, optical sighting instrument and track gauge.
- Tightening and loosening tools include but are not limited to fish bolt spanner, shifting spanner, socket spanners, fist levers and Pandrol levers.
- Straightening and bending tools include but are not limited to jim-crow.
- Liquid and fuel containers include but are not limited to oil cans, jerry cans and water cans.
- Clamping tools include but are not limited to joggle fish plates, g-clamps, points and clamp tie bars.

**Hand tool maintenance includes**, de-rusting, oiling and replacing.

**Basic units of measure include** length, mass, temperature and angle.

**Measuring equipment includes** but are not limited to tapes, rules, feeler gauges, thermometers, rail wear gauges, try square and centre punch.

**Damaged or faulty measuring equipment includes** deformities, breakages, stickiness, not zeroing, missing parts and expired calibration.

**Maintenance of measuring equipment includes** oiling, setting and calibration.

**Perway power tools include but are not limited to:** rail drills, rail cutting machines, disc cutters, Pionjrs, sleepers drills, stumec machines and impact wrench.

#### **Learners must be able to:**

- PA0301 Select and use Perway hand tools.
- PA0302 Select and use Perway measuring equipment.
- PA0303 Select and use Perway power tools.
- PA0304 Ensure tools and equipment are maintained.

#### **Applied Knowledge**

- AK0301 Basic concepts of leverage, force, pressure and torque.
- AK0302 Types, properties and application of Perway hand tools, measuring equipment and power tools.

- AK0303 Storage and maintenance requirements with regard to Perway hand tools, measuring equipment and power tools.
- AK0304 Basic units of measure, symbols and derived units of measure.
- AK0305 Types and application of Personal Protective Equipment.
- AK0306 Health, Safety & Housekeeping procedures and regulations. Reporting requirements and procedures Inspection techniques including analysis and investigation techniques;

***Internal Assessment Criteria***

- IAC0301 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0302 Observe and evaluate compliance with regulatory requirements;
- IAC0303 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0304 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0305 Evaluate the effectiveness of problem-solving;
- IAC0306 Evaluate the accuracy and timeliness of reporting and records.

**1.2.4. PM-01-PS04: Cut rails of various profiles and grades**

***Scope of Practical Skill***

Give a simulated or controlled work environment where railway rails of various profiles and grades must be cut as well as all the required materials, tools and equipment learners **are able to:**

- PA0401 Identify, select and use of the correct equipment, tools and material.
- PA0402 Do Operational testing of equipment.
- PA0403 Plan and prepare for cutting.
- PA0404 Identify rail types.
- PA0405 Cut rails.
- PA0406 Deal with unforeseen circumstances during the cutting operation.
- PA0407 Remove equipment from rail after the cutting process.

***Applied Knowledge***

- AK0401 The purpose, function and use of measuring equipment.
- AK0402 District asset diagram reading.
- AK0403 The purpose, function and operation of tools and equipment.
- AK0404 The purpose, function, identification and use of consumables.
- AK0405 Act 85 related to applicable equipment and machines used.
- AK0406 Lifting equipment (Code of Practice No 29 & 30).
- AK0407 The stowage of equipment.
- AK0408 Track maintenance instructions, procedures and specifications related to the cutting of rails.



- AK0409 Track welding specifications related to the cutting of rails.
- AK04010 Safe work procedures related to the cutting of rails.
- AK04011 Basic electricity.
- AK04012 The purpose, function and use of personal protective equipment.
- AK04013 Rails identification (Roll marks).
- AK04014 The parameters of limits as stated in specification for the length and depth of defects.
- AK04015 Crack detection by non-destructive test.
- AK04016 The identification, purpose and use of specific fastenings.
- AK04017 The pre-heating process and procedures for different rail types.

#### ***Internal Assessment Criteria***

- IAC0401 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0402 Observe and evaluate compliance with regulatory requirements;
- IAC0403 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0404 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0405 Evaluate the effectiveness of problem-solving;
- IAC0406 Evaluate the accuracy and timeliness of reporting and records.

#### **1.2.5. PM-01-PS05: Operate rail disc-cutting machine**

##### ***Scope of Practical Skill***

Give a simulated or controlled work environment where a rail disc-cutting machine must be operated as well as all the required materials, tools and equipment learners must be able to: **are able to:**

- PA0501 Identify and obtain the relevant rail disc cutting machines.
- PA0502 Identify and obtain relevant consumables.
- Prepare the rail disc-cutting machine according to manufacturer's instructions and specifications correctly and safely.
- PA0504 Plan and prepare for cutting.
- PA0505 Identifying the different rail profiles;
- PA0506 Operate the disk cutting machine;
- PA0507 Execute post operation activities

##### ***Applied Knowledge***

- AK0501 The purpose, function and use of measuring equipment.
- AK0502 The identification of fire hazards.
- AK0503 The purpose, function and operation of tools and equipment.
- AK0504 The purpose, function, identification and use of consumables.

- AK0505 Act 85 related to applicable equipment and machines used.
- AK0506 Code of Practice No 29 & 30.
- AK0507 The stowage of tools, equipment and consumables.
- AK0508 Track welding specifications as well as track maintenance instructions related to the operation of the rail disc cutter.
- AK0509 Safe work procedures related to the operation of the rail disc cutter.
- AK05010 The purpose, function and use of personal protective equipment. Material identification.
- AK05010 The identification, purpose and use of a cutting disc.

#### ***Internal Assessment Criteria***

- IAC0501 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0502 Observe and evaluate compliance with regulatory requirements;
- IAC0503 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0504 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0505 Evaluate the effectiveness of problem-solving;
- IAC0506 Evaluate the accuracy and timeliness of reporting and records.

#### **1.3 Provider Programme Accreditation Criteria**

##### ***Physical Requirements:***

- Learning provider must demonstrate access to an appropriate lecture facility with all the resources to deliver the required learning as set out in the curriculum;
- Providers must have access to simulated or actual work environments where the practical skills can be developed.

##### ***Human Resource Requirements:***

- Facilitators of learning must be in possession of a recognised qualification that qualifies them as track masters;
- Facilitators of learning should have a minimum of three years post qualification experience as a practising Track Master;
- The facilitator/learner ratio should not exceed 1:15.

##### ***Legal Requirements:***

- Meet all Occupational Health and safety requirements;
- Meet the requirements of all relevant regulatory specifications.

#### **1.4 Exemptions**

- No exemptions were identified providers must apply to the AQP to have programmes recognised for purposes of exemption.

## **2. 734212000-PM-02, Execute basic per-way maintenance and construction work, NQF Level 2, Credits 18**

### **2.1 Purpose of the Practical Skill Modules**

The focus of the learning in this module is on providing the learner an opportunity to practice the skills required to operate and control ash and dust disposal works in a fossil power generating facility.

The learner will be required to:

- PM02-01: Maintain clearances, safety devices and markers to ensure a safe rail environment
- PM02-02: Install and maintain trackside rail lubricators
- PM02-03: Maintain ballast
- PM02-04: Maintain sleepers

### **2.2 Guidelines for Practical Skills**

#### **2.2.1. PM-02-PS01: Maintain clearances, safety devices and markers to ensure a safe rail environment**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where clearances, safety devices and markers must be maintained, including all the required materials, tools and equipment:

- In different weather and environmental conditions
- Preferably in daytime
- In different yard layouts/mainline/sidings/private sidings/shed/workshop (might or might not include overhead traction and Railway signaling)
- Within a specific time, span Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility etc
- Horizontal and vertical clearances include:
  - Track center clearances
  - Clearances between track and structures including platforms
  - Tunnel Clearances
  - Temporary clearances
  - Track signage
- Appropriate corrective action to rectify clearance deviations include:
  - Correction by hand
  - Correction by machine
  - Closure of track (termination of train operations)
- Safety devices include, but are not limited to:
  - Stop blocks Derailment devices
  - Points blade protector
  - Clearance marker

##### **Learners must be able to:**

- PA0101 Prepare to maintain clearances, safety devices and markers.
- PA0102 Maintain horizontal and vertical clearances.
- PA0103 Install and/or maintain safety devices and fouling points.
- PA0104 Complete post-maintenance operations.

##### ***Applied Knowledge***

- AK0101 Code of Practice 29

- AK0102 Purpose, types and positioning of safety devices
- AK0103 Principles and methods for the measurement of structures
- AK0104 Types of corrective action for maintaining clearances Installation methods for safety devices
- AK0105 Track standards and specifications
- AK0106 Relevant environmental regulations and legislation Health, Safety and Housekeeping procedures and regulations
- AK0107 Reporting and documentation requirements and procedures

#### ***Internal Assessment Criteria***

- IAC0101 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0102 Observe and evaluate compliance with regulatory requirements;
- IAC0103 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0104 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions
- IAC0105 Evaluate the effectiveness of problem-solving;
- IAC0106 Evaluate the accuracy and timeliness of reporting and records.

#### **2.2.2. PM-02-PS02: Install and maintain trackside rail lubricators**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where track-side rail lubricators must be installed and maintained, including all the required material, tools and equipment:

- In different weather and environmental conditions.
- Preferably in daytime.
- In different yard layouts/mainline/sidings/private sidings/shed/workshop (might or might not include overhead traction and Railway signaling).
- Within a specific time, span.
- Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility etc.
- Lubricators include but are not limited to:
  - Porter and Moore type lubricators.
  - Moore and Steele type lubricators.
- Lubricator defects could include:
  - Worn, broken or incorrect components.
  - Leakages and other environmental threats.
  - Component adjustment defect.
  - Insufficient lubricant levels.
  - Incorrect lubricants.

##### **Learners must be able to:**

- PA0201 Demonstrate an understanding of trackside rail lubricators.
- PA0202 Prepare to install trackside rail lubricators.
- PA0203 Install trackside rail lubricators.
- PA0204 Inspect, fill and maintain trackside rail lubricators.

- PA0205 Complete post installation and maintenance operations.

### ***Applied Knowledge***

- AK0201 Code of Practice 29 The purpose of rail lubrication
- AK0202 Different types and models of track side lubricators
- AK0203 Components of lubricators and their function
- AK0204 Typical problems experienced with lubricators in service
- AK0205 Environmental impact of lubrication spillages, leakages and misuses
- AK0206 Quantity calculation of materials required for lubricator maintenance/installation
- AK0207 The properties of different lubricants, as well as filling methods used
- AK0208 Rail types, rail wear and sizes
- AK0209 Track standards and specifications with regard to off-sets
- AK02010 Relevant environmental regulations and legislation Health, Safety and Housekeeping procedures and regulations
- AK02011 Reporting and documentation requirements and procedures

### ***Internal Assessment Criteria***

- IAC0201 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0202 Observe and evaluate compliance with regulatory requirements;
- IAC0203 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0204 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0205 Evaluate the effectiveness of problem-solving;
- IAC0206 Evaluate the accuracy and timeliness of reporting and records

### **2.2.3. PM-02-PS03: Maintain ballast**

#### **Scope of Practical Skill**

Given a simulated or controlled railway work environment where ballast must be maintained, including all the required materials tools and equipment:

- In different weather and environmental conditions.
- Preferably in daytime.
- In different yard layouts/mainline/sidings/private sidings/shed/workshops (might or might not include overhead traction and Railway signalling).
- Within a specific time, span.
- Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility

#### **Learners must be able to:**

- PA0301 Prepare for ballast maintenance.

- PA0302 Screen ballast by hand.
- PA0303 Replenish ballast.
- PA0304 Complete post-maintenance operations.

### **Applied Knowledge**

- AK0301 Code of Practice 29 Ballast profile dimensions
- AK0302 Temperature ranges Ballast off-loading procedures
- AK0303 Tamping and screening procedures
- AK0304 Box-in procedures Quality requirements and specifications with regard to ballast works
- AK0305 Relevant environmental regulations and legislation Health, Safety and Housekeeping procedures and regulations
- AK0306 Reporting and documentation requirements and procedures

### **Internal Assessment Criteria**

- IAC0101 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0102 Observe and evaluate compliance with regulatory requirements;
- IAC0103 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0104 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions
- IAC0105 Evaluate the effectiveness of problem-solving;
- IAC0106 Evaluate the accuracy and timeliness of reporting and records.

### **2.2.4. PM-02-PS04: Maintain sleepers**

#### **Scope of Practical Skill**

Given a simulated or controlled railway work environment where sleepers must be maintained, including all the required material, tools and equipment:

Competency must be demonstrated:

- In different weather and environmental conditions
- Preferably in daytime > In different yard layouts/mainline/sidings/private sidings/shed/workshops (might or might not include overhead traction and Railway signalling)
- Within a specific time, span
- By handling heavy materials
- Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility, etc
- Sleepers include: Wooden sleepers > Steel sleepers > Concrete sleepers > Transition ladders > Rail substitute sleepers > Sleepers on bridges without ballast
- Fastening includes different fastenings for different types of sleepers, as well as drilling of sleepers
- Handling includes: > Storage > Loading > Transporting > Stacking > Off-loading > The use of push trolleys and rail transporters to transport permanent way materials
- The learner must be able to tamp sleepers manually, as well as by using small work.
- The learner should prove competence in the maintenance of sleepers on all types of railway track.

#### **Learners must be able to:**

- PA0401 Prepare to maintain sleepers.
- PA0401 Replace and space sleeper in track.
- PA0401 Tamp sleepers.
- PA0401 Complete post-maintenance operations.

## **Applied Knowledge**

- AK0401 Types of sleepers and their properties and applications
- AK0402 Handling requirements with regard to sleepers
- AK0403 Drilling methods and procedures
- AK0404 Sleeper placing procedures
- AK0405 Requirements with regards to different types of sleeper fastenings
- AK0406 Specifications with regards to sleeper spacing and placing
- AK0407 Tamping procedures
- AK0408 Box-in procedures
- AK0409 Code of Practice 29 Relevant environmental regulations and legislation Health, Safety & Housekeeping procedures and regulations
- AK04010 Reporting and documentation requirements and procedures

## **Internal Assessment Criteria**

- IAC0201 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0202 Observe and evaluate compliance with regulatory requirements;
- IAC0203 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0204 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0205 Evaluate the effectiveness of problem-solving;
- IAC0206 Evaluate the accuracy and timeliness of reporting and records

## **2.3 Provider Programme Accreditation Criteria**

### ***Physical Requirements:***

- Learning provider must demonstrate access to an appropriate lecture facility with all the resources to deliver the required learning as set out in the curriculum;
- Providers must have access to simulated or actual work environments where the practical skills can be developed.

### ***Human Resource Requirements:***

- Facilitators of learning must be in possession of a recognised qualification that qualifies them to work as a Railway Track Master;
- Facilitators of learning should have a minimum of three years post qualification experience as a practising Railway Track Master;
- The facilitator/learner ratio should not exceed 1:15.

### ***Legal Requirements:***

- Meet all Occupational Health and safety requirements;
- Meet the requirements of all relevant regulatory specifications.

## **2.4 Exemptions**

- No exemptions were identified providers must apply to the AQP to have programmes recognised for purposes of exemption.

## **3. 734212000-PM-03, Title: Execute basic grinding and welding work to install and repair railway lines, NQF Level 3, Credits 32**

### **3.1 Purpose of the Practical Skill Modules**

The focus of the learning in this module is on providing learners an opportunity to practice the skills required to execute basic welding and grinding work for the installation and maintenance of railway tracks.

The learner will be required to:

- PM03-01: Cut materials using the oxy-fuel gas cutting process (manual cutting)
- PM03-02: Grind rails of various profiles and grades
- PM03-03: Operate hydraulic rail shearing machine
- PM03-04: Operate petrol- air pre-heating machine
- PM03-05: Operate rail grinding machine
- PM03-06: Repair battered rail ends
- PM03-07: Weld carbon steel work-pieces using the shielded metal arc welding process in the down-hand position.
- PM03-08: Weld wheel spin burns

### **3.2 Guidelines for Practical Skills**

#### **3.2.1. PM-03-PS01: Cut materials using the oxy-fuel gas cutting process (manual cutting);**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where material must be cut using the oxy-fuel gas cutting process (manual cutting) including all the required materials, tools and equipment:

- o Material type to be used: May be selected from the range of carbon steels (plate only), applicable to the material groups 1, 2, 3 or 11 [according to ISO (TR) 15608]. Material thickness: minimum - 10mm.
- o Visual identification of cutting defects includes but is not limited to incorrect cutting torch manipulation, angle, burned edges, flame and pressure setting.
- o Cleaning of cuts includes removal of scale, spatter, soot and removal of sharp edges.
- o Cleaning tools include but are not limited to wire brushes, chipping hammer, and chisels.
- o Statutory requirements include OHS Act and local authority requirements.
- o Work site practices include but are not limited to written and/or verbal procedures.

**The learner must be able to:**

- PA0101 Describe the oxy-fuel cutting process.
- PA0102 Prepare for the oxy-fuel cutting operation.
- PA0103 Cut material.

##### ***Applied Knowledge***

- AK0101 ***Names and functions of:***
  - o Gas cutting equipment.
  - o Different types of gases.
  - o Nozzles.
  - o Personal protective equipment.
- AK0102 **Attributes, descriptions, characteristics and properties:**
  - o Characteristics of metals.



- Types of fuel gases and gas pressures.
- Common defects.
- Hazards.
- Properties of gases (oxygen, acetylene, propane, LPG). Sensory cues: Smell indicating flammable gas leaks.
- Purpose of: Oxy-fuel gas cutting.
- Safety checks.
- Quality checks. Processes, events, causes and effects, implications:
- **AK0103 Implications of using incorrect gas.**
  - Implications of using incorrect nozzles.
  - Implications of using incorrect gas pressure settings.
  - Implications of ignoring cutting defects.
  - Implications of not following correct light up and shutdown procedures.
  - Implications of not checking for gas leaks.
  - Implications of not preparing work piece before cutting. Implications of not caring for equipment.
- **AK0104 Procedures and techniques:**
  - Set up procedures for gas cutting equipment.
  - Oxy-fuel gas cutting procedures.
  - Preparation for cutting metals.
  - Safety procedures.
  - Safety procedures for cutting coated material.
  - Quality procedures.
  - Recording and reporting procedures.
  - Regulations, legislation, agreements, policies, standards:
  - Applicable safety, health and environmental protection legislation and standards.
- **AK0105 Theory: rules, principles, laws:**
  - Applicable basic cutting theory covering properties of materials.
  - Safety principles governing use of gas cutting equipment.
- **AK0106 Relationships, systems:**
  - Relationship of the gas to the metals.
  - Relationship of pressure to nozzle size.
  - Relationship between cutting torch manipulation and quality of cut.
  - Relationship between the thickness of the material and the size of the nozzle.
  - Relationship between the thickness of the material and the cutting process (mechanical or thermal).

### ***Internal Assessment Criteria***

- IAC0101 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0102 Observe and evaluate compliance with regulatory requirements;
- IAC0103 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0104 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions
- IAC0105 Evaluate the effectiveness of problem-solving;
- IAC0106 Evaluate the accuracy and timeliness of reporting and records.

### **3.2.2. PM-03-PS02: Grind rails of various profiles and grades;**

#### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where rails of various profiles and grades must be grinded including all the required materials, tools and equipment:

Performance must be carried out:

- o In different weather conditions
- o During day and night time
- o In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction)
- o Within a specific time, span
- o Under hazardous conditions
- o Inclusive of all types of rail structures.
- o Exclusive of non-ferrous metals.
- o Inclusive of all IC-electric and hydraulic-driven rail grinding equipment.

#### **The learner must be able to:**

- PA0201 Plan and prepare resources and equipment prior to the grinding of rails.
- PA0202 Plan and prepare for the grinding of rails.
- PA0203 Grind rails of various profiles and grades.
- PA0204 Complete the relevant technical documentation.

#### ***Applied Knowledge***

- AK0201 Basic metallurgical principles.
- AK0202 Purpose, function and use of measuring equipment.
- AK0203 District asset diagram reading.
- AK0204 Purpose, function and operation of tools and equipment.
- AK0205 Purpose, function, identification and use of consumables. Act 85 related to applicable equipment and machines used.
- AK0206 Lifting equipment (Code of Practice No 29 & 30).
- AK0207 Stowage of equipment.
- AK0208 Track Maintenance instructions, procedures and specifications related to the grinding of rails.
- AK0209 Relevant clauses of track welding specifications related to the grinding of rails. Safe work procedures related to the grinding of rails.
- AK02010 Basic electricity.
- AK02011 Purpose, function and use of personal protective equipment.
- AK02012 Rail structure identification (Roll marks).
- AK02013 Parameters of limits as stated in the specification for the length and depth of defects.

- AK02014 Crack detection by non-destructive test.
- AK02015 Identification, purpose and use of specific fastenings.

**Internal Assessment Criteria**

- IAC0201 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0202 Observe and evaluate compliance with regulatory requirements;
- IAC0203 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0204 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0205 Evaluate the effectiveness of problem-solving
- IAC0206 Evaluate the accuracy and timeliness of reporting and records.

**3.2.3. PM-03-PS03: Operate hydraulic rail shearing machine;**

**Scope of Practical Skill**

Given a simulated or controlled railway work environment where a hydraulic rail shearing machine must be operated including all the required materials, tools and equipment: In different weather conditions. During day and night time. In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction). Within a specific time-span. Under hazardous conditions. **The learner must be able to:**

- PA0301 Identify and obtaining the relevant rail shearing machines;
- PA0302 Identify and obtaining relevant consumables.
- PA0303 Prepare the rail-shearing machine according to manufacturer's instructions and specifications correctly and safely.
- PA0304 Plan and prepare for shearing.
- PA0305 Identify the different rail profiles
- PA0306 Stabilize out of normal conditions;
- PA0307 Conduct running checks and fault finding on the equipment

**Applied Knowledge**

- AK0301 Inspection techniques including analysis and investigation techniques;
- AK0302 Risk assessment techniques;
- AK0303 Field work techniques;
- AK0304 Operating techniques;
- AK0305 Problem solving techniques and processes;
- AK0306 Record keeping and log writing techniques;
- AK0307 Reporting, teamwork and communication techniques;
- AK0308 Organising and big picture thinking techniques.

**Internal Assessment Criteria**

- IAC0301 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0302 Observe and evaluate compliance with regulatory requirements;
- IAC0303 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0304 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0305 Evaluate the effectiveness of problem-solving;
- IAC0306 Evaluate the accuracy and timeliness of reporting and records

#### **3.2.4. PM-03-PS04: Operate petrol- air pre-heating machine;**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where a petrol- air pre-heating machine must be operated including all the required materials, tools and equipment: In different weather conditions. During day and night time. In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction). Within a specific time, span. Under hazardous conditions.

##### **The learner must be able to:**

- PA0401 Plan and prepare for petrol air pre-heating machine.
- PA0402 Identify and select the petrol air pre-heating equipment.
- PA0403 Identify the different rail types.
- PA0404 Apply the correct start up procedures according to manufacturer's specifications and company instructions.
- PA0405 Apply the correct testing procedures according to manufacturer's specifications and company instructions.
- PA0406 Apply the correct operating procedures according to manufacturer's specifications and company instructions.
- PA0407 Apply the correct shutdown procedures according to manufacturer's/company instructions.
- PA0408 Inspect total work and perform line up operations

##### ***Applied Knowledge***

- AK0401 Inspection techniques including analysis and investigation techniques;
- AK0402 Risk assessment techniques;
- AK0403 Field work techniques;
- AK0404 Operating techniques;
- AK0405 Problem solving techniques and processes;
- AK0406 Record keeping and log writing techniques;
- AK0407 Reporting, teamwork and communication techniques;
- AK0408 Organising and big picture thinking techniques.

##### ***Internal Assessment Criteria***

- IAC0401 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0402 Observe and evaluate compliance with regulatory requirements;

- IAC0403 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0404 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions
- IAC0405 Evaluate the effectiveness of problem-solving;
- IAC0406 Evaluate the accuracy and timeliness of reporting and records

### **3.2.5. PM-03-PS05: Operate rail grinding machine;**

#### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where a rail grinding machine must be operated including all the required materials, equipment and tools: In different weather conditions. During day and night time. In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction). Within a specific time-span. Under hazardous conditions. Learners will be able to:

#### **The learner must be able to:**

- PA0501 Identify and obtaining the relevant rail grinding machines.
- PA0502 Identify and obtain relevant consumables.
- PA0503 Prepare the rail-grinding machine according to manufacturer's instructions and specifications correctly and safely.
- PA0504 Plan and prepare for grinding.
- PA0505 Identify the different rail profiles

#### ***Applied Knowledge***

- AK0501 Purpose, function and use of measuring equipment.
- AK0502 Identification and handling of fire hazards.
- AK0503 Identification and handling of safety hazards.
- AK0504 Purpose, function, identification and operation of tools and equipment.
- AK0505 Purpose, function, identification and use of consumables.
- AK0506 Act 85 related to applicable equipment and machines used.
- AK0507 Stowage of tools, equipment and consumables.
- AK0508 Track welding specifications and instructions related to the operation of the rail-grinding machine.
- AK0509 Safe work procedures related to the operation of the rail-grinding machine.
- AK05010 Purpose, function and use of personal protective equipment.
- AK05011 Material identification and verification.
- AK05012 Purpose, function and use of fire-fighting and first-aid equipment Inspection techniques including analysis and investigation techniques;

#### ***Internal Assessment Criteria***

- IAC0501 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0502 Observe and evaluate compliance with regulatory requirements;

- IAC0503 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0504 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0505 Evaluate the effectiveness of problem-solving;
- IAC0506 Evaluate the accuracy and timeliness of reporting and records

### **3.2.6. PM-03-PS06: Repair battered rail ends.**

#### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where battered rail ends must be repaired, including all the required materials, tools and equipment: In different weather conditions. During day and night time. In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction). Within a specific time-span. Under hazardous conditions.

#### **The learner must be able to:**

- PA0601 Identify and selecting the correct rail-grinding machine.
- PA0602 Identify, select and use of the correct equipment, tools and material.
- PA0603 Identify the different rail profiles.
- PA0604 Operationally test equipment.
- PA0605 Apply safe working procedures and instructions related to repairing battered rail ends.
- PA0606 Repair battered rails ends in accordance with the prescribe procedures, instructions and specifications.
- PA0607 Perform none destructive test on rails.
- PA0608 Perform pre- and post-heating procedures.
- PA0609 Deal with unforeseen circumstances during the shearing operation.
- PA06010 Inspect total work and perform line up operations;

#### ***Applied Knowledge***

- AK0601 Inspection techniques including analysis and investigation techniques;
- AK0602 Risk assessment techniques;
- AK0603 Field work techniques;
- AK0604 Operating techniques;
- AK0605 Problem solving techniques and processes;
- AK0606 Record keeping and log writing techniques;
- AK0607 Reporting, teamwork and communication techniques;
- AK0608 Organising and big picture thinking techniques.

#### ***Internal Assessment Criteria***

- IAC0601 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0602 Observe and evaluate compliance with regulatory requirements;
- IAC0603 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);

- IAC0604 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0605 Evaluate the effectiveness of problem-solving;
- IAC0606 Evaluate the accuracy and timeliness of reporting and records.

### **3.2.6. PM-03-PS07: Weld carbon steel work-pieces using the shielded metal arc welding process in the down-hand position.**

#### ***Scope of Practical Skill***

Given a simulated or controlled work environment where the welding of carbon steel work-pieces using the shielded metal arc welding process in the down-hand position is required. Including all the required materials, tools and equipment: Scope: Material type to be selected from the range of carbon steels (plate only), applicable to the material groups 1, 2, 3 or 11 [according to ISO (TR) 15608]. Material thickness: Minimum - 1,6mm. Context: All work undertaken must comply with Occupational Health and Safety Act. All work done must comply with worksite practices. All work done under consistent supervision.

#### **The learner must be able to:**

- PA0701 Describe the shielded metal arc welding process.
- PA0702 Select, set up and conduct pre-operational checks of shielded metal arc welding equipment.
- PA0703 Prepare workpieces prior to welding.
- PA0704 Weld workpieces.
- PA0705 Inspect welded work piece for defects in compliance with drawing specifications.
- PA0706 Care for and store welding consumables and equipment.

#### ***Applied Knowledge***

- AK0701 Inspection techniques including analysis and investigation techniques;
- AK0702 Risk assessment techniques;
- AK0703 Field work techniques;
- AK0704 Operating techniques;
- AK0705 Problem solving techniques and processes;
- AK0706 Record keeping and log writing techniques;
- AK0707 Reporting, teamwork and communication techniques;
- AK0708 Organising and big picture thinking techniques.

#### ***Internal Assessment Criteria***

- IAC0701 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0702 Observe and evaluate compliance with regulatory requirements;
- IAC0703 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0704 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0705 Evaluate the effectiveness of problem-solving;
- IAC0706 Evaluate the accuracy and timeliness of reporting and records.

### **3.2.6. PM-03-PS08: Weld wheel spin burns**

#### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where wheel spin burns must be welded including all the required materials, tools and equipment: In different weather conditions. During day and night time. In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction). Within a specific time, span. Under hazardous conditions.

#### **The learner must be able to:**

- PA0801 Identify and select the correct rail-grinding machine.
- PA0802 Identify, select and use of the correct equipment, tools and material.
- PA0803 Identify the different rail profiles.
- PA0804 Operationally test equipment.
- PA0805 Apply safe working procedures and instructions related to repair wheel spin burns.
- PA0806 Repair rails in accordance with the prescribe procedures, instructions and specifications.
- PA0807 Perform none destructive test on rails.
- PA0808 Perform pre- and post-heating procedures correctly.
- PA0809 Deal with unforeseen circumstances during the shearing operation.

#### ***Applied Knowledge***

- AK0801 Inspection techniques including analysis and investigation techniques;
- AK0802 Risk assessment techniques;
- AK0803 Field work techniques;
- AK0804 Operating techniques;
- AK0805 Problem solving techniques and processes;
- AK0806 Record keeping and log writing techniques;
- AK0807 Reporting, teamwork and communication techniques;
- AK0808 Organising and big picture thinking techniques.

#### ***Internal Assessment Criteria***

- IAC0801 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0802 Observe and evaluate compliance with regulatory requirements;
- IAC0803 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0804 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0805 Evaluate the effectiveness of problem-solving;
- IAC0806 Evaluate the accuracy and timeliness of reporting and records.

### **3.3 Provider Programme Accreditation Criteria**

#### ***Physical Requirements:***

- Learning provider must demonstrate access to an appropriate lecture facility with all the resources to deliver the required learning as set out in the curriculum;



- Providers must have access to simulated or actual work environments where the practical skills can be developed.

*Human Resource Requirements:*

- Facilitators of learning must be in possession of a recognised qualification for Railway Track Master;
- Facilitators of learning should have a minimum of three years post qualification experience as a practising Railway Track Masters;
- The facilitator/learner ratio should not exceed 1:15.

*Legal Requirements:*

- Meet all Occupational Health and safety requirements;
- Meet the requirements of all relevant regulatory specifications.

**3.4 Exemptions**

- No exemptions were identified providers must apply to the AQP to have programmes recognised for purposes of exemption.

## **4. 734212000-PM-04, Execute generic railway maintenance and construction tasks, NQF Level 3, Credits 32**

### **4.1 Purpose of the Practical Skill Modules**

The focus of the learning in this module is on providing learners an opportunity to practice the skills required to execute generic railway maintenance and construction tasks.

The learner will be required to:

- PM04-01: Destress rails
- PM04-02: Maintain rails
- PM04-03: Restore track alignment
- PM04-04: Maintain associated works
- PM04-05: Provide on-track protection

### **4.2 Guidelines for Practical Skills**

#### **4.2.1. PM-04-PS01: Destress rails**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where rails must be destressed as well as all the required tools, equipment and material. In normal weather conditions within specified temperature ranges during daytime. In different yard layouts/mainline/sidings/shed/workshop (might or might not include overhead traction and railway signalling). Within a specific time, span. Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility etc. Is inclusive of: Continuous welded rails Short Rails, turn out frog, the setting of splice joints, Determining stress free temperatures in the rail.

**The learner must be able to:**

- PA0101 Prepare to destress rails.
- PA0102 Destress continuous welded rails conventionally.
- PA0103 Destress continuous welded rails using a rail tensioner.
- PA0104 Destress jointed rails.
- PA0105 Repair creep in the track.
- PA0106 Determine stress free temperatures in the rail.
- PA0107 Complete post-operational tasks related to destressing.
- PA0108 Inspect total work and perform line up operations;

##### ***Applied Knowledge***

- AK0101 Inspection techniques including analysis and investigation techniques;
- AK0102 Risk assessment techniques;
- AK0103 Field work techniques;
- AK0104 Operating techniques;
- AK0105 Problem solving techniques and processes;
- AK0106 Record keeping and log writing techniques;
- AK0107 Reporting, teamwork and communication techniques;
- AK0108 Organising and big picture thinking techniques.

##### ***Internal Assessment Criteria***

- IAC0101 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0102 Observe and evaluate compliance with regulatory requirements;
- IAC0103 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);

- IAC0104 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0105 Evaluate the effectiveness of problem-solving;
- IAC0106 Evaluate the accuracy and timeliness of reporting and records.

#### **4.2.2. PM-04-PS02: Maintain rails**

##### ***Scope of Practical Skill***

Given a simulated or controlled work environment where railway rails must be maintained as well as all the required material, tools and equipment. Competency must be demonstrated: In different weather and environmental conditions. Preferably in daytime. In different yard layouts/mainline/sidings/private sidings/shed/workshop (might or might not include overhead traction and Railway signalling). Within a specific time, span. Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility etc. This includes the maintenance of:

- All rails of different profiles and mass in all types of railway tracks.
- Jointed and continuous welded track.
- Check rail curves.
- Safety rails on bridges.
- Junction rails.
- Reconditioned rails.
- Second hand rails.
- All types of rail joints.
- Rails not complying to specifications (e.g. defective rails).
- Closure rails.
- Special rails. The maintenance of the following is excluded:
- Turnout components (all types of stock and switch rails, frogs, stock and guard rails).
- Pre-assembled spliced joints.
- Rail joints include: Different types of fish plates. Different types of insulated joints.
- Handling includes: Storage. Loading Transporting. Off-loading. Stacking. The use of push trolleys and rail transporters to transport permanent way materials.
- Actions to maintain rail joints could include: Lifting and alignment. Preparation for welding or grinding. Lubrication of joint. Replacement of material not complying to specifications. Repairing or cropping battered and dipped joints.

##### **The learner must be able to:**

- PA0201 Prepare for rail maintenance.
- PA0202 Prepare rails for placement.
- PA0203 Replace rails.
- PA0204 Maintain rail joints.
- PA0205 Complete post maintenance operations.

##### ***Applied Knowledge***

- AK0201 Code of Practice 29 Rail inspection procedures
- AK0202 Composition of rails and different rail classes
- AK0203 Different rail profiles and properties
- AK0204 Factors to consider in the selection of rails for specific applications and in the re-use of rails
- AK0205 Typical rail defects and fractures
- AK0206 Principles of rail wear
- AK0207 Principles of the utilisation of rail wear gauges
- AK0208 Quantity calculations of rails and fastenings
- AK0209 Safe handling of rails, equipment and tools (storage, stacking, loading, off-loading, transportation)

- AK0210 Application and calculation of off sets
- AK0211 Methods of bending, cutting and drilling rails
- AK0212 Methods for placing rails Rail fastening procedures
- AK0213 Rail joint maintenance procedures
- AK0214 Transposing procedures and principles
- AK0215 Temperature ranges
- AK0216 Track standards and specifications
- AK0217 Welding principles and procedures
- AK0218 Relevant environmental regulations and legislation Health, Safety and Housekeeping procedures and regulations
- AK0219 Reporting and documentation requirements and procedures
- AK0220 Inspection techniques including analysis and investigation techniques;

#### ***Internal Assessment Criteria***

- IAC0201 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0202 Observe and evaluate compliance with regulatory requirements;
- IAC0203 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0204 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0205 Evaluate the effectiveness of problem-solving;
- IAC0206 Evaluate the accuracy and timeliness of reporting and records.

#### **4.2.3. PM-04-PS03: Restore track alignment**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where rail alignment must be restored including all the required material, tools and equipment; Competency must be demonstrated In different weather and environmental conditions Preferably in daytime In different yard layouts/mainline/sidings/private sidings/shed/workshop (might or might not include overhead traction and Railway signalling) Within a specific time span Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility etc The learner should prove competence in the restoring of track alignment deviations in accordance with the required track standards, on the following: Short rails Continuous welded rails Tangent (Straight) rails Curved rails Turnouts Vertical alignment deviations include, but are not limited to: Slack Cross slack Blind slack Joint slack Hump Horizontal alignment deviations include: Kinks Kick-outs Track gauge The learner should prove competence in the restoration of horizontal and vertical deviations on tracks that have been built with steel, wooden and concrete sleepers.

##### **The learner must be able to:**

- PA0301 Prepare to restore alignment.
- PA0302 Restore vertical alignment.
- PA0303 Restore horizontal alignment.
- PA0304 Complete the restoring process.
- PA0305 Prepare to destress rails.

##### ***Applied Knowledge***

- AK0301 Different types of track alignment deviations
- AK0302 Possible causes of track alignment deviations and preventative actions
- AK0303 Track maintenance and specifications
- AK0304 Track restoring methods

- AK0305 Track hand-over procedures
- AK0306 Health, Safety and Housekeeping procedures and regulations
- AK0307 Environmental regulations and legislation
- AK0308 Reporting and documentation requirements and procedures
- AK0309 Inspection techniques including analysis and investigation techniques;

#### ***Internal Assessment Criteria***

- IAC0301 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0302 Observe and evaluate compliance with regulatory requirements;
- IAC0303 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0304 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0305 Evaluate the effectiveness of problem-solving;
- IAC0306 Evaluate the accuracy and timeliness of reporting and records.

#### **4.2.4. PM-04-PS04: Maintain associated works**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where associated works must be maintained as well as all the required materials, tools and equipment: Associated works include, but are not limited to: Beacons Fences Level crossings (Including track sign boards) Cattle guards Rail indicator boards Off-track platforms Weed control Service roads Underground services Fire/fire breaks Types of level crossings include: Pedestrian crossings Cattle crossings Obligatory private level crossings Private crossings Public crossings Rail indicator boards include: Gradient indicators and kilometre posts Permanent speed restriction boards Temporary speed restriction boards Distance, warning and water boards Different types of materials for the construction of level crossings include, but are not limited to: Paving Tar Concrete, Concrete blocks, All types of sleepers, Gravel and grid Drainage systems include but are not limited to: Box culverts Pipe culverts Storm water drains Sub surface drains Surface drains

##### **The learner must be able to:**

- PA0401 Demonstrate an understanding of associated works.
- PA0402 Prepare for the maintenance of associated works.
- PA0403 Inspect and maintain associated works.
- PA0404 Complete post-maintenance operations.

##### ***Applied Knowledge***

- AK0401 Code of Practice 29 Track standards and specifications
- AK0402 Purpose of and maintenance requirements with regards to the range of associated works
- AK0403 Different drainage systems
- AK0404 Earthworks specifications
- AK0405 Relevant environmental regulations and legislation Health, Safety and Housekeeping procedures and regulations
- AK0406 Reporting and documentation requirements and procedures
- AK0407 Inspection techniques including analysis and investigation techniques;

#### ***Internal Assessment Criteria***

- IAC0401 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0402 Observe and evaluate compliance with regulatory requirements;

- IAC0403 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0404 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0405 Evaluate the effectiveness of problem-solving;
- IAC0406 Evaluate the accuracy and timeliness of reporting and records.

#### **4.2.5. PM-04-PS05: Provide on-track protection**

##### ***Scope of Practical Skill***

Given simulated or controlled railway work environments where on track protection must be provided including all the required materials, tools and equipment.

##### **The learner must be able to:**

- PA0501 Mitigate the impact of hazards and risks in railway operations.
- PA0502 Respond to an emergency situation.
- PA0503 Afford protection in applicable area of operation.
- PA0504 Conduct post protection procedures.

##### ***Applied Knowledge***

- AK0501 Specific situations that require protection.
- AK0502 Methods of providing protection.
- AK0503 Communication processes a specific situation.
- AK0504 Safety rules and regulations related to protection that include detonators.
- AK0505 Relevant elements of POSMOR and specific company rules related to protection.
- AK0506 Relevant elements of the OHS Act, Act 85 of 1993.

##### ***Internal Assessment Criteria***

- IAC0501 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0502 Observe and evaluate compliance with regulatory requirements;
- IAC0503 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0504 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0505 Evaluate the effectiveness of problem-solving;
- IAC0506 Evaluate the accuracy and timeliness of reporting and records.

#### **4.3 Provider Programme Accreditation Criteria**

##### ***Physical Requirements:***

- Learning provider must demonstrate access to an appropriate lecture facility with all the resources to deliver the required learning as set out in the curriculum;
- Providers must have access to simulated or actual work environments where the practical skills can be developed.

##### ***Human Resource Requirements:***

- Facilitators of learning must be in possession of a recognised qualification for Railway Track Master;

- Facilitators of learning should have a minimum of three years post qualification experience as a practising Railway Track Master;
- The facilitator/learner ratio should not exceed 1:15.

*Legal Requirements:*

- Meet all Occupational Health and safety requirements;
- Meet the requirements of all relevant regulatory specifications.

**4.4 Exemptions**

- No exemptions were identified providers must apply to the AQP to have programmes recognised for purposes of exemption.

## **5. 734212000-PM-05, Join and repair railway rails using welding techniques, NQF Level 4, Credits 32**

### **5.1 Purpose of the Practical Skill Modules**

The focus of the learning in this module is on providing learners an opportunity to practice the skills required to join and repair railway tracks using basic welding techniques.

The learner will be required to:

- PM05-01: Join rails by means of the exothermic welding process
- PM05-02: Repair rail-manufactured frogs

### **5.2 Guidelines for Practical Skills**

#### **5.2.1. PM-05-PS01: Join rails by means of the exothermic welding process**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where rails must be joined by means of the exothermic welding process, including all the required materials, tools and equipment: In different weather conditions. During day and night time. In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction). Within a specific time-span. Under hazardous conditions. This unit standard is inclusive of chrome-manganese rails, rail-bound and rail-manufactured frogs. This unit standard is exclusive of mono block frogs.

- PA0101 Obtain the correct equipment, tools, consumables and human resources.
- PA0102 Test the operation of equipment.
- PA0103 Apply safe working procedures and instructions related to the exothermic welding process.
- PA0104 Execute none destructive test on rails.
- PA0105 Cast rails.
- PA0106 Shear rails.
- PA0107 Grind rails.
- PA0108 Remove equipment from rail in accordance with company and manufacturer's instructions.

##### ***Applied Knowledge***

- AK0101 District asset diagram reading.
- AK0102 Purpose, function and operation of tools and equipment.
- AK0103 Purpose, function, identification and use of consumables.
- AK0104 Act 85 related to applicable equipment and machines used.
- AK0105 Lifting equipment (Code of Practice No 29 & 30).
- AK0106 Stowage of equipment.
- AK0107 Track maintenance instructions and specifications related to exothermic welding.
- AK0108 Track welding specifications related to exothermic welding process.
- AK0109 Safe work procedures related to the exothermic welding process.
- AK0110 Basic electricity.
- AK0111 Purpose, function and use of personal protective equipment.



- AK0112 Rails identification (Roll marks).
- AK0113 Parameters of limits as stated in specification for the length and depth of defects.
- AK0114 Crack detection by non-destructive test.
- AK0115 Identification, purpose and use of specific fastenings.
- AK0116 Pre-heating process and procedures for different rail types.
- AK0117 Exothermic welding process, procedures and specifications.
- AK0118 Stencilling.
- AK0119 Coding.

***Internal Assessment Criteria***

- IAC0101 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0102 Observe and evaluate compliance with regulatory requirements;
- IAC0103 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0104 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0105 Evaluate the effectiveness of problem-solving;
- IAC0106 Evaluate the accuracy and timeliness of reporting and records.

**5.2.2. PM-05-PS02: Repair rail-manufactured frogs**

***Scope of Practical Skill***

Given a simulated or controlled railway work environment where railway frogs must be repaired, including all the required materials, tools and equipment: In different weather conditions During day and night time In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction) Within a specific time-span Under hazardous conditions

**The learner must be able to:**

- PA0201 Obtain the correct equipment, tools, consumables and human resources.
- PA0201 Test the operation of equipment.
- PA0201 Apply safe working procedures and instructions related to the repairing of rail manufactured frogs.
- PA0201 Perform pre- and post-heating procedures correctly.
- PA0202 Execute none destructive test on rails.
- PA0203 Perform controlled cooling procedures correctly.
- PA0204 Deal with unforeseen circumstances.
- PA0205 Remove equipment from rail in accordance with company and manufacturer's instructions.

***Applied Knowledge***

- AK0201 District asset diagram reading.
- AK0202 Purpose, function and operation of tools and equipment.

- AK0203 Purpose, function, identification and use of consumables.
- AK0204 Act 85 related to applicable equipment and machines used.
- AK0205 Lifting equipment (Code of Practice No 29 & 30).
- AK0206 Stowage of equipment.
- AK0207 Track maintenance instructions and specifications related to exothermic welding.
- AK0208 Track welding specifications related to exothermic welding process.
- AK0209 Safe work procedures related to the exothermic welding process.
- AK0210 Basic electricity.
- AK0211 Purpose, function and use of personal protective equipment.
- AK0212 Rails identification (Roll marks).
- AK0213 Parameters of limits as stated in specification for the length and depth of defects.
- AK0214 Crack detection by non-destructive test.
- AK0215 Identification, purpose and use of specific fastenings.
- AK0216 Pre-heating process and procedures for different rail types.
- AK0217 Exothermic welding process, procedures and specifications.
- AK0218 Stencilling.
- AK0219 Coding.

***Internal Assessment Criteria***

- IAC0201 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0202 Observe and evaluate compliance with regulatory requirements;
- IAC0203 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0204 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0205 Evaluate the effectiveness of problem-solving;
- IAC0206 Evaluate the accuracy and timeliness of reporting and records.

**5.3 Provider Programme Accreditation Criteria**

***Physical Requirements:***

- Learning provider must demonstrate access to an appropriate lecture facility with all the resources to deliver the required learning as set out in the curriculum;
- Providers must have access to simulated or actual work environments where the practical skills can be developed.

***Human Resource Requirements:***

- Facilitators of learning must be in possession of a recognised qualification for Railway Track Master;

- Facilitators of learning should have a minimum of three years post qualification experience as a practising Railway Track Master;
- The facilitator/learner ratio should not exceed 1:15.

***Legal Requirements:***

- Meet all Occupational Health and safety requirements;
- Meet the requirements of all relevant regulatory specifications.

**5.4 Exemptions**

- No exemptions were identified providers must apply to the AQP to have programmes recognised for purposes of exemption.

## **6. 734212000-PM-06, Build and construct specialised railway lines and related infrastructure, , NQF Level 4, Credits 32**

### **6.1 Purpose of the Practical Skill Modules**

The focus of the learning in this module is on providing learners an opportunity to practice the skills required to build and construct specialised railway tracks and related infrastructure.

The learner will be required to:

- PM06-01: Build a standard rail turnout
- PM06-02: Construct a railway line
- PM06-03: Maintain rail turnouts and turnout components
- PM06-04: Build an advanced rail turnout
- PM06-05: Construct temporary track support

### **6.2 Guidelines for Practical Skills**

#### **6.2.1. PM-06-PS01: Build a standard rail turnout**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where a standard rail turnout must be built, including all the required material, equipment and tools:

**The learner must be able to:**

- PA0101 Prepare to build a turnout.
- PA0102 Lay out and build turnout in accordance with specifications.
- PA0103 Assess turnout.
- PA0104 Assess stock and switchblades.
- PA0105 Complete post-construction operations.
- PA0106 Inspect total work and perform line up operations;

##### ***Applied Knowledge***

- AK0102 Code of Practice 29.
- AK0103 The purpose, functions and use of different turnout components.
- AK0104 Reading and analysis of design plan/specifications related to turnout.
- AK0105 Principles regarding the use of temporary reference points.
- AK0106 Safe handling of turnout components, equipment and tools (storage, stacking, loading, off-loading, transportation).
- AK0107 Applying of middle and quarter off sets.
- AK0108 Methods of bending, cutting and drilling turnout components.
- AK0109 Sleeper spacing procedures and specifications.
- AK0110 Procedures and specifications for placement of turnout components.
- AK0111 Procedures and specifications for fitting of hand tumbler.

- AK0112 Gauge plate/clip combinations.
- AK0113 Principles of gauge widening.
- AK0114 Track standards and specifications.
- AK0115 Track hand-over procedures.
- AK0116 Relevant environmental regulations and legislation.
- AK0117 Health, Safety and Housekeeping procedures and regulations.

#### ***Internal Assessment Criteria***

- IAC0101 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0102 Observe and evaluate compliance with regulatory requirements;
- IAC0103 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0104 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0105 Evaluate the effectiveness of problem-solving;
- IAC0106 Evaluate the accuracy and timeliness of reporting and records.

#### **6.2.2. PM-06-PS02: Construct a railway line**

##### ***Scope of Practical Skill***

Given a simulated or controlled work environment where a railway line must be constructed, including all the required materials, tools and equipment: competency must be demonstrated: In different weather and environmental conditions. Preferably in daytime. In different yard layouts/mainline/sidings/private sidings/shed/workshop (might or might not include overhead traction and Railway signalling). Within a specific time, span. Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility etc. Competence must be demonstrated in: Junction rails Check rails Safety rails for bridges Second hand rails Reconditioned rails This Unit Standard is inclusive of all types of fastenings and sleepers. Material included: Rail - Correct type and profile Fastenings Sleepers Ballast Handling includes: Storage Loading Transporting Off-loading Stacking The use of push trolleys and rail transporters to transport permanent way materials

##### **The learner must be able to:**

- PA0201 Read, interpret and apply information on design plan of railway line.
- PA0202 Prepare to construct a railway line.
- PA0203 Prepare rails for placement.
- PA0204 Place ballast, sleepers, fastenings and rails.
- PA0205 Finalise ballast, lift, align and tamp track.
- PA0206 Finalise track and hand over to client

##### ***Applied Knowledge***

- AK0201 Reading and analysis of design plan/specifications
- AK0202 Composition of rails and different rail classes
- AK0203 Different rail profiles and properties

- AK0204 Factors to consider in the selection of rails for specific applications and in the re-use of rails
- AK0205 Typical rail defects and fractures
- AK0206 Principles of rail wear
- AK0207 Principles regarding the use of temporary reference points
- AK0208 Quantity calculations of ballast, sleepers, rails and fastenings
- AK0209 Safe handling of rails, equipment and tools (storage, stacking, loading, off-loading, transportation)
- AK0210 Applying of middle off sets
- AK0211 Methods of bending, cutting and drilling rails
- AK0212 Methods for placing rails Rail fastening procedures
- AK0213 Sleeper spacing procedures and specifications
- AK0214 Gauge plate/clip combinations
- AK0215 Principles of gauge widening
- AK0216 Ballast off-loading procedures
- AK0217 Tamping procedures
- AK0218 Temperature ranges
- AK0219 Principles of track distressing
- AK0220 Track standards and specifications
- AK0221 Track hand-over procedures Code of Practice 29
- AK0222 Relevant environmental regulations and legislation
- AK0223 Health, Safety and Housekeeping procedures and regulations
- AK0224 Reporting and documentation requirements and procedures

***Internal Assessment Criteria***

- IAC0201 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0202 Observe and evaluate compliance with regulatory requirements;
- IAC0203 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0204 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0205 Evaluate the effectiveness of problem-solving;
- IAC0206 Evaluate the accuracy and timeliness of reporting and records.

### **6.2.3. PM-06-PS03: Maintain rail turnouts and turnout components**

#### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where rail turnouts and turnout components must be maintained, including all the materials, tools and equipment: performance must be carried out: In different weather and environmental conditions. Preferably in daytime. In different yard layouts/mainline/sidings/shed/workshop (might or might not include overhead traction and Railway signalling). Within a specific time, span. Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility etc. This learning includes the maintenance of turnouts and turnout components in all types of railway tracks. Handling includes: Storage Loading Transporting Off-loading Stacking The use of push trolleys and rail transporters to transport permanent way materials

#### **The learner must be able to:**

- PA0301 Prepare to maintain turnouts and components.
- PA0302 Obtain measurements of turnouts, turnout components and replacement material.
- PA0303 Remove and replace turnouts and components.
- PA0304 Perform post-maintenance operations.

#### ***Applied Knowledge***

- AK0301 Code of Practice 29 The purpose, functions and use of different turnout components
- AK0302 Procedures, instructions and specifications related to the removal and replacement of turnout components
- AK0303 Safe handling of turnout components, equipment and tools (storage, stacking, loading, off-loading, transportation)
- AK0304 Methods of bending, cutting and drilling turnout components
- AK0305 Temperature ranges
- AK0306 Track standards and specifications
- AK0307 Track hand-over procedures
- AK0308 Relevant environmental regulations and legislation Health, Safety and Housekeeping procedures and regulations
- AK0309 Reporting and documentation requirements and procedures

#### ***Internal Assessment Criteria***

- IAC0301 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0302 Evaluate the effectiveness of problem-solving;
- IAC0303 Evaluate the accuracy and timeliness of reporting and records
- IAC0304 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0305 Evaluate the effectiveness of problem-solving;
- IAC0306 Evaluate the accuracy and timeliness of reporting and records.

#### **6.2.4. PM-06-PS04: Build an advanced rail turnout**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where an advanced rail turnout must be built, including all the required materials, tools and equipment: Competency must be demonstrated: > In different weather and environmental conditions. > Preferably in day- time. > In different yard layouts/mainline/sidings/shed/workshop (might or might not include overhead traction and Railway signalling). > Within a specific time, span. > Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility etc. Handling includes: > Storage. > Loading. > Transporting. > Off-loading. > Stacking. > The use of push trolleys and rail transporters to transport permanent way materials. The learner should prove competence in the construction of the following types of left hand or right-hand turnouts in railway tracks: All single slips irrespective of angles in railway tracks. Scissor turnout irrespective of angles or track centres in railway tracks. Double slips irrespective of angles in railway tracks. Diamond crossing irrespective of angles or track centres in railway tracks. Tandem turnout irrespective of angles in railway tracks.

##### **The learner must be able to:**

- PA0401 Prepare to build a turnout.
- PA0402 Lay out and build turnout in accordance with specifications.
- PA0403 Assess turnout.
- PA0404 Assess stock and switchblades.
- PA0405 Complete post-construction operations.

##### ***Applied Knowledge***

- AK0401 Code of Practice 29.
- AK0402 The purpose, functions and use of different turnout components.
- AK0403 Reading and analysis of design plan/specifications related to turnout.
- AK0404 Principles regarding the use of temporary reference points.
- AK0405 Safe handling of turnout components, equipment and tools (storage, stacking, loading, off-loading, transportation).
- AK0406 Applying of middle and quarter off sets.
- AK0407 Methods of bending, cutting and drilling turnout components.
- AK0408 Sleeper spacing procedures and specifications.
- AK0409 Procedures and specifications for placement of turnout components.
- AK0410 Procedures and specifications for fitting of hand tumbler.
- AK0411 Gauge plate/clip combinations.
- AK0412 Principles of gauge widening.
- AK0413 Track standards and specifications.
- AK0414 Track hand-over procedures.
- AK0415 Relevant environmental regulations and legislation.
- AK0416 Health, Safety and Housekeeping procedures and regulations.



- AK0417 Reporting and documentation requirements and procedures.

#### ***Internal Assessment Criteria***

- IAC0401 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0402 Evaluate the effectiveness of problem-solving;
- IAC0403 Evaluate the accuracy and timeliness of reporting and records
- IAC0404 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0405 Evaluate the effectiveness of problem-solving;
- IAC0406 Evaluate the accuracy and timeliness of reporting and records.

#### **6.2.5. PM-06-PS05: Construct temporary track support**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment, including all the required materials, tools and equipment: Competency must be demonstrated in different weather and environmental conditions. Preferably in day-time. In different yard layouts/mainline/sidings/private sidings/shed/workshop (might or might not include overhead traction and Railway signalling. Within a specific time, span. Different site conditions, e.g. cuttings, embankments, multiple lines, tunnels, sites with restricted accessibility etc. The learner has to prove competence in the construction of track support of varying complexity. Temporary track support includes the following: Rail girders, including top and bottom girder. Sleeper cribs. Bridging cribs. Cribs should be constructed under supervision of an expert: Handling includes: Storage. Loading. Transporting. Off-loading. Stacking. The use of push trolleys and rail transporters to transport permanent way materials.

##### **The learner must be able to:**

- PA0501 Prepare to construct temporary track support.
- PA0502 Construct rail girders.
- PA0503 Construct cribs.
- PA0504 Perform post construction operations.

##### ***Applied Knowledge***

- AK0501 Code of Practice 29
- AK0502 Different types of track support and their applications
- AK0503 Classification of materials
- AK0504 Rail profiles and classes
- AK0505 Safe handling of materials, equipment and tools (storage, stacking, loading, off-loading, transportation)
- AK0506 Methods for placing and fastening rails on sleepers
- AK0507 Tamping procedures Methods for determining crib height
- AK0508 Track standards and specifications
- AK0509 Relevant environmental regulations and legislation Health, Safety and Housekeeping procedures and regulations

- AK0510 Reporting and documentation requirements and procedures

### ***Internal Assessment Criteria***

- IAC0501 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0502 Observe and evaluate compliance with regulatory requirements;
- IAC0503 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0504 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0505 Evaluate the effectiveness of problem-solving;
- IAC0506 Evaluate the accuracy and timeliness of reporting and records.

### **6.3 Provider Programme Accreditation Criteria**

#### *Physical Requirements:*

- Learning provider must demonstrate access to an appropriate lecture facility with all the resources to deliver the required learning as set out in the curriculum;
- Providers must have access to simulated or actual work environments where the practical skills can be developed.

#### *Human Resource Requirements:*

- Facilitators of learning must be in possession of a recognised qualification for Railway Track Master;
- Facilitators of learning should have a minimum of three years post qualification experience as a practising Railway Track Master;
- The facilitator/learner ratio should not exceed 1:15.

#### *Legal Requirements:*

- Meet all Occupational Health and safety requirements;
- Meet the requirements of all relevant regulatory specifications.

### **6.4 Exemptions**

- No exemptions were identified providers must apply to the AQP to have programmes recognised for purposes of exemption.

## **7. 734212000-PM-07, Execute advanced rail joining, repair and maintenance work, NQF Level 4, Credits 32**

### **7.1 Purpose of the Practical Skill Modules**

The focus of the learning in this module is on providing learners an opportunity to practice the skills required to execute advanced rail joining, repairing and maintenance work.

The learner will be required to:

- PM07-01: Repair 14% cast manganese frogs
- PM07-02: Repair points blades (only hinged type)
- PM07-03: Repair rail bound frogs
- PM07-04: Braze metals using the oxy-fuel brazing process

### **7.2 Guidelines for Practical Skills**

#### **7.2.1. PM-07-PS01: Repair 14% cast manganese frogs**

##### ***Scope of Practical Skill***

Given a simulated or controlled work environment where 14% cast manganese frogs must be repaired, including all the required materials, tools and equipment: In different weather conditions. During day and night time. In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction). Within a specific time, span. Under hazardous conditions.

**The learner must be able to:**

- PA0101 Obtain the correct equipment, tools, consumables and human resources.
- PA0102 Test the operation of equipment.
- PA0103 Apply safe working procedures and instructions related to 14% cast manganese frog.
- PA0104 Execute non-destructive test on rails.
- PA0105 Repair frog in accordance with the Permanent way welding specifications.
- PA0106 Deal with unforeseen circumstances.
- PA0107 Remove equipment from rail in accordance with company and manufacturer's instructions.

##### ***Applied Knowledge***

- AK0101 Purpose, function and use of measuring equipment.
- AK0102. District asset diagram reading.
- AK0103. The purpose, function and operation of tools and equipment.
- AK0104. The purpose, function, identification and use of consumables.
- AK0105. Act 85 related to applicable equipment and machines used.

- AK0106. Lifting equipment (Code of Practice No 29 & 30).
- AK0107. The stowage of equipment.
- AK0108. Track maintenance instructions and specifications related to the repairing of 14% cast manganese frogs.
- AK0109. Track welding specifications related to the repairing of 14% cast manganese frogs.
- AK0110. The safe work procedures related to 14% cast manganese frogs.
- AK0111. Basic electricity.
- AK0112. The purpose, function and use of personal protective equipment.
- AK0113. Frog identification (Cast marks).
- AK0114. The parameters of limits as stated in specification for the length and depth of defects.
- AK0115. Crack detection by non-destructive test.
- AK0116. The identification, purpose and use of all fastenings.
- AK0117. 14% Cast manganese frog welding processes, procedures and specifications.
- AK0118. Stencilling.
- AK0119. Coding.

#### ***Internal Assessment Criteria***

- IAC0101 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0102 Observe and evaluate compliance with regulatory requirements;
- IAC0103 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0104 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0105 Evaluate the effectiveness of problem-solving;
- IAC0106 Evaluate the accuracy and timeliness of reporting and records.

#### **7.2.2. PM-07-PS02: Repair points blades (only hinged type)**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where points blades must be repaired, including all the required materials, tools and equipment: In different weather conditions. During day and night time. In different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction). Within a specific-time span. Under hazardous conditions

##### **The learner must be able to:**

- PA0201 Repair the point blades by means of welding and grinding processes.
- PA0202 Grind rails in accordance with relevant procedures, instructions and specifications.
- PA0203 Apply safe work procedures and instructions according to prescribe instructions
- PA0204 Deal with unforeseen circumstances during the welding and grinding operation.

- PA0205 Remove equipment from rail after the grinding process in accordance with company specific and manufacturer's instructions.
- PA0206 Execute none destructive tests.
- PA0207 Read, interpret and apply information on design plan of railway line.

### ***Applied Knowledge***

- AK0201 The purpose, function and use of measuring equipment.
- AK0201 District asset diagram reading.
- AK0202 Purpose, function and operation of tools and equipment.
- AK0203 Purpose, function, identification and use of consumables.
- AK0204 Act 85 related to applicable equipment and machines used.
- AK0205 Lifting equipment (Code of Practice No 29 & 30).
- AK0206 Stowage of equipment.
- AK0207 Track maintenance instructions and specifications related to the repairing of points blades.
- AK0208 Permanent way welding specifications related to the repairing of points blades. The safe work procedures related to points blades.
- AK0209 Basic electricity.
- AK0210 Purpose, function and use of personal protective equipment.
- AK0211 Points blade type identification.
- AK0212 Rail type identification (Roll marks).
- AK0213 The parameters of limits as stated in specification for the length and depth of defects.
- AK0214 Crack detection by non-destructive test.
- AK0215 Points blade welding processes, procedures and specifications.

### ***Internal Assessment Criteria***

- IAC0201 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0202 Observe and evaluate compliance with regulatory requirements;
- IAC0203 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0204 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0205 Evaluate the effectiveness of problem-solving;
- IAC0206 Evaluate the accuracy and timeliness of reporting and records.

### **7.2.3. PM-07-PS03: Repair rail bound frogs**

#### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment where rail-bound frogs must be repaired, including all the required materials, tools and equipment: In different weather conditions. During day and night time. In

different yard layouts/mainline/siding/shed/workshop (might or might not include overhead traction). Within a specific time, span. Under hazardous conditions.

**The learner must be able to:**

- PA0301 Obtain the correct equipment, tools, consumables and personnel.
- PA0302 Load and off load equipment, tools and consumables.
- PA0303 Prepare rail bound frogs for welding.
- PA0304 Repair rails in accordance with the prescribe procedures, instructions and specifications.
- PA0305 Execute none destructive testing of rails.
- PA0306 Conduct Pre- and post-heating on various rail types.
- PA0307 Interpret job instructions, procedures, and specifications.

***Applied Knowledge***

- AK0301 Purpose, function and use of measuring equipment.
- AK0302 District asset diagram reading.
- AK0303 Purpose, function and operation of tools and equipment.
- AK0304 Purpose, function, identification and use of consumables.
- AK0305 Act 85 related to applicable equipment and machines used.
- AK0306 Lifting equipment (Code of practice 29 & 30).
- AK0307 Stowage of equipment.
- AK0308 Track Maintenance instructions and specifications related to the repairing of rail bound frogs.
- AK0309 Track Welding specifications related to the repairing of rail bound frogs.
- AK0310 Safe work procedures related to rail bound frogs.
- AK0311 Basic electricity.
- AK0312 Purpose, function and use of Personal protective equipment.
- AK0313 Rails identification (Roll marks).
- AK0314 Parameters of limits as stated in specification for the length and depth of defects.
- AK0315 Crack detection by non-destructive test.
- AK0316 Identification, purpose and use of all fastenings.
- AK0317 Pre heat process and procedures for different rail types.
- AK0318 Rail bound frogs welding process, procedures and specifications.
- AK0319 Stencilling.
- AK0320 Coding.

***Internal Assessment Criteria***

- IAC0301 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;

- IAC0302 Observe and evaluate compliance with regulatory requirements;
- IAC0303 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0304 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0305 Evaluate the effectiveness of problem-solving;
- IAC0306 Evaluate the accuracy and timeliness of reporting and records.

#### **7.2.4. PM-07-PS04: Braze metals using the oxy-fuel brazing process**

##### ***Scope of Practical Skill***

Given a simulated or controlled work environment where brazing must be executed, including all the required materials, tools and equipment: Scope: Material type to be used: May be selected from the range of carbon steels (plate only), applicable to the material groups 1, 2, 3 or 11 [according to ISO (TR) 15608]. Material thickness: Minimum - 3mm. Context: All work undertaken must comply with Occupational Health and Safety Act. All work done must comply with worksite practices. Under general supervision.

##### **The learner must be able to:**

- PA0401 Describe the oxy-fuel brazing process.
- PA0402 Select, assemble and conduct pre-operational checks of oxy-fuel brazing equipment.
- PA0403 Prepare work pieces prior to brazing.
- PA0404 Braze work piece.
- PA0405 Inspect brazed work piece.

##### ***Applied Knowledge***

- AK0401 Names and functions of: Oxy-fuel brazing equipment.
- AK0401 Different types of gases.
- AK0401 Nozzles.
- AK0401 Personal protective equipment.
- AK0401 Attributes, descriptions, characteristics and properties: Characteristics of metals. Types of fuel gases and gas pressures. Common defects. Hazards. Properties of gases (oxygen, acetylene, propane, LPG). Sensory cues: Smell indicating flammable gas leaks. Purpose of: Oxy-fuel brazing. Safety checks. Quality checks.
- AK0401 Processes, events, causes and effects, implications: Implications of using incorrect gas. Implications of using incorrect nozzles. Implications of using incorrect gas pressure settings. Implications of ignoring cutting defects. Implications of not following correct light up and shutdown procedures. Implications of not checking for gas leaks. Implications of not preparing work piece before brazing. Implications of not caring for equipment.
- AK0401 Procedures and techniques: Set up procedures for gas brazing equipment. Oxy-fuel gas brazing procedures. Preparation of metals. Safety procedures. Safety procedures for brazing. Quality procedures. Recording and reporting procedures. Regulations, legislation, agreements, policies, standards: Applicable safety, health and environmental protection legislation and standards.
- AK0401 Theory: rules, principles, laws: Applicable brazing theory, relating to the properties of materials. Safety principles governing use of gas brazing equipment.

- AK0401 Relationships, systems: Relationship of the gas to the metals. Relationship of pressure to nozzle size. Relationship between brazing torch manipulation and quality of completed work. Relationship between the thickness of the material and the size of the nozzle. Relationship between the thickness of the material and the brazing process (mechanical or thermal).

#### ***Internal Assessment Criteria***

- IAC0401 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0402 Observe and evaluate compliance with regulatory requirements;
- IAC0403 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0404 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0405 Evaluate the effectiveness of problem-solving;
- IAC0406 Evaluate the accuracy and timeliness of reporting and records.

### **7.3 Provider Programme Accreditation Criteria**

#### *Physical Requirements:*

- Learning provider must demonstrate access to an appropriate lecture facility with all the resources to deliver the required learning as set out in the curriculum;
- Providers must have access to simulated or actual work environments where the practical skills can be developed.

#### *Human Resource Requirements:*

- Facilitators of learning must be in possession of a recognised qualification for Railway Track Master;
- Facilitators of learning should have a minimum of three years post qualification experience as a practising Railway Track Master;
- The facilitator/learner ratio should not exceed 1:15.

#### *Legal Requirements:*

- Meet all Occupational Health and safety requirements;
- Meet the requirements of all relevant regulatory specifications.

### **7.4 Exemptions**

- No exemptions were identified providers must apply to the AQP to have programmes recognised for purposes of exemption.



## **8. 734212000-PM-08, Supervise and oversee the execution of rail construction and maintenance activities, NQF Level 4, Credits 32**

### **8.1 Purpose of the Practical Skill Modules**

The focus of the learning in this module is on providing learners an opportunity to practice the skills required to execute advanced rail joining, repairing and maintenance work.

The learner will be required to:

- PM08-01: Assess rail track conditions
- PM08-02: Maintain production records for work and equipment on a construction

### **8.2 Guidelines for Practical Skills**

#### **8.2.1. PM-08-PS01: Assess rail track conditions**

##### ***Scope of Practical Skill***

Given a simulated or controlled railway work environment

**The learner must be able to:**

- PA0101 Carry out rail track inspections.
- PA0102 Perform rail track surveys.
- PA0103 Evaluate rail track data.
- PA0104 Determine resources required for rectification of rail track conditions.
- PA0105 Control rail track rectification and production quality.

##### ***Applied Knowledge***

- AK0101 Reading and analysing specifications.
- AK0102 Tamping of ballast procedures.
- AK0103 Temperature ranges.
- AK0104 Track standards and specifications.
- AK0105 Track handover procedures.
- AK0106 Quantity calculations.
- AK0107 Interpretation of contracts.
- AK0108 Relevant environmental regulations and legislation.
- AK0109 Health, safety and housekeeping procedures and regulations.

- AK0110 Reporting and documentation requirements and procedures.
- AK0121 Construction regulations.
- AK0112 On-track machine capacities and outputs.
- AK0113 Track and turnout measurement methods.

***Internal Assessment Criteria***

- IAC0101 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0102 Observe and evaluate compliance with regulatory requirements;
- IAC0103 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);
- IAC0104 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0105 Evaluate the effectiveness of problem-solving;
- IAC0106 Evaluate the accuracy and timeliness of reporting and records.

**8.2.2. PM-08-PS02: Maintain production records for work and equipment on a construction site**

***Scope of Practical Skill***

Given a simulated or controlled railway work environment, including all the required materials, tools and equipment: In different weather conditions. During day and night time. In different yard layouts/mainline/siding/shed/workshop. Within a specific-time span. Under hazardous conditions

**The learner must be able to:**

- PA0201 Confirm recording requirements on site
- PA0202 Complete time, log and production sheets
- PA0203 Monitor performance levels
- PA0204 Store and communicate records

***Applied Knowledge***

- AK0201 Recording requirements on site.
- AK0202 Recording of information on time and log sheets.
- AK0203 Recording of labour, work and material log sheets.
- AK0204 Recording of information on process control sheets.
- AK0205 Storage of recorded information according to organizational

***Internal Assessment Criteria***

- IAC0201 Observe and evaluate the extent to which learners comply with the appropriate procedures and work protocols;
- IAC0202 Observe and evaluate compliance with regulatory requirements;
- IAC0203 Observe and evaluate the ability to demonstrate an integrated understanding of the theory within a range of practical conditions (Work integrated learning);

- IAC0204 Evaluate the ability to demonstrate understanding of up and down stream impacts of actions;
- IAC0205 Evaluate the effectiveness of problem-solving;
- IAC0206 Evaluate the accuracy and timeliness of reporting and records.

### **8.3 Provider Programme Accreditation Criteria**

#### *Physical Requirements:*

- Learning provider must demonstrate access to an appropriate lecture facility with all the resources to deliver the required learning as set out in the curriculum;
- Providers must have access to simulated or actual work environments where the practical skills can be developed.

#### *Human Resource Requirements:*

- Facilitators of learning must be in possession of a recognised qualification for Railway Track Master;
- Facilitators of learning should have a minimum of three years post qualification experience as a practising Railway Track Master;
- The facilitator/learner ratio should not exceed 1:15.

#### *Legal Requirements:*

- Meet all Occupational Health and safety requirements;
- Meet the requirements of all relevant regulatory specifications.

### **8.4 Exemptions**

- No exemptions were identified providers must apply to the AQP to have programmes recognised for purposes of exemption.

## SECTION 3C: WORK EXPERIENCE MODULE SPECIFICATIONS

### List of Work Experience Module Specifications

- 734212-000-WM-01 Apply generic processes and procedures of constructing and maintaining a Railway Lines, NQF Level 2, Credits 16;
- 734212-000-WM-02 Execute basic track joining and welding duties, NQF Level 2, Credits 16;
- 734212-000-WM-03 Execute generic railway maintenance and construction tasks, NQF Level 3, Credits 16;
- 734212-000-WM-04 Execute specialised railway track of joining, welding tasks, NQF Level 3, Credits 32;
- 734212-000-WM-05 Execute specialised railway track construction and maintenance tasks, NQF Level 3, Credits 32;
- 734212-000-WM-06 Execute advanced rail joining, repair and maintenance work, NQF Level 4, Credits 32;
- 734212-000-WM-07 Rail construction and maintenance management processes, NQF Level 4, Credits 32.

#### **Module Number: 734212-000-WM-01**

#### **Title: Apply generic processes and procedures of constructing and maintaining a Railway Lines**

#### **NQF Level:**

2

#### **Credits:**

16

#### **Purpose of the Work Experience Module:**

To provide learners an opportunity to gain relevant experience in the application of the specific railway track construction and maintenance tasks

#### **Work Experience:**

1. Destress rails
2. Maintain rails
3. Restore track alignment
4. Maintain associated works
5. Operate rail disc-cutting machine
6. Select, use and care for engineering hand tools
7. Select, use and care for engineering power tools
8. Select, use and maintain Perway tools and equipment
9. Operate road rail vehicles and associated hydraulic equipment
10. Provide on-track protection

#### **Module Number: 734212-000-WM-02**

#### **Title: Execute basic track joining and welding duties**

#### **NQF Level:**

2

#### **Credits:**

16

#### **Purpose of the Work Experience Module:**

To provide learners an opportunity to gain relevant experience in the application of the specific railway track construction and maintenance tasks

**Work Experience:**

1. Cut rails of various profiles and grades
2. Operate rail disc-cutting machine
3. Select, use and care for engineering hand tools
4. Select, use and care for engineering power tools
5. Operate road rail vehicles and associated hydraulic equipment
6. Provide on-track protection

**Module Number: 734212-000-WM-03**

**Title: Execute generic railway maintenance and construction tasks**

**NQF Level:**

2

**Credits:**

16

**Purpose of the Work Experience Module:**

To provide learners an opportunity to gain relevant experience in the application of the specific railway track construction and maintenance tasks

**Work Experience:**

1. Destress rails
2. Maintain rails
3. Restore track alignment
4. Maintain associated works
5. Provide on-track protection

**Module Number: 734212-000-WM-04**

**Title: Execute specialised railway track of joining, welding tasks**

**NQF Level:**

3

**Credits:**

32

**Purpose of the Work Experience Module:**

To provide learners an opportunity to gain relevant experience in the application of the specific railway track construction and maintenance tasks

**Work Experience:**

1. Grind rails of various profiles and grades
2. Operate hydraulic rail shearing machine
3. Operate petrol- air pre-heating machine
4. Operate rail grinding machine
5. Repair battered rail ends
6. Weld carbon steel work-pieces using the shielded metal arc welding process in the down-hand position.
7. Weld wheel spin burns
8. Join rails by means of the exothermic welding process
9. Repair rail-manufactured frogs
10. Repair 14% cast manganese frogs
11. Repair points blades (only hinged type)

## 12. Repair rail bound frogs

**Module Number: 734212-000-WM-05**

**Title: Execute specialised railway track construction and maintenance tasks**

**NQF Level:**

3

**Credits:**

32

**Purpose of the Work Experience Module:**

To provide learners an opportunity to gain relevant experience in the application of the specific railway track construction and maintenance tasks

**Work Experience:**

1. Build a standard rail turnout
2. Construct a railway line
3. Maintain rail turnouts and turnout components
4. Build an advanced rail turnout
5. Construct temporary track support

**Module Number: 734212-000-WM-06**

**Title: Execute advanced rail joining, repair and maintenance work**

**NQF Level:**

3

**Credits:**

32

**Purpose of the Work Experience Module:**

To provide learners an opportunity to gain relevant experience in the application of the specific railway track construction and maintenance tasks

**Work Experience:**

1. Repair 14% cast manganese frogs
2. Repair points blades (only hinged type)
3. Repair rail bound frogs
4. Braze metals using the oxy-fuel brazing process

**Module Number: 734212-000-WM-07**

**Title: Rail construction and maintenance management processes**

**NQF Level:**

4

**Credits:**

32

**Purpose of the Work Experience Module:**

To provide learners an opportunity to gain relevant experience in the application of the specific railway track construction and maintenance tasks

**Work Experience:**

1. Assess rail track conditions
2. Maintain production records for plant and equipment on a construction site