No. 283 **13 March 2009**

SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)

In accordance with Regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Task Team for

Maintenance

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

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the Qualifications and Unit Standards. The full Qualifications and Unit Standards can be accessed via the SAQA web-site at **www.saqa.org.za**. Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the Qualifications and Unit Standards should reach SAQA at the address below and ***no later than 14 April 2009.*** All correspondence should be marked **Standards Setting – Task Team for Maintenance** and addressed to

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ACTING DIRECTOR: STANDARDS SETTING AND DEVELOPMENT

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
National Certificate: Diesel Electrical Fitting

SAQA QUAL ID	*QUALIFICATION TITLE*		
66009	National Certificate: Diesel Electrical Fitting		
ORIGINATOR		*PROVIDER*	
Task Team - Maintenance			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
National Certificate	6 - Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	124	Level 3	Regular-Unit Stds Based

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

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

The purpose of this Qualification is to equip learners with the standards and learning required to continue working and developing in various industries which use and maintain Diesel and Electric machines such as locomotives and motor coaches. It will also enable the further development of learners within this environment by providing articulation with higher level learning in this dynamic changing and challenging environment.

Qualifying learners will also be able to relate their learning to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

A learner acquiring this Qualification will be able to:

> Install and commission electrical equipment in a variety of diesel and electric machinery.
> Demonstrate the ability to test, fault find and maintain diesel and electric machinery.
> Demonstrate operational knowledge of mathematical, technological and theoretical concepts during the execution of tasks with an ability to read, interpret technical drawings, sketch electrical/electronic wiring diagrams for diesel and electric machinery.
> Apply health, safety and environmental procedures in order to comply with worksite and regulatory requirements.
> Demonstrate the ability to gather and interpret information from a range of sources and apply solutions to familiar problems related to working in the diesel and electric machinery environment with some scope for personal decision-making and responsibility.

The status and relevance of this Qualification will attract and retain quality learners and employees, and is the second step along a recognised and meaningful career path. Qualifying learners will be able to relate the tasks and processes to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures integral to safety, health and the environment. Learner achievements in this

Qualification will also serve as a basis for further learning to engage in more complex installation and maintenance activities and processes in the Diesel and Electric machines environment.

Rationale:

This is the second of a three-level Qualification series that reflect the workplace-based needs of the diesel electrical and electrical fitting sectors such as Locomotive and Motor Coach repair and maintenance, Millwrighting, etc. that is expressed by employers and employees. This Diesel Electrical Fitting and Electrical Fitting Qualification, provides the intermediate competencies required to work on both diesel electric and electric machines. This Qualification provides the learner with accessibility to be employed within various industries and provides the flexibility to pursue different careers across various industry sectors.

This Qualification provides learners with opportunities for professional development and career advancement within the diesel electrical and electrical fitting sectors such as Locomotive and Motor Coach repair and maintenance, Millwrighting, etc. Learners will be able to provide better and more efficient repair and maintenance services to their particular sector. It develops the fundamental competencies required by workers at an intermediate level. Qualifications at higher levels are designed to develop learners into fully fledged artisans, and are based on the learning in this Qualification.

The competencies in this Qualification are applicable to a wide range of industries. This Qualification is the second in a series for learners who want to follow a career in the field of diesel, diesel electric and electrical fitting. This Qualification focuses on developing the knowledge and skills and attitudes necessary to function at an intermediate level and also offers the opportunity for learners to apply what they have learnt in a range of specialised areas.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
> Mathematical Literacy at NQF Level 2.
> Communication NQF at NQF Level 2.
> Learners must first complete the National Certificate: Diesel Electrical Fitting, NQF Level 2 before accessing this Qualification.

Recognition of Prior Learning:

The Qualification can be achieved in whole or part through the Recognition of Prior Learning (RPL). Learners obtaining the whole Qualification through RPL and wishing to be declared competent are required to complete a practical assessment component for the purpose of such recognition. This implies that the Qualification may be granted to learners who have acquired the skills and knowledge without attending formal courses, providing they can demonstrate competence in the outcomes of the individual Unit Standards as required by the Fundamental, Core and Elective components stipulated in the Qualification and by the Exit Level Outcomes.

Learners submitting themselves for RPL should be thoroughly briefed prior to the assessment, and may be required to submit a Portfolio of Evidence (POE) in the prescribed format and/or undergo a workplace assessment to be assessed for formal recognition. While this is primarily a workplace-based Qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the Exit Level Outcomes.

Access to the Qualification:

Access is open to all learners.

QUALIFICATION RULES
The Qualification is made up of a combination of learning outcomes from Fundamental, Core and Elective components, totalling a minimum of 124 Credits.

Fundamental component:

> All unit standards to the value of 36 credits are compulsory.

Core component:

> All unit standards to the value of 59 credits are compulsory.

Elective component:

> The Elective component consists of a number of Unit Standards from which learners are required to choose a combination totalling a minimum of 29 credits. However, learners wishing to qualify in a diesel electrical or electrical fitting trades in the locomotive sector are required to complete one of the following set of Elective Unit Standards:

Specialisation Area - Electrical Fitting (38 credits):

> ID 116882: Maintain and repair a bank of batteries as used in railway signalling (8 credits).
> ID 119235: Conduct dye penetrant testing (4 credits).
> ID 253375: Overhaul compressors (5 credits).
> ID 259187: Install and terminate medium voltage switch gear (6 credits).
> ID 10269: Maintain lighting system (4 credits).
> ID 113889: Perform work on energised low voltage networks (8 credits).
> ID 253396: Repair a vacuum pump (3 credits).

Thus 133 credits in total.

Specialisation Area: Diesel Electrical Fitting (29 credits):

> ID 259187: Install and terminate medium voltage switch gear (6 credits).
> ID 10269: Maintain lighting system (4 credits).
> ID 253376: Overhaul centrifugal pumps (7 credits).
> ID 253386: Overhaul positive displacement pumps (7 credits).
> ID 253357: Perform routine maintenance and inspections on diesel engines used for emergency plant operations (5 credits).

Thus 124 credits in total.

Additional specialisations for other sectors in which diesel, diesel electrical and electrical fitting that are applicable will be added to this Qualification once they are finalised.

EXIT LEVEL OUTCOMES
On achieving this Qualification, the learner will be able to:

1. Install and commission electrical equipment in a variety of diesel and electric machinery.

2. Demonstrate the ability to test, fault find and maintain diesel and electric machinery.

3. Demonstrate operational knowledge of mathematical, technological and theoretical concepts during the execution of tasks.

> Range: Demonstration includes reading, interpreting technical drawings and to sketch electric/electronic wiring diagrams for diesel and electric machinery.

4. Apply health, safety and environmental procedures in order to comply with worksite and regulatory requirements.

5. Demonstrate the ability to gather and interpret information from a range of sources and apply solutions to familiar problems related to working in the diesel and electric machinery environment with some scope for personal decision-making and responsibility.

ASSOCIATED ASSESSMENT CRITERIA

Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Components and equipment relating to the installation of a variety of diesel and electric machinery are identified and installed according to specifications.
1.2 Components and equipment in a variety of diesel and electric machinery are connected according to diagrams.
1.3 Relevant control/protection devices are selected and applied according to safe operating parameters.
1.4 A variety of diesel and electric machinery installations are commissioned according to worksite and statutory requirements.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Diesel and electric machinery to be worked on is isolated and secured according to worksite procedures.
2.2 Diesel and electric machine components are inspected for non-conformance according to worksite procedures.
2.3 Correct operation of equipment in diesel and electric machinery is tested and verified according to requirements.
2.4 Faults are identified and faulty equipment in diesel and electric machinery is maintained or replaced according to work procedures.
2.5 Diesel and electric machinery and installations are maintained and repaired according to work procedures.
2.6 Conditions in diesel and electric machinery are monitored and recorded according to work procedures.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Principles of mechanical and electrical engineering are applied in the interpretation and problem solving of integrated electrical circuit drawings and diagrams.
3.2 The principles and operation of protection in mechanical and electric machinery are demonstrated in accordance with circuit and equipment specifications.

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 Oral and written instructions are interpreted and carried out as required by relevant health, safety, environmental and electrical procedures.
4.2 Communication with superiors, peers and clients is conducted effectively according to industry procedures.
4.3 Knowledge of statutory requirements pertaining to the safe operation of diesel and electrical machinery is applied in accordance with relevant codes.
4.4 Relevant on-site health, safety and environmental requirements are demonstrated as required.

Associated Assessment Criteria for Exit Level Outcome 5:

5.1 Known solutions to familiar and simple unfamiliar problems within the diesel and electric machinery and maintenance environment are identified and applied according to standard practices.
5.2 Energy efficiency and related environmental issues that enable the learner to resolve problems in the work environment are identified and discussed.
5.3 Reports on basic problems and hazards are drafted and communicated according to worksite procedures.

INTERNATIONAL COMPARABILITY
The purpose of this International Comparability study is to facilitate the development of a meaningful learning path and its associated curriculum incorporating both theoretical and practical vocational skills which will ensure compatibility, comparability and compliance with existing international Qualification specifications and regulations.

This National Certificate was compared with equivalent courses/Qualifications from a range of countries. However, Canada is the best country for comparison as their railway industry uses the same type/make of diesel and electric machines as South Africa. However, other countries were selected because they offer education and training that is also considered international best practice in terms of diesel electric fitting and electric fitting' for diesel and electric machines. These countries are Australia, United States of America and New Zealand.

It must be noted that in South Africa we have opted for individual Qualifications each of a year in duration. This has been made possible because of the fact that South Africa are using Unit Standards for the development of the Qualifications and this allows for the progression and difficulty to be built in to each individual Unit Standard.

Below are the Qualifications/programmes that were used:

Canada:

Railway Association of Canada (RAC) - Career On Track:

Course Title: Railway Car Technician (3 year duration):

> Interpret engineering drawing to plan maintenance.
> Perform calculations and measurements.
> Using manuals.
> Completing required administration.
> Using hand, power, pneumatic and hydraulic tools and equipment.
> Welding techniques.
> Benchworking practices.
> Methods and procedures for services and inspecting rail vehicles.
> Occupational health and safety practices.

Course Title: Diesel Mechanic (3 year duration):

> Understanding mechanics.
> Diesel engine technology.
> Diagnose malfunctions using testing equipment.
> Computer diagnostic tools.
> Determining repair required.
> Repairing and replacing defective parts, components using hand and power tools.
> Testing repaired equipment.
> Performing maintenance work.

Course Title: Industrial Electrician (4 year duration):

> Read and interpret drawings, blueprints, schematics and code specifications.
> Determine layout of industrial electrical installations.
> Install, examine, replace and repair electrical components.
> Test electrical and electronic equipments and components.
> Maintain, repair, install and test a variety of components.
> Troubleshoot, maintain and repair electrical and electronic control systems.
> Conduct preventative maintenance.

Course Title: Industrial machinist (4 year duration):

> Read and interpret engineering drawings, blueprints, charts and tables.
> Set-up, operate and maintain a variety of machine tools.
> Make or modify parts and products with precise dimensions.
> Fit and assemble machined metal parts and subassemblies using hand and power tools.
> Using precision measuring instruments.
> Reporting deviations from specifications and tolerances.
> Completing administration and reports.

Course Title: Sheet Metal Worker (3 year duration):

> Read and interpret engineering and architectural drawings.
> Develop patterns for sheet metal using CAD software.
> Measure and mark sheet metal.
> Operate light metalworking machines.
> Operate computerised or plasma cutting equipment.
> Install and use rigging and hoisting equipment.
> Fit and join metal parts using specialised equipment.
> Fabricate, assemble, install and repair sheet metal products.
> Inspect product quality.
> Inspect installation.

Course Title: Pipe Fitter (4 year duration):

> Read and interpret drawings, blueprints and code specifications.
> Determine type of pipe and tools use.
> Lay-out and plan sequence of tasks.
> Cut openings for pipe using hand and power tools and machines.
> Measure, cut, bend and thread pipe using hand and power tools.
> Join sections of piping system using a variety of methods.
> Install supports, valves, piping and control systems.
> Use testing equipment.
> Clean and maintain pipe units.
> Replace worn components in pipe units.

The above courses are compatible with the South African Qualification however they cover far more than just diesel and diesel electrical repair and maintenance of the diesel electric machines. Their modules however are much broader than ours by offering far more comprehensive issues, and are run over three to four years each, which are be covered in some form or other in our level 2 and/or higher (next) level Qualifications.

Australia:

Fitzpatrick Rail Services:

Course Title: Locomotive Familiarisation:

> Major Components - Above Deck:
> Cooling fan.
> Radiators.
> Shutters.
> Expansion tank and sight glass.
> Oil filter housing.
> Fuel pumps and filters.
> Air compressor and governor.
> Engine protective devices.
> Diesel engine.
> Generator.

> Major Components - Below Deck:
> Coupler and draft gear.
> Trucks.
> Sanders.
> Brakes and rigging.
> Fuel tank.
> Main reservoirs.
> Radio.

> Understanding the Cab:
> Throttle.
> Reverser.
> Load meter.
> Automatic brake.
> Independent brake.
> Air gages and switches.
> Warning lights.

The above course only covers a small section of our level 3 Qualification in that some of its content is covered in some of the Unit Standards (Specific Outcomes and Assessment Criteria) in the South African one.

United States of America:

National Academy of Railroad Sciences (NARS):

Course Title: Locomotive Engineer:

> Safety and general operating skills.
> Locomotive diesel power plants.
> Air brake and locomotive electrical equipment.
> On-board computerised systems.
> Train handling rules.
> Unusual events.
> Hazardous materials transport.

This course does not compare well with the South African one as it covers more issues around the operating skills and the driving of locomotives as opposed to their repair and maintenance. Only the sections on the diesel power plant and air brakes involve some form of repair and maintenance to Diesel Electric and Electrical fitting.

Course Title: Mechanical:

> Air brake operations, testing and repair.
> Freight car inspection, testing and repair.
> Electrical system design, diagnostics and repair on most models of locomotives.
> Operation, maintenance and repair of diesel engines.
> Remote control operations, diagnostics and repair.
> Federal Railway Administration Regulations.

The above course is far more compatible with the South African Qualifications as its focus is more on the repair and maintenance of the locomotive. Their modules however are much broader than ours by offering far more comprehensive issues, which are also covered in our higher (next) level 4 Qualification. They also offer some learning on the operation of the locomotive and motor coach which we do not offer in ours.

Okefenokee Technical College - Georgia:

Course Title: Locomotive Electrical Systems:

> MAT 103 Algebraic concepts.
> SCT 100 Introduction to microcomputers.
> IFC 100 Industrial safety procedures.
> IFC 101 Direct current circuits I.
> IFC 102 Alternating current I.
> IDS 103 Industrial wiring.
> ADM 103 Basic engine theory.
> IFC 103 Solid state devices I.
> ELC 110 Alternating current II.
> IDS 105 DC and AC motors.
> IDS 110 Fundamentals of motor control.
> IDS 113 Magnetic starters and braking.
> RRI 101 Introduction to the rail industry.
> RRE 101 Locomotive electrical systems.

Course Title: Locomotive Mechanical Systems:

> MAT 101 General math.
> SCT 100 Introduction to microcomputers.
> ADM 103 Basic engine theory.
> ELC 152 Prep electronics training I.
> IFC 100 Industrial safety procedures.
> IDS 215 Industrial mechanics.
> IDS 221 Industrial fluid power.
> IDS 231 Pumps and piping systems.
> WLD 103 Blueprint reading for welders I.
> WLD 108 Blueprint f or readers II.
> WLD 133 Metal welding and cutting techniques.
> RRI101 Introduction to the rail industry.
> RRE 101 Locomotive electric systems.

Keeping Track - Railroad Consulting and Training - Texas:

Course Title: Re-Certification for Locomotive Engineers:

> Operating rules, drugs and alcohol in the workplace.
> Your operating rules, safety rules, FRA rules.
> The locomotive: mechanical, electrical.
> The locomotive: air brake and operation.
> Tests evaluations, train handling.

Course Title: Re-Certification for Locomotive Engineers Currently Working as an Engineer:

> The railroad: what it is and what it does computerised.
> The role of operating rules for this railroad.
> The role of operating rules, safety rules, FRA laws.
> Safety rules, equipment and committee formation.
> The locomotives on your railroad, construction.
> Fundamental of locomotive air brakes.
> Locomotive, diesel engine, governor, lube, fuel oil.
> Locomotive, electrical, nomenclature, starting.
> Battery, transition, load regulator, main generator controller and trouble shooting.
> Final testing, evaluation and train handling.
> Operation evaluation, safety and rules compliance.

Course Title: Operating Supervisors: VP, GM, Ex Railroad Professionals:

> Operating rules for the railroad.
> Operating rules, safety rules, the safety committee.
> Adopting and discussing operating and safety rules.
> Special instructions, employee timetable pro and con.
> Dispatcher, more than one train out at a time, bulletins, track warrant, operational suggestions, the FRA today.
> Road trip with instructor to put items discussed into effect as long as it takes.
> Locomotives of your railroad, construction, trucks, carbody, couplers draft gear mechanical, diesel engine.
> Fuel, lube oil systems, cooling system, the governor.
> Locomotive electric's, traction motors, main generator.
> Aux, gen, batteries, starting, load regulator, contractors relays, the controller and trouble shooting.
> The locomotive and car air brake, review.
> AAR interchange rules and car construction.
> Being a leader-supervising people.
> The role of the hearing officer.
> Investigations, discipline and procedures.
> The union and the local chairman.
> Locomotive operation and evaluation.
> Surprise testing and evaluations of your employees, proper equipment.
> Drug and alcohol testing, tests taken.
> Testing and evaluation review.

Course Title: Machinery:

> General nomenclature of the diesel-electric locomotive, this course is made for the locomotives operated by your railroad or any other builder (Alco, Fairbanks-Morse, EMD, GE, Lima, Baldwin and any others) or models that you specify.
> The diesel engine and its components: complete cooling, fuel, and lubricating systems.
> The diesel engine governor (Woodward) and the load regulator.
> Trucks, wheels, axles and suspension bearings.
> Couplers and draft gears.

> Basic electricity.
> Electrical system: relays, contractors, control air, electromagnetic contractors, ganged control contractors, wiring, main generator, auxiliary generators, alternators, SCRs, controller, dynamic brakes.
> Radio control of slave units.
> Cab signals and train control.
> Passenger: head end power and blended brake.

Course Title: Air Brakes:

> History and development of braking systems.
> Complete computerised air brake course including brake tests and train handling.
> Locomotive air brakes: number 6, 24RL or 26L, and the independent brake.
> Freight car air brakes AB, ABD. ABDW, ABDWX.
> Heavy passenger air brakes UC, 24, 26.
> Light rail braking.
> Dynamic braking, extended range.
> Blended braking and graduated release.
> The air compressor and its operation.
> Train control: why you need it and how it works.
> The different overspeeds and the P2A.
> Disk and shoe brakes.
> Car and truck mounted brake rigging and equipment.
> Alertors and their operation.

Union Pacific:

Course Title: Diesel Mechanic (Mechanical: Locomotive):

> Conduct Inspections of Locomotive Electrical Systems. Perform daily and periodic locomotive and diesel engine inspections in compliance with company, industry and federal standards; inspect various mechanical systems (air brake, fuel, and lubrication) and locomotive components (wheels, trucks, cab, and internal diesel engine parts); inspect for unusual sounds, vibrations, smells, and small changes in the visual appearance of materials or objects.

> Troubleshoot Malfunctions. Diagnose malfunctions in diesel engine components, air equipment, trucks, and other components; assess nature of problem and determine needed corrective action; make judgments concerning seriousness of defects or damage.

> Perform Maintenance And Repair. Perform daily and periodic locomotive servicing (grease couplings and fittings, change oil and air filters, replace brake shoes and filters, adjust brake cylinder piston travel); replace locomotive and diesel engine components (wheels on trucks, traction motors); repair locomotive parts (cracked engine blocks, truck frames) requiring use of machine tools and welding equipment; re-bore and hone cylinders and other operations requiring use of lathes, grinders; disassemble engine and other components and clean parts.

> Work With Shop Machines And Tools. Safely and effectively operate the following: high and low precision measuring instruments (micrometers, tape measures, dial callipers); precision machines (drill and punch presses, bench lathes); electric, pneumatic and hydraulic tools (drills, wrenches, grinders); material handling equipment (fork lifts, cranes, overhead hoists); acetylene torches and electric welders.

> Practice Safe Work Habits. Follow company and federal safety rules, policy, and procedures; wear prescribed safety apparel; take appropriate action when conditions threaten safety of crew or other personnel; read and comply with train orders, signals, railroad rules, and regulation.

The above journeyman programmes do not compare well with this level three Qualification as it covers the whole diesel electric mechanic apprenticeship and the issues around the skills of inspection, repair and maintenance of the engine and mechanical components on diesel electric locomotives and motor coaches. All of these subject are however be covered over the three Qualifications, at levels 2, 3 and 4 if learners select the specialisations on Diesel Electric Fitting or Electrical Fitting.

Course Title: Diesel Electrician (Electrical: Locomotive):

> Perform, with use of blueprints, schematics, and location circuit plans, scheduled electrical inspections of various components and inspection and test of circuitry.
> Ensure that all signals, lights, and other safety appliances used for protection are properly displayed and used.
> Understand and follow company and industry safety rules, practices, and procedures.
> Diagnose electrical malfunctions in locomotive control circuits and components, assess the nature of problems, and determine corrective action needed.
> Perform maintenance and repair of electrical components in locomotive cabs or electrical compartments and perform maintenance for miscellaneous equipment using blueprints, schematics, and location circuit plans.
> Work with shop machines and tools.
> Plan and coordinate work activities, determine equipment needs, and develop sequences of steps to get work completed.
> Read, interpret, and understand written or electronic information, maintain the information, and compile reports.
> Communicate with others, verbally and in writing, technical information, job procedure recommendations, and other work-related information.
> Detect and interpret visual colour signals and displays at near and far distances, identify alterations of objects (size, shape, temperature), detect unusual sounds and smells during inspections and tests (leaks in air systems), use depth perception to judge speed and distance of locomotives being moved on service area, and listen to detect warning signals.

The above journeyman programme does not compare well with the level three Qualification as it covers the whole diesel electrician apprenticeship and the issues around the skills of inspection, repair and maintenance of the electrical components on diesel electric machines. Most of these subjects are however be covered over the three South African Qualifications at levels 2, 3 and 4 depending on the specialisation chosen by the learner.

New Zealand:

New Zealand Qualifications Authority (NZQA):

Course Title: National Certificate in Rail Operations (Locomotive Engineer) - Level 3 or 4:

Core Standards:

> ID 3271 - Suppress fire with hand extinguishers and fixed hose reels level 2 - 1 credit.
> ID 548 - Plan to manage personal use of alcohol and other drugs - level 1 - 2 credits.
> ID 12355 - Demonstrate knowledge of stress and ways of dealing with it - level - 2 - 2 credits.
> ID 4249 - Demonstrate care and timeliness as an employee - level 1 - 3 credits.
> ID 16688 - Identify and manage the effects of shift work - level 2 - 2 credits.
> ID 497 - Protect health and safety in the workplace - level 1 - 1 credit.
> ID 17593 - Apply safe work practices in the workplace - level 2 - 4 credits.
> ID 1277 - Communicate information in a specified workplace - level 2 - 3 credits.
> ID 9705 - Give and receive feedback - level 3 - 3 credits.
> ID 1279 - Write in plain English - level 3 - 2 credits.
> ID 3490 - Write an incident report - level 1 - 3 credits.

> ID 18864 - Demonstrate basic knowledge of railway signals - level 2 - 4 credits.
> ID 19392 - Demonstrate knowledge of rail transport in New Zealand - level 2 - 5 credits.
> ID 19286 - Demonstrate an advanced knowledge of railway signals - level 4 -15 credits.
> ID 19287 - Demonstrate knowledge of the Centralised Traffic Control (CTC) system - level 4 - 5 credits.
> ID 19387 - Haul a freight train on a network route using a main line locomotive - level 4 - 25 credits.

Elective Standards:

> ID 19394 - Demonstrate knowledge of a track warrant control (TWC) system - level 4 - 6 credits.
> ID 19395 - Demonstrate knowledge of a single line automatic signalling system - level 4 - 5 credits.
> ID 19396 - Demonstrate knowledge of double line automatic signalling system - level 4 - 5 credits.
> ID 6401 - Provide first aid - level 2 - 1 credit.
> ID 6402 - Provide resuscitation at level 2 - level 1 - 1 credit.
> ID 18869 - Demonstrate basic knowledge of electric overhead traction systems - level 2 - 2 credits.
> ID 18863 - Service and operate a diesel-electric shunt class locomotive - level 3 - 5 credits.
> ID 18865 - Operate hand points within a railway system - level 2 - 1 credit.
> ID 18866 - Perform manual operation of lever-type motor points - level 2 - 2 credits.
> ID 18867 - Perform manual operation of crank-handle type motor points - level 2 - 2 credits.
> ID 18868 - Operate a two-way radio within a rail system - level 2 - 2 credits.
> ID 18870 - Service and operate a diesel-electric main line locomotive - level 3 - 5 credits.
> ID 18871 - Service and operate a diesel shunt class locomotive - level 3 - 4 credits.
> ID 18872 - Move rail service vehicles using a shunt class or main line locomotive within yard limits - level 3 - 4 credits.
> ID 18873 - Service and operate an electric main line locomotive - level 3 - 5 credits.
> ID 19281 - Perform core stationary shunting duties - level 2 - 2 credits.
> ID 19282 - Perform freight and passenger train shunting duties - level 3 - 8 credits.
> ID 19283 - Perform freight train inspection - level 3 - 10 credits.
> ID 19288 - Demonstrate knowledge of shunting terms, commands, and hand signals - level 2 - 2 credits.
> ID 19388 - Haul a passenger train on a network route using a main line locomotive - level 4 - 15 credits.
> ID 16802 - Protect people in situations of danger - level 3 - 6 credits.
> ID 19284 - Perform passenger train inspection - level 3 - 8 credits.
> ID 19384 - Operate a diesel-mechanical railcar on a main line managed by a network operator - level 4 - 10 credits.
> ID 19386 - Operate an electric multiple-unit on a main line managed by a network operator - level 4 - 10 credits.
> ID 19390 - Operate a diesel-electric railcar on a main line managed by a network operator - level 4 - 10 credits.
> ID 16802 - Protect people in situations of danger - level 3 - 6 credits.

The above standards compare fairly well with all three Qualifications at levels 2, 3 and 4 as they covers the whole process of Diesel Electric Fitting or Electric Fitting on diesel electric locomotives and motor coaches. Many of these standards are however covered over the three Qualifications, at levels 2, 3 and 4 if learners select the specialisations. The exception is those standards which cover the driving of the locomotives or motor coaches.

Conclusion:

Some of the above Qualifications and learning programmes do not compare well with this level three Qualification, as they cover the whole diesel electric mechanic apprenticeship and the issues around the skills of inspection, repair and maintenance of the engine and mechanical components on diesel electric locomotives. They focus more on the operations of a locomotive as opposed to its repair and maintenance with strands in signalling/track control and railcar operation.

ARTICULATION OPTIONS
Horizontal articulation is possible with:

> ID 58288: National Certificate: Electro-Mechanics at NQF Level 3.
> ID 58497: National Certificate: Automotive Repair And Maintenance at NQF Level 3.
> ID 59669: National Certificate: Mechanical Engineering: Fitting at NQF Level 3.
> ID 63790: National Certificate: Electrical Engineering at NQF Level 3.

Vertical articulation is possible with:

> ID 48978: Further Education and Training Certificate: Electrical Network Control at NQF Level 4.
> ID 58270: Further Education and Training Certificate: Electro-Mechanics at NQF Level 4.
> ID 58539: Further Education and Training Certificate: Automotive Repair and Maintenance at NQF Level 4.
> ID 59709: Further Education and Training Certificate: Mechanical Engineering: Fitting at NQF Level 4.
> ID 63889: Further Education and Training Certificate: Electrical Engineering at NQF Level 4.
> ID 63849: Further Education and Training Certificate: Electronics at NQF Level 4.

MODERATION OPTIONS
> Anyone assessing a learner or moderating the assessment of a learner against the qualification must be registered as an assessor with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

> Any institution offering learning that will enable the achievement of this qualification must be accredited as a provider with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

> Assessment and moderation of assessment will be overseen by the relevant Education, Training, Quality, Assurance (ETQA) Body, or by an ETQA that has a Memorandum of Understanding with the relevant ETQA, according to the ETQA's policies and guidelines for assessment and moderation.

> Moderation must include both internal and external moderation of assessments, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described in the associated unit standards.

> Anyone wishing to be assessed against this qualification may apply to be assessed by any assessment agency, assessor or provider institution that is accredited by the relevant ETQA.

CRITERIA FOR THE REGISTRATION OF ASSESSORS
For an applicant to register as an assessor, the applicant should:

> Be registered as an assessor with the relevant ETQA and be a qualified artisan in the relevant trade.

NOTES

N/A

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	9010	Demonstrate an understanding of the use of different number bases and measurement units and an awareness of error in the context of relevant calculations	Level 3	2
Fundamental	9013	Describe, apply, analyse and calculate shape and motion in 2-and 3-dimensional space in different contexts	Level 3	4
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	9012	Investigate life and work related problems using data and probabilities	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	7456	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Core	259078	Install and commission electrical metering units, measuring instruments and control devices	Level 2	8
Core	259038	Maintain and repair direct-on-line AC rotating machines and control gear	Level 3	8
Core	13280	Maintain direct drives	Level 3	6
Core	258977	Understand basic electronic theory and components	Level 3	4
Core	259217	Install and commission AC machines and control gear	Level 4	8
Core	259188	Install and commission direct current (DC) machines	Level 4	8
Core	259201	Maintain Direct Current machines and control gear	Level 4	5
Core	13818	Maintain low voltage switchgear	Level 4	4
Core	253361	Maintain pneumatic systems	Level 4	8
Elective	258917	Maintain batteries, battery rooms or tripping units	Level 2	7
Elective	253537	Overhaul the bogey of rolling stock	Level 2	2
Elective	119235	Conduct dye penetrant testing	Level 3	4
Elective	10270	Construct Basic Electronic Circuits	Level 3	4
Elective	262926	Inspect, remove and install wheel sets on rolling stock	Level 3	2
Elective	116882	Maintain and repair a bank of batteries as used in railway signalling	Level 3	8
Elective	10269	Maintain lighting System	Level 3	4
Elective	253375	Overhaul compressors	Level 3	5
Elective	253386	Overhaul positive displacement pumps	Level 3	7
Elective	113889	Perform work on energised low voltage networks	Level 3	8
Elective	253396	Repair a vacuum pump	Level 3	3
Elective	259187	Install and terminate Medium Voltage cables	Level 4	6
Elective	253376	Overhaul centrifugal pumps	Level 4	7
Elective	253357	Perform routine maintenance and inspections on diesel engines used for emergency plant operations	Level 4	5

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Inspect, remove and install wheel sets on rolling stock

SAQA US ID	*UNIT STANDARD TITLE*		
262926	Inspect, remove and install wheel sets on rolling stock		
ORIGINATOR		*PROVIDER*	
Task Team - Maintenance			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Engineering and Related Design	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 3	2

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

SPECIFIC OUTCOME 1
Explain the factors critical for the selection of wheel sets.

SPECIFIC OUTCOME 2
Qualify and select wheel sets.

SPECIFIC OUTCOME 3
Remove and install wheel sets.

SPECIFIC OUTCOME 4
Complete the installation process.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Elective	66009	National Certificate: Diesel Electrical Fitting	Level 3

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:
Further Education Training Certificate: Diesel Electrical Fitting

SAQA QUAL ID	*QUALIFICATION TITLE*		
66049	Further Education Training Certificate: Diesel Electrical Fitting		
ORIGINATOR		*PROVIDER*	
Task Team - Maintenance			
QUALIFICATION TYPE	*FIELD*	*SUBFIELD*	
Further Ed and Training Cert	6 - Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	*MINIMUM CREDITS*	*NQF LEVEL*	*QUAL CLASS*
Undefined	143	Level 4	Regular-Unit Stds Based

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

PURPOSE AND RATIONALE OF THE QUALIFICATION
Purpose:

The purpose of this Qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively within various industries which use and maintain diesel and electric machines such as locomotives and motor coaches, making use of mechanical and electrical knowledge and skills to meet the challenges of such an environment.

Qualifying learners will also be able to relate their learning to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace. This Qualification will enable the learner to find employment as a skilled worker to perform Artisan duties in the diesel electric and diesel electrical field.

A learner acquiring this Qualification will be able to:

> Demonstrate the skills and ability to overhaul, install and commission complex mechanical and electrical assemblies and systems.
> Plan and schedule work according to machine or system production and maintenance requirements.
> Solve a variety of problems, both familiar and unfamiliar in terms of advanced mechanical and electrical theory and practice.
> Demonstrate leadership through effective interaction and communication with clients, peers and supervisors and management.

The Further Education Training Certificate: Diesel Electrical Fitting and Electrical Fitting (NQF Level 4) is the culmination of a learning path spanning three Qualifications and is intended to produce a highly competent person who will be able to meet the challenges of a competitive and demanding environment.

The successful completion of the three Diesel Electrical Fitting (NQF Levels 2, 3 and 4) will permit the learner to apply to undergo a trade test (assessed as an artisan).

Rationale:

This is the third of a three-level Qualification series that reflect the workplace-based needs of the diesel electrical and electrical field that is expressed by employers and employees, both now and for the future. This Diesel Electrical Fitting and Electrical Fitting Qualification provides, the advanced competencies required to work on integrated mechanical and electrical systems and installations. This Qualification provides the learner with accessibility to be employed within the diesel electric fitting and electrical fitting fields and provides the flexibility to pursue different careers across various industry sectors and articulate within the rail transport industry.

This Qualification will enhance the status and productivity of the learner as well as contribute to improved quality, production rate and growth within the diesel electric fitting and electrical fitting sector. The range of typical learners at this level could include individuals preparing to qualify as Diesel Electrical Fitters or Electrical Fitters. Qualifying learners will obtain a Further Education Certificate as Diesel Electrical Fitting and Electrical Fitting which places the learner in a position to investigate requirements for advancement to qualified artisan status.

RECOGNIZE PREVIOUS LEARNING?
Y

LEARNING ASSUMED IN PLACE
> Mathematical Literacy at NQF Level 3.
> Communication at NQF Level 3.
> Learners must first complete the National Certificate: Diesel Electrical Fitter at NQF Level 3 before accessing this Qualification.

Recognition of Prior Learning:

The Qualification can be achieved in whole or part through the Recognition of Prior Learning (RPL). Learners obtaining the whole Qualification through RPL and wishing to be declared competent are required to complete a practical assessment component for the purpose of such recognition. This implies that the Qualification may be granted to learners who have acquired the skills and knowledge without attending formal courses, providing they can demonstrate competence in the outcomes of the individual Unit Standards as required by the Fundamental, Core and Elective components stipulated in the Qualification and by the Exit Level Outcomes.

Learners submitting themselves for RPL should be thoroughly briefed prior to the assessment, and may be required to submit a Portfolio of Evidence (POE) in the prescribed format and/or undergo a workplace assessment to be assessed for formal recognition. While this is primarily a workplace-based Qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the Exit Level Outcomes.

Access to the Qualification:

Access is open to all learners.

QUALIFICATION RULES
The Qualification is made up of a combination of learning outcomes from Fundamental, Core and Elective components, totalling a minimum of 143 Credits.

Fundamental component:

All unit standards to the value of 56 credits are compulsory.

Core component:

All unit standards to the value of 50 credits are compulsory.

Elective component:

The Elective component consists of a number of Unit Standards from which learners are required to choose a combination totalling a minimum of 37 credits. However, learners wishing to qualify in a Diesel Electric or Electrical Fitting trade in the Locomotive sector are required to complete one of the following sets of Elective Unit Standards.

Specialization area - Diesel Electric Fitting (37 credits):

> ID 259200: Design, construct and commission three phase control gear (10 credits).
> ID 244119: Assemble an engine sub assembly (10 credits).
> ID 244046: Demonstrate knowledge of mechanical fuel injection systems (5 credits).
> ID 244121: Diagnose, service and repair forced induction systems (4 credits).
> ID 244051: Test and repair an engine cooling system (4 credits).
> ID 244057: Test and repair an engine lubrication system (4 credits).

Thus 143 credits in total.

Specialization area - Electrical Fitting (37 credits):

> ID 259200: Design, construct and commission three phase control gear (10 credits).
> ID 259198: Inspect, test and maintain 3kV DC busbar chamber and associated equipment in traction substations (8 credits).
> ID 259199: Inspect, test and maintain earthing and negative return systems on 3kV DC traction substations (7 credits).
> ID 259202: Inspect, test and maintain high voltage isolators (12 credits).

Thus 143 credits in total.

Additional specialisations for other sectors in which Diesel, Diesel Electric and Electric Fitting that are applicable will be added to this Qualification once they are finalised.

EXIT LEVEL OUTCOMES
On achieving this Qualification, the learner will be able to:

1. Demonstrate the skills and ability to overhaul, install and commission complex mechanical and electrical assemblies and systems.

2. Plan and schedule work according to machine or system production and maintenance requirements.

3. Solve a variety of problems, both familiar and unfamiliar in terms of advanced mechanical and electrical theory and practice.

4. Demonstrate leadership through effective interaction and communication with clients, peers and supervisors and management.

ASSOCIATED ASSESSMENT CRITERIA
Associated Assessment Criteria for Exit Level Outcome 1:

1.1 Diesel electric and diesel electrical system operation, overhaul, recondition and commissioning procedures are explained and demonstrated in terms of worksite practice and manufacturers` prescribed guidelines and specifications.
1.2 Solutions to problems are demonstrated during the commissioning process and are based on a clear analysis of information gathered through the use of diagnostic procedures.
1.3 Inspection and testing is conducted to ensure that the machine, equipment and systems have been restored and the cause of the problem rectified.
1.4 Procedures are modified to respond to specific environmental conditions, where appropriate.

Associated Assessment Criteria for Exit Level Outcome 2:

2.1 Planning and scheduling of own work is demonstrated in terms of productivity, safety, health and the environment.
2.2 Work flow is explained and demonstrated, based on job information, in terms of standard worksite practices and the demonstration of the ability to read and interpret detailed engineering drawings.
2.3 Production and maintenance personnel are consulted and machine downtime is minimised.

Associated Assessment Criteria for Exit Level Outcome 3:

3.1 Mechanical and electrical principles are applied to establish the cause of machine, equipment and/or system malfunction and faultfinding techniques are used to understand and rectify related problems.
3.2 Solutions to maintenance or production problems are based on a clear analysis of information gathered through diagnostic procedures.
3.3 Procedures are modified in order to respond to unfamiliar problems by demonstrating the ability to discuss and record alternative solutions to familiar and unfamiliar problems.

Associated Assessment Criteria for Exit Level Outcome 4:

4.1 Relationships with peers, supervisors and management are established and leadership is demonstrated by assertive communication and behaviour within the workplace.
4.2 Technical writing skills are applied in recording information, in order to understand, evaluate and report on machine and system faults and problems.
4.3 Learning opportunities and preparation requirements are identified and a learning plan is developed in terms of vertical articulation and the range of choices available.

INTERNATIONAL COMPARABILITY
The purpose of this International Comparability exercise is to facilitate the development of a meaningful learning path and its associated curriculum incorporating both theoretical and practical vocational skills which will ensure compatibility, comparability and compliance with existing international Qualification specifications and regulations.

This Further Education Training Certificate was compared with equivalent courses/Qualifications from a range of countries. However, Canada is the best country for comparison as their railway industry uses the same type/make of diesel electric and electrical machines as South Africa. However, other countries were selected because they offer education and training that is also considered international best practice in terms of diesel electric fitting and electric fitting' for diesel electric and electrical machines. These countries are Australia, United States of America and New Zealand.

It must be noted that in South Africa we have opted for individual Qualifications each of a year in duration. This has been made possible because of the fact that South Africa are using Unit Standards for the development of the Qualifications and this allows for the progression and difficulty to be built in to each individual Unit Standard.

Below are the Qualifications/programmes that were used:

Canada:

Railway Association of Canada (RAC) - Career On Track.

Course Title: Railway Car Technician (3 year duration):

> Interpret engineering drawing to plan maintenance.
> Perform calculations and measurements.
> Using manuals.
> Completing required administration.
> Using hand, power, pneumatic and hydraulic tools and equipment.
> Welding techniques.
> Benchworking practices.
> Methods and procedures for services and inspecting rail vehicles.
> Occupational health and safety practices.

Course Title: Diesel Mechanic (3 year duration):

> Understanding mechanics.
> Diesel engine technology.
> Diagnose malfunctions using testing equipment.
> Computer diagnostic tools.
> Determining repair required.
> Repairing and replacing defective parts, components using hand and power tools.
> Testing repaired equipment.
> Performing maintenance work.

Course Title: Industrial Electrician (4 year duration):

> Read and interpret drawings, blueprints, schematics and code specifications.
> Determine layout of industrial electrical installations.
> Install, examine, replace and repair electrical components.
> Test electrical and electronic equipments and components.
> Maintain, repair, install and test a variety of components.
> Troubleshoot, maintain and repair electrical and electronic control systems.
> Conduct preventative maintenance.

Course Title: Industrial machinist (4 year duration):

> Read and interpret engineering drawings, blueprints, charts and tables.
> Set-up, operate and maintain a variety of machine tools.
> Make or modify parts and products with precise dimensions.
> Fit and assemble machined metal parts and subassemblies using hand and power tools.
> Using precision measuring instruments.
> Reporting deviations from specifications and tolerances.
> Completing administration and reports.

Course Title: Sheet Metal Worker (3 year duration):

> Read and interpret engineering and architectural drawings.
> Develop patterns for sheet metal using CAD software.
> Measure and mark sheet metal.
> Operate light metalworking machines.

> Operate computerised or plasma cutting equipment.
> Install and use rigging and hoisting equipment.
> Fit and join metal parts using specialised equipment.
> Fabricate, assemble, install and repair sheet metal products.
> Inspect product quality.
> Inspect installation.

Course Title: Pipe Fitter (4 year duration):

> Read and interpret drawings, blueprints and code specifications.
> Determine type of pipe and tools use.
> Lay-out and plan sequence of tasks.
> Cut openings for pipe using hand and power tools and machines.
> Measure, cut, bend and thread pipe using hand and power tools.
> Join sections of piping system using a variety of methods.
> Install supports, valves, piping and control systems.
> Use testing equipment.
> Clean and maintain pipe units.
> Replace worn components in pipe units.

The above courses are far more compatible with the South African Qualification however they cover far more than just diesel electric and electrical repair and maintenance of the diesel electric machines. Their modules however are much broader than ours by offering far more comprehensive issues, and are run over three to four years each, which are be covered in some form or other in our level 2 and level 3 Qualifications.

Australia:

Fitzpatrick Rail Services:

Course Title: Locomotive Familiarisation:

> Major Components - Above Deck:
> Cooling fan.
> Radiators.
> Shutters.
> Expansion tank and sight glass.
> Oil filter housing.
> Fuel pumps and filters.
> Air compressor and governor.
> Engine protective devices.
> Diesel engine.
> Generator.

> Major Components - Below Deck:
> Coupler and draft gear.
> Trucks.
> Sanders.
> Brakes and rigging.
> Fuel tank.
> Main reservoirs.
> Radio.

> Understanding the Cab:
> Throttle.

> Reverser.
> Load meter.
> Automatic brake.
> Independent brake.
> Air gages and switches.
> Warning lights.

The above course only covers a small section of our Qualification in that some of its content is covered in a single Unit Standard in the South African ones.

United States of America:

National Academy of Railroad Sciences (NARS):

Course Title: Locomotive Engineer:

> Safety and general operating skills.
> Locomotive diesel power plants.
> Air brake and locomotive electrical equipment.
> On-board computerised systems.
> Train handling rules.
> Unusual events.
> Hazardous materials transport.

This course does not compare well with the South African one as it covers more issues around the operating skills and the driving of locomotives as opposed to their repair and maintenance. Only the sections on the diesel power plant and air brakes involve some form of repair and maintenance.

Course Title: Mechanical:

> Air brake operations, testing and repair.
> Freight car inspection, testing and repair.
> Electrical system design, diagnostics and repair on most models of locomotives.
> Operation, maintenance and repair of diesel engines.
> Remote control operations, diagnostics and repair.
> Federal Railway Administration Regulations.

The above course is far more compatible with the South African Qualifications as its focus is more on the repair and maintenance of the locomotive. Their modules however are much broader than ours by offering far more comprehensive issues, which are covered in our lower level Qualifications. They also offer some learning on the operation of the locomotive which we do not.

Okefenokee Technical College - Georgia:

Course Title: Locomotive Electrical Systems:

> MAT 103 Algebraic concepts.
> SCT 100 Introduction to microcomputers.
> IFC 100 Industrial safety procedures.
> IFC 101 Direct current circuits I.
> IFC 102 Alternating current I.
> IDS 103 Industrial wiring.
> ADM 103 Basic engine theory.

> IFC 103 Solid state devices I.
> ELC 110 Alternating current II.
> IDS 105 DC and AC motors.
> IDS 110 Fundamentals of motor control.
> IDS 113 Magnetic starters and braking.
> RRI 101 Introduction to the rail industry.
> RRE 101 Locomotive electrical systems.

Course Title: Locomotive Mechanical Systems:

> MAT 101 General math.
> SCT 100 Introduction to microcomputers.
> ADM 103 Basic engine theory.
> ELC 152 Prep electronics training I.
> IFC 100 Industrial safety procedures.
> IDS 215 Industrial mechanics.
> IDS 221 Industrial fluid power.
> IDS 231 Pumps and piping systems.
> WLD 103 Blueprint reading for welders I.
> WLD 108 Blueprint f or readers II.
> WLD 133 Metal welding and cutting techniques.
> RRI101 Introduction to the rail industry.
> RRE 101 Locomotive electric systems.

Keeping Track - Railroad Consulting and Training - Texas:

Course Title: Re-Certification for Locomotive Engineers:

> Operating rules, drugs and alcohol in the workplace.
> Your operating rules, safety rules, FRA rules.
> The locomotive: mechanical, electrical.
> The locomotive: air brake and operation.
> Tests evaluations, train handling.

Course Title: Re-Certification for Locomotive Engineers Currently Working as an Engineer:

> The railroad: what it is and what it does computerised.
> The role of operating rules for this railroad.
> The role of operating rules, safety rules, FRA laws.
> Safety rules, equipment and committee formation.
> The locomotives on your railroad, construction.
> Fundamental of locomotive air brakes.
> Locomotive, diesel engine, governor, lube, fuel oil.
> Locomotive, electrical, nomenclature, starting.
> Battery, transition, load regulator, main generator controller and trouble shooting.
> Final testing, evaluation and train handling.
> Operation evaluation, safety and rules compliance.

Course Title: Operating Supervisors: VP, GM, Ex Railroad Professionals:

> Operating rules for the railroad.
> Operating rules, safety rules, the safety committee.
> Adopting and discussing operating and safety rules.
> Special instructions, employee timetable pro and con.

> Dispatcher, more than one train out at a time, bulletins, track warrant, operational suggestions, the FRA today.
> Road trip with instructor to put items discussed into effect as long as it takes.
> Locomotives of your railroad, construction, trucks, carbody, couplers draft gear mechanical, diesel engine.
> Fuel, lube oil systems, cooling system, the governor.
> Locomotive electric's, traction motors, main generator.
> Aux, gen, batteries, starting, load regulator, contractors relays, the controller and trouble shooting.
> The locomotive and car air brake, review.
> AAR interchange rules and car construction.
> Being a leader-supervising people.
> The role of the hearing officer.
> Investigations, discipline and procedures.
> The union and the local chairman.
> Locomotive operation and evaluation.
> Surprise testing and evaluations of your employees, proper equipment.
> Drug and alcohol testing, tests taken.
> Testing and evaluation review.

Course Title: Machinery:

> General nomenclature of the diesel-electric locomotive, this course is made for the locomotives operated by your railroad or any other builder (Alco, Fairbanks-Morse, EMD, GE, Lima, Baldwin and any others) or models that you specify.
> The diesel engine and its components: complete cooling, fuel, and lubricating systems.
> The diesel engine governor (Woodward) and the load regulator.
> Trucks, wheels, axles and suspension bearings.
> Couplers and draft gears.
> Basic electricity.
> Electrical system: relays, contractors, control air, electromagnetic contractors, ganged control contractors, wiring, main generator, auxiliary generators, alternators, SCRs, controller, dynamic brakes.
> Radio control of slave units.
> Cab signals and train control.
> Passenger: head end power and blended brake.

Course Title: Air Brakes:

> History and development of braking systems.
> Complete computerised air brake course including brake tests and train handling.
> Locomotive air brakes: number 6, 24RL or 26L, and the independent brake.
> Freight car air brakes AB, ABD. ABDW, ABDWX.
> Heavy passenger air brakes UC, 24, 26.
> Light rail braking.
> Dynamic braking, extended range.
> Blended braking and graduated release.
> The air compressor and its operation.
> Train control: why you need it and how it works.
> The different overspeeds and the P2A.
> Disk and shoe brakes.
> Car and truck mounted brake rigging and equipment.
> Alertors and their operation.

Union Pacific:

Course Title: Diesel Mechanic (Mechanical: Locomotive):

> Conduct Inspections of Locomotive Electrical Systems. Perform daily and periodic locomotive and diesel engine inspections in compliance with company, industry and federal standards; inspect various mechanical systems (air brake, fuel, and lubrication) and locomotive components (wheels, trucks, cab, and internal diesel engine parts); inspect for unusual sounds, vibrations, smells, and small changes in the visual appearance of materials or objects.

> Troubleshoot Malfunctions. Diagnose malfunctions in diesel engine components, air equipment, trucks, and other components; assess nature of problem and determine needed corrective action; make judgments concerning seriousness of defects or damage.

> Perform Maintenance And Repair. Perform daily and periodic locomotive servicing (grease couplings and fittings, change oil and air filters, replace brake shoes and filters, adjust brake cylinder piston travel); replace locomotive and diesel engine components (wheels on trucks, traction motors); repair locomotive parts (cracked engine blocks, truck frames) requiring use of machine tools and welding equipment; re-bore and hone cylinders and other operations requiring use of lathes, grinders; disassemble engine and other components and clean parts.

> Work With Shop Machines And Tools. Safely and effectively operate the following: high and low precision measuring instruments (micrometers, tape measures, dial callipers); precision machines (drill and punch presses, bench lathes); electric, pneumatic and hydraulic tools (drills, wrenches, grinders); material handling equipment (fork lifts, cranes, overhead hoists); acetylene torches and electric welders.

> Practice Safe Work Habits. Follow company and federal safety rules, policy, and procedures; wear prescribed safety apparel; take appropriate action when conditions threaten safety of crew or other personnel; read and comply with train orders, signals, railroad rules, and regulation.

The above journeyman programme does not compare well with this level four Qualification as it covers the whole diesel mechanic apprenticeship and the issues around the skills of inspection, repair and maintenance of the engine and mechanical components on diesel electric locomotives. All of these subject will however be covered over the three Qualifications, at levels 2, 3 and 4 if learners select the specialisation on diesel electric fitting.

Course Title: Diesel Electrician (Electrical: Locomotive):

> Perform, with use of blueprints, schematics, and location circuit plans, scheduled electrical inspections of various components and inspection and test of circuitry.
> Ensure that all signals, lights, and other safety appliances used for protection are properly displayed and used.
> Understand and follow company and industry safety rules, practices, and procedures.
> Diagnose electrical malfunctions in locomotive control circuits and components, assess the nature of problems, and determine corrective action needed.
> Perform maintenance and repair of electrical components in locomotive cabs or electrical compartments and perform maintenance for miscellaneous equipment using blueprints, schematics, and location circuit plans.
> Work with shop machines and tools.
> Plan and coordinate work activities, determine equipment needs, and develop sequences of steps to get work completed.
> Read, interpret, and understand written or electronic information, maintain the information, and compile reports.
> Communicate with others, verbally and in writing, technical information, job procedure recommendations, and other work-related information.

> Detect and interpret visual colour signals and displays at near and far distances, identify alterations of objects (size, shape, temperature), detect unusual sounds and smells during inspections and tests (leaks in air systems), use depth perception to judge speed and distance of locomotives being moved on service area, and listen to detect warning signals.

The above journeyman programme does not compare well with this level four Qualification as it covers the whole diesel electrician apprenticeship and the issues around the skills of inspection, repair and maintenance of the electrical components on diesel electric machines. All of these subject will however be covered over the three Qualifications at levels 2, 3 and 4 depending on the specialisation chosen by the learner.

New Zealand:

New Zealand Qualifications Authority (NZQA):

Course Title: National Certificate in Rail Operations (Locomotive Engineer) - Level 3 or 4:

Core Standards:

> ID 3271: Suppress fire with hand extinguishers and fixed hose reels level 2 - 1 credit.
> ID 548: Plan to manage personal use of alcohol and other drugs - level 1 - 2 credits.
> ID 12355: Demonstrate knowledge of stress and ways of dealing with it - level - 2 - 2 credits.
> ID 4249: Demonstrate care and timeliness as an employee - level 1 - 3 credits.
> ID 16688: Identify and manage the effects of shift work - level 2 - 2 credits.
> ID 497: Protect health and safety in the workplace - level 1 - 1 credit.
> ID 17593: Apply safe work practices in the workplace - level 2 - 4 credits.
> ID 1277: Communicate information in a specified workplace - level 2 - 3 credits.
> ID 9705: Give and receive feedback - level 3 - 3 credits.
> ID 1279: Write in plain English - level 3 - 2 credits.
> ID 3490: Write an incident report - level 1 - 3 credits.
> ID 18864: Demonstrate basic knowledge of railway signals - level 2 - 4 credits.
> ID 19392: Demonstrate knowledge of rail transport in New Zealand - level 2 - 5 credits.
> ID 19286: Demonstrate an advanced knowledge of railway signals - level 4 -15 credits.
> ID 19287: Demonstrate knowledge of the Centralised Traffic Control (CTC) system - level 4 - 5 credits.
> ID 19387: Haul a freight train on a network route using a main line locomotive - level 4 - 25 credits.

Elective Standards:

> ID 19394: Demonstrate knowledge of a track warrant control (TWC) system - level 4 - 6 credits.
> ID 19395: Demonstrate knowledge of a single line automatic signalling system - level 4 - 5 credits.
> ID 19396: Demonstrate knowledge of double line automatic signalling system - level 4 - 5 credits.
> ID 6401: Provide first aid - level 2 - 1 credit.
> ID 6402: Provide resuscitation at level 2 - level 1 - 1 credit.
> ID 18869: Demonstrate basic knowledge of electric overhead traction systems - level 2 - 2 credits.
> ID 18863: Service and operate a diesel-electric shunt class locomotive - level 3 - 5 credits.
> ID 18865: Operate hand points within a railway system - level 2 - 1 credit.
> ID 18866: Perform manual operation of lever-type motor points - level 2 - 2 credits.
> ID 18867: Perform manual operation of crank-handle type motor points - level 2 - 2 credits.
> ID 18868: Operate a two-way radio within a rail system - level 2 - 2 credits.
> ID 18870: Service and operate a diesel-electric main line locomotive - level 3 - 5 credits.

> ID 18871: Service and operate a diesel shunt class locomotive - level 3 - 4 credits.
> ID 18872: Move rail service vehicles using a shunt class or main line locomotive within yard limits - level 3 - 4 credits.
> ID 18873: Service and operate an electric main line locomotive - level 3 - 5 credits.
> ID 19281: Perform core stationary shunting duties - level 2 - 2 credits.
> ID 19282: Perform freight and passenger train shunting duties - level 3 - 8 credits.
> ID 19283: Perform freight train inspection - level 3 - 10 credits.
> ID 19288: Demonstrate knowledge of shunting terms, commands, and hand signals - level 2 - 2 credits.
> ID 19388: Haul a passenger train on a network route using a main line locomotive - level 4 - 15 credits.
> ID 16802: Protect people in situations of danger - level 3 - 6 credits.
> ID 19284: Perform passenger train inspection - level 3 - 8 credits.
> ID 19384: Operate a diesel-mechanical railcar on a main line managed by a network operator - level 4 - 10 credits.
> ID 19386: Operate an electric multiple-unit on a main line managed by a network operator - level 4 - 10 credits.
> ID 19390: Operate a diesel-electric railcar on a main line managed by a network operator - level 4 - 10 credits.
> ID 16802: Protect people in situations of danger - level 3 - 6 credits.

The above standards compare fairly well with all three Qualifications at levels 2, 3 and 4 as they covers the whole process of Diesel Electric Fitting or Electrical Fitting on diesel electric locomotives and motor coaches. Many of these standards are however covered over the three Qualifications, at levels 2, 3 and 4 if learners select the specialisations. The exception is those standards which cover the driving of the locomotives or motor coaches.

Conclusion:

Some of the above Qualifications and learning programmes do not compare well with this level four Qualification, as they cover the whole diesel mechanic apprenticeship and the issues around the skills of inspection, repair and maintenance of the engine and mechanical components on diesel electric locomotives. They focus more on the operations of a locomotive as opposed to its repair and maintenance with strands in signalling/track control and railcar operation.

ARTICULATION OPTIONS
Horizontal articulation is possible with:

> ID 48978: Further Education and Training Certificate: Electrical Network Control at NQF Level 4.
> ID 58270: Further Education and Training Certificate: Electro-Mechanics at NQF Level 4.
> ID 58539: Further Education and Training Certificate: Automotive Repair and Maintenance at NQF Level 4.
> ID 59709: Further Education and Training Certificate: Mechanical Engineering: Fitting at NQF Level 4.
> ID 63889: Further Education and Training Certificate: Electrical Engineering at NQF Level 4.
> ID 48978: Further Education and Training Certificate: Electronics at NQF Level 4.

Vertical articulation is possible with:

> ID 50245: National Diploma: Maintenance Management at NQF Level 5.
> ID 59201: National Certificate: Generic Management at NQF Level 5.
> ID 61594: National Certificate: Management at NQF Level 5.
> ID 49061: National Certificate: Master Craftsmanship (Electrical) at NQF Level 5.
> ID 60110: National Certificate: Engineering at NQF Level 5.

MODERATION OPTIONS

> Any institution offering learning that will enable the achievement of this qualification must be accredited as a provider with the relevant Education Training Quality Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

> Assessment and moderation of assessment will be overseen by the relevant Education Training Quality Assurance (ETQA) Body, or by an ETQA that has a Memorandum of Understanding with the relevant ETQA, according to the ETQA's policies and guidelines for assessment and moderation.

> Moderation must include both internal and external moderation of assessments, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described in the associated unit standards.

> Anyone wishing to be assessed against this qualification may apply to be assessed by any assessment agency, assessor or provider institution that is accredited by the relevant ETQA.

CRITERIA FOR THE REGISTRATION OF ASSESSORS

For an applicant to register as an assessor, the applicant should:

> Be registered as an assessor with the relevant ETQA and be a qualified artisan in the relevant trade.

NOTES

N/A

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Fundamental	9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	Level 4	6
Fundamental	119462	Engage in sustained oral/signed communication and evaluate spoken/signed texts	Level 4	5
Fundamental	119469	Read/view, analyse and respond to a variety of texts	Level 4	5
Fundamental	9016	Represent analyse and calculate shape and motion in 2- and 3-dimensional space in different contexts	Level 4	4
Fundamental	119471	Use language and communication in occupational learning programmes	Level 4	5
Fundamental	7468	Use mathematics to investigate and monitor the financial aspects of personal, business, national and international issues	Level 4	6
Fundamental	119459	Write/present/sign for a wide range of contexts	Level 4	5
Core	116046	Fault find and repair Equipment associated with Final Control Elements	Level 4	10
Core	10259	Fault find, repair and maintain three phase voltage electrical circuits	Level 4	8
Core	259177	Maintain, test and repair AC machines and control gear	Level 4	12
Core	263017	Monitor performance of equipment and machinery on locomotives during operation	Level 4	8
Core	263025	Test a train equipped with a vacuum and/or air brake system	Level 5	12
Elective	244046	Demonstrate knowledge of mechanical fuel injection systems	Level 3	5

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	244051	Test and repair an engine cooling system	Level 3	4
Elective	244057	Test and repair an engine lubrication system	Level 3	4
Elective	244119	Assemble an engine sub assembly	Level 4	10
Elective	259200	Design, construct and commission three phase electrical circuits	Level 4	10
Elective	244121	Diagnose, service and repair forced induction systems	Level 4	4
Elective	259198	Inspect, test and maintain 3-kV DC busbar chamber and associated equipment in traction sub-stations	Level 4	8
Elective	259199	Inspect, test and maintain earthing and negative return systems on 3-kV DC traction substations	Level 4	7
Elective	259202	Inspect, test and maintain high voltage isolators	Level 4	12

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION
None

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Monitor performance of equipment and machinery on locomotives during operation

SAQA US ID	*UNIT STANDARD TITLE*		
263017	Monitor performance of equipment and machinery on locomotives during operation		
ORIGINATOR		*PROVIDER*	
Task Team - Maintenance			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Engineering and Related Design	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 4	8

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

SPECIFIC OUTCOME 1
Prepare to monitor and examine equipment and machinery for correct operation.

SPECIFIC OUTCOME 2
Examine equipment and machinery and perform minor repairs.

SPECIFIC OUTCOME 3
Perform qualifying tests and release locomotive for operations.

SPECIFIC OUTCOME 4
Complete the monitoring and examination process.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	66049	Further Education Training Certificate: Diesel Electrical Fitting	Level 4

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Test a train equipped with a vacuum and/or air brake system

SAQA US ID	*UNIT STANDARD TITLE*		
263025	Test a train equipped with a vacuum and/or air brake system		
ORIGINATOR		*PROVIDER*	
Task Team - Maintenance			
FIELD		*SUBFIELD*	
6 - Manufacturing, Engineering and Technology		Engineering and Related Design	
ABET BAND	*UNIT STANDARD TYPE*	*NQF LEVEL*	*CREDITS*
Undefined	Regular	Level 5	12

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

SPECIFIC OUTCOME 1
Identify and explain the purpose and function of the brake equipment on a train.

SPECIFIC OUTCOME 2
Set up and test a vacuum and/or air brake system on a train.

SPECIFIC OUTCOME 3
Describe related brake valves/systems.

SPECIFIC OUTCOME 4
Diagnose brake faults and perform repairs.

SPECIFIC OUTCOME 5
Qualify and return the locomotive or train set to service.

QUALIFICATIONS UTILISING THIS UNIT STANDARD

	ID	QUALIFICATION TITLE	LEVEL
Core	66049	Further Education Training Certificate: Diesel Electrical Fitting	Level 4