

Unit ID: 870

Domain

ELECTRICAL ENGINEERING - CORE

Title:

Apply knowledge of basic circuit protection devices

Level: 2

Credits: 3

Purpose

This unit standard is intended for those who apply knowledge of circuit protection and protective devices. People credited with this unit standard are able to demonstrate knowledge of circuit protection principles; demonstrate knowledge of basic circuit protective devices; demonstrate knowledge of Residual Current Devices (RCDs); select circuit protective devices for electrical applications; and replace defective protective devices.

This unit standard is intended for those who work in electrical workplace 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 a simulated workplace environment in which electrical operations are carried out.

3. All inspections, tests, service and maintenance entailed in this unit standard must comply with statutory requirements and manufacturers' and/or workplace guidelines and instructions.

4. Glossary of terms

- '*Specifications*' refers to any, or all of the following: manufacturers' specifications and recommendations, workplace specific requirements.
- '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 and safety of employees at work under Schedule 1 (2) of the Labour Act No.11 of 2007
- SANS 10142-1.
- SANS 10142-2.
- Namibia Electricity Safety Code 2009: Electricity No. 4 Act 2007 and all subsequent amendments.

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: Demonstrate knowledge of circuit protection principles

Range

Terms related to circuit protection may include but not limited to rated current, voltage rating, fusing current (fusing factor, tripping factor), utilization category, classes of fuses and circuit breakers, cut-off characteristic, time versus current characteristic, category of duty, discrimination, back-up protection, rupturing capacity (breaking capacity), prospective short-circuit current (PSCC), coarse excess-current protection, close excess-current protection and sensitivity.

Electrical faults may include but are not limited to leakage current, over current and short circuit.

Effects of electrical faults may include but are not limited to electromechanical energy effects, heat energy effects, damaged cables and equipment, fire, explosion and electric shock.

Performance Criteria

- 1.2 Circumstances leading to excessive current in an electrical circuit are identified.
- 1.3 Relationship between fusing or tripping current, current rating, and fusing or tripping factor for a protective device is explained.
- 1.4 Merits of providing close excess-current protection are explained according to industry regulations and standards.
- 1.5 The effects of electrical faults are described in terms of the danger to people, animals and property.
- 1.6 The need for rapid disconnection of faulty circuits is explained.

Element 2: Demonstrate knowledge of basic circuit protective devices

Range

Basic circuit protective devices may include but is not limited to fuses, circuit-breakers, relays, Low Voltage (LV) surge arrestors and isolation transformers.

Poor selection of circuit protective devices may take form of underrating, overrating, incorrect utilization category, incorrect classes of fuses and circuit breakers, fusing or tripping factor and rupturing capacity.

Fault conditions may include but are not limited to overload, short-circuit, earth leakage fault, mechanical overload, phase failure in a motor, fault level calculations, selection of correct rated equipment and excessive earth leakage.

Performance Criteria

- 2.1 Protective devices are classified according to their ability to provide coarse or close excess-current protection.
- 2.2 Time versus current curves of rewirable fuses, High Rupture Capacity (HRC) fuses, and miniature circuit breakers are compared in terms of speed of operation and accuracy of calibration.
- 2.3 Effects of poor selection of protective devices are described for different fault conditions.
- 2.4 A three-phase protective device is described with reference to construction, operating principle, and protection afforded additional to that of single-phasing of a circuit.
- 2.5 Resetting or reloading of protective devices is demonstrated in accordance with industry practice and safety procedures.

Element 3: Demonstrate knowledge of Residual Current Devices (RCDs)

Range

RCDs are to include earth-leakage circuit-breaker (ELCB), residual current-operated circuit breaker (RCCB), residual current-operated circuit breaker with over-current protection (RCBO) and ground-fault interrupter (GFI).

Precautions may include but not limited to warning labels, disconnection of RCD when using a high voltage tester and accidental tripping of RCD when testing other parts of the circuit.

Performance Criteria

- 3.1 RCD terms are explained according to industry regulations and standards.
- 3.2 An RCD is described with reference to construction and principle of operation.
- 3.3 Procedures for testing the operation of RCDs are explained according to industry regulations and standards.
- 3.4 Precautions to be taken when testing circuits containing RCDs are explained.
- 3.5 Situations requiring RCD protection are explained according to industry regulations and standards.

Element 4: Select circuit protective devices for electrical applications

Range

Electrical applications may include but not limited to general applications and three-phase motor applications.

General applications may include but not limited to sub main, sub circuit wiring, electrical accessories, three-phase and single-phase appliances and outdoor appliance.

Three-phase motor applications may include but not limited to overload, short circuit, locked rotor, phase failure and phase reversal.

Performance Criteria

- 4.1 Current rating of the device is identified from examination of markings and/or manufacturers' data.
- 4.2 Protective devices are selected to meet the application requirements in terms of electrical protection characteristic, speed of operation, reset method, and current regulations and standards.
- 4.3 Relative merits of devices are explained and compared where more than one device meets the application requirements.

Element 5: Replace defective protective devices

Performance Criteria

- 5.1 Defective appliance is disconnected and main switch turned off before removal of the device according to lockout procedures.

- 5.2 Defective device is removed, cleaned and read to obtain current ratings and device characteristics.
- 5.3 Current rating, characteristics, size and/or base are matched according to industry practice.
- 5.4 Device is replaced and/or repaired according to industry practice.
- 5.5 Device is fully seated in its based after reinsertion according to industry practice.
- 5.6 Re-set is done in accordance with industry practice.

Registration Data

Subfield:	Electrical Engineering
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