	Unit ID: 952
Domain	**RIGGING**
Title:	**Demonstrate knowledge and apply basic electrical and mechanical engineering**
Level: 4	**Credits: 8**

Purpose

This unit standard specifies the competencies required to demonstrate knowledge of basic electrical and mechanical engineering. It includes using and describing International Standards (SI), energy, electrical and mechanical quantities correctly, demonstrating knowledge of and using direct current (DC) theory and network analysis in solving RLC circuits, demonstrating knowledge and applying magnetic theory, demonstrating knowledge electromagnetic theory, demonstrating knowledge of capacitance theory and demonstrating knowledge of alternating current theory. This unit standard is intended for those who work as general lifting machine operators.

Special Notes

1. Entry information:

   Prerequisite:

   - *937 - Apply safety rules and regulations in lifting machine operations* or demonstrated equivalent knowledge and skills.

2. This unit standard may include but is not limited to electrical and mechanical engineering quantities and electrical applications, the advanced principles of magnetism, electromagnetism and electrical fields, the principles of alternating (AC) and direct (DC) power generation (single and three phase), AC theory (resistance, voltage, current, frequency, r.m.s values, capacitance, inductance, reactance, impendence power, var and power factor) and DC circuit theory and network analysis.

3. Assessment evidence may be collected from a real workplace, or an appropriate simulated realistic environment in which lifting machine operations are carried out.

4. All inspection, operation and maintenance procedures associated with the use of tools and equipment shall comply with manufacturers' specifications, guidelines and instructions.

5. Regulations and legislation relevant to this unit standard include the following:
   - Labour Act, No. 11, 2007
   - Regulations relating to the Health and Safety of employees at work, 1997 and all subsequent amendment.

Quality Assurance Requirements

This unit standard and others within this subfield may be awarded by institutions which meet the accreditation requirements set by the Namibia Qualifications Authority and the Namibia Training Authority and which comply with the national assessment and moderation requirements. Details of specific accreditation requirements and the national assessment arrangements are available from the Namibia Qualifications Authority and the Namibia Training Authority on www.nta.com.na.

Elements and Performance Criteria

Element 1: Use and describe International Standards (SI) , energy, electrical and mechanical quantities correctly

Range

Quantities may include but are not limited to force, torque, work done, velocity, acceleration, angular velocity, power, current, quantity of electricity, voltage, potential difference, electromotive force, electrical power, resistance, resistivity, temperature coefficient of resistance and conductivity.

Performance Criteria

1.1 Quantities are converted to their correct SI units.

1.2 Energy, electrical and mechanical units are defined and its symbols listed correctly.

1.3 The difference between power energy and kWh is explained.

1.4 Basic battery theory is understood in terms of e.m.f., internal resistance, Ahr, Whr, and terminal voltage with the aid of basic calculations.

1.5 Resistance, voltage and current of single-and three phases, pure resistive AC circuits are measured and power calculated with the aid of Ohms law.

Element 2: Demonstrate knowledge and use DC theory and network analysis in solving RLC circuits

Performance Criteria

2.1 Series circuits with one supply are drawn and explained in relation with voltage, current and resistance values.

2.2 Parallel circuits with one supply are drawn and explained in relation with voltage, current and resistance values.

2.3 Series-and parallel circuits with one supply are drawn and explained in relation with voltage, current and resistance values.

2.4 Basic calculations of RLC circuits are done with the application of Kirchhoff's laws.

Element 3: Demonstrate knowledge and apply magnetic theory

Range

Magnetic fields may include but are not limited to toriod, core type, shell type and composite.

Magnetic unit and basic calculations may include but are not limited to flux, flux density, magneto motive force, magnetic field strength, permeability of free space, relative permeability, reluctance, length of a magnetic circuit and the cross sectional area of a magnetic circuit.

Performance Criteria

3.1 The laws of magnetic flux lines are defined in relation with the principles of magnetism.

3.2 Magnetic fields in various magnetic circuits are described in relation with the principles of electromagnetism.

3.3 The direction of magnetic fields is determined and described with reference to screening, leakage and fringing.

3.4 Magnetic units are named and applied with the aid of basic calculations.

Element 4: Demonstrate knowledge and apply electromagnetic theory

Performance Criteria

4.1 Magnetic fields produced by coils and conductors are described and sketched.

4.2 Flemings left and right hand rules are defined and applied.

4.3 Lenz`s law is defined and applied.

4.3 Induced e.m.f and rate of change are understood and applied.

4.4 Basic calculations related to electromagnetic theory are carried out.

Element 5: Demonstrate knowledge and apply capacitance theory

Range

Capacitance may include but is not limited to electric field strength, electric flux density, permittivity of free space, dielectric, dielectric strength, relative permittivity and capacitance.

Performance Criteria

5.1 The operation of a capacitor is described in relation with different types and sizes.

5.2 Capacitance units are named and applied in relation with different types and sizes.

5.3 The relationship between capacitance and relevant variables are described.

5.4 Advanced calculations relevant to capacitance theory are carried out.

Element 6: Demonstrate knowledge of alternating current theory

Range

Alternating current (AC) units and principles may include but are not limited to cycle, frequency, wavelength, amplitude, peak and maximum values, peak tp peak value, sine wave, electrical degrees, r.m.s. and average values.

Performance Criteria

6.1 The difference between Alternating (AC) and Direct (DC) current is described with reference to the various generation machine configurations.

6.2 The principle of how AC electromotive force (e.m.f.) is generated is described as per AC theory principles.

6.3 Factors influencing the value of alternating voltage and current are described as per AC theory principles.

6.4 AC units are described and applied as per AC theory principles.

6.5 Factors influencing frequency are described as per AC theory principles.

6.6 Advanced calculations related to capacitance, inductance, reactance, impedance, power vars and power factor theory is carried out and explained as per AC theory principles.

Registration Data

Subfield:	Lifting, Shifting and Secure Loads
Date first registered:	27 September 2012
Date this version registered:	27 September 2012
Anticipated review:	2015
Body responsible for review:	Namibia Training Authority