	Unit ID: 876
Domain	**ELECTRICAL ENGINEERING- CORE**
Title:	**Demonstrate knowledge of electrical fundamentals**
Level: 2	**Credits: 3**

Purpose

This unit standard is intended for those who demonstrate knowledge of electrical fundamentals. People credited with unit standards are able to outline the basic atomic theory; outline the principle of direct current (DC) flow; outline fundamentals of resistance and conductance of materials; outline fundamentals of energy and power; outline the concept of alternating current (AC) theory; and demonstrate knowledge of magnetism and electromagnetism induction.

This unit standard is intended for those who work in electrical work environment.

Special Notes

1. Entry information:

   Prerequisite
   - *Unit 1157 - Demonstrate basic knowledge of workplace health and safety*

2. Assessment evidence may be collected from a real workplace or an appropriate simulated realistic environment in which electrical operations are carried out.

3. Performance of all elements in this unit standard must comply with manufacturers' specifications and workplace specific requirements.

4. Glossary of terms:
   - *'SANS'* refers to South Africa National Standards

5. Regulations and legislation relevant to this unit standard include the following:

   - Labour Act, No. 11, 2007.
   - Regulations relating to the health & safety of employees at work under Schedule 1 (2) of the Labour Act No.11 of 2007 and all subsequent amendments.
   - SANS 10142-1.

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. All approved unit standards, qualifications and national assessment arrangements are available on the Namibia Training Authority website www.nta.com.na.

Elements and Performance Criteria

Element 1: Outline the basic atomic theory

Performance Criteria

1.1 The structure of an atom is described.

1.2 Terms atomic structure, atomic number and ionisation are explained.

1.3 The difference between conductive, insulation and semi conductive materials is described.

1.4 Electrical behaviour of conductors, insulators and semiconductors is described in terms of free and bound charges.

Element 2: Outline the principle of direct current (DC) flow

Range

Terms related to DC may include but not limited to charge, polarities, ground and source of energy.

Performance Criteria

2.1 Concepts of conventional and electron current flow are explained.

2.2 Cells and batteries as sources of energy is explained.

2.2 Electrical quantities, units and symbols are explained in terms of charge, current, resistance, voltage and power.

2.4 Generation of direct current is explained using a simple model.

2.5 Behaviors of resistive (R), inductive (L) and capacitive (C) in DC circuits are described.

2.6 Ohm's law, Kirchhoff's law and other laws are described.

2.7 Units and symbols of electro-technology quantities (voltage, current, resistance, power etc) are identified and explained.

2.8 Calculations relating to voltage, current, resistance and power are performed.

2.9 Measurements related to current, voltage and power in DC circuits are performed.

Element 3: Outline fundamentals of resistance and conductance of materials

Performance Criteria

3.1 Fundamentals of resistance and conductance of conductive materials are explained.

3.2 Factors (length, cross-sectional area, resistivity, and temperature) affecting resistance are explained and related calculations are performed.

3.3 Basic calculations of resistance, length, cross-sectional area and resistivity of materials are performed.

Element 4: Outline fundamentals of energy and power

Performance Criteria

4.1 The difference between potential and kinetic energy is described.

4.2 The meaning and equations of electrical energy and power are explained.

4.3 Impedance matching and power transfer are described.

4.4 Calculations of electrical energy and power are performed.

Element 5: Outline the concept of alternating current (AC) theory

Range

AC terms related to waveforms may include but not limited to cycle, period, frequency, peak, peak-to-peak, average values, instantaneous values and root means square (rms).

Calculations may include but are not limited to peak, peak-to-peak, (rms), frequency, pulse repetitive time (PRT), pulse repetitive frequency PRF, angle velocity phase and period.

Non-sinusoidal waveforms may include but not limited to square, triangular, and saw-tooth waveforms.

Performance Criteria

5.1 Differences between direct current, alternating current and voltages are explained using graphic illustrations.

5.2 Generation of alternating current is explained using a simple model.

5.3 Sinusoidal and non-sinusoidal waveforms are sketched and explained.

5.5 Calculations relating to instantaneous values, rms, average, peak and peak-to peak values in terms of voltage, current and power are performed.

5.6 Behaviours of resistance (R), inductance (L) and current (C) in AC circuits are described.

5.7 Measurements related to current, voltage and power in AC circuits are performed.

Element 6: Demonstrate knowledge of magnetism and electromagnetism induction

Range

Magnetic terms may include but not limited to magnetization, magnetic field, lines of forces, magnetic poles, attraction, repulsion and magnetic flux.

Terms relevant to magnetic circuits may include but not limited to permeability, reluctance, flux density and hysteresis.

Terms related to electromagnetic induction may include but not limited to rate of changes of flux (induction), generation of electromotive force (emf), time constant, back-emf and inductor losses.

Performance Criteria

6.1 Natural magnets are explained in terms of their behaviour and material characteristics.

6.3 The difference between natural (permanent) magnetism and electromagnetism is explained.

6.4 Magnetic circuits and relevant terms used are described.

6.5 Effects of magnetism on current flow are explained using the right-hand rule and clock rule.

6.6 Various applications of electromagnetism are identified and explained.

6.7 Electromagnetic induction is explained using Faraday's law and Lens law.

6.9 Inductive circuits and their electrical behaviours are described.

6.10 Measurements and calculations relevant to inductive circuits are performed.

Registration Data

Subfield:	Electrical Engineering
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Body responsible for review:	Namibia Training Authority