

PART B-03: UNDERGROUND NETWORKS

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1. Scope

This document provides minimum maintenance guidelines for underground networks.

2. Requirements

2.1 Safety

A risk assessment should be carried out in accordance with local risk assessment procedures. All work should be carried out in accordance with NRS 040 and national and organizational low-voltage standards (i.e. SANS 10142-1), and all environmental hazards shall be removed in accordance with the organization's policy.

2.2 Statutory requirements

The requirements of the Labour Act and all subsequent amendments and regulations are to be observed and adhered to. If any text or drawings in this guide are in conflict with the Labour Act, the Labour Act requirements shall take precedence over this guide.

2.3 Environmental requirements

All relevant environmental policies and procedures shall be adhered to.

3. Cables

3.1 Inspections

Inspection planning should be carried out in order to comply with this guide. Inspection frequencies may vary from area to area depending on the type and severity of the pollution involved. The recommendations indicated in **Annex B** are intended as a guide to assist in the planning of maintenance intervals. Visual and physical inspections should be carried out at the minimum frequencies given in **Annex B**. All inspections are to be properly reported for further action if necessary. These inspections should be to identify defects in aspects such as:

- a) Loading on cable
- b) Cable sheath temperature
- c) Cable serving and protective covering where visible above ground
- d) Terminations and
- e) Earthing

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Table 1: Maintenance guidelines for underground distribution systems

Component sub item	Routine inspection	Routine condition Monitoring	Routine service (minor of major)	Major maintenance	Overhaul / reengineering	Opportunistic
Cable end termination	Dust Pollution Covering Connectors	None	None	None	None	As and when
Protective sleeve/kick pipe	In place corrosion	None	None	None	None	As and when
Routes	Cable markers Obstruction Construction	None	None	None	None	As and when
Distribution Kiosks	Pedestal mounting Alignment Doors Seals Rust Moisture/vermin Ingress Connections Circuit breakers	None	None	None	None	As and when

4. Kiosks and meter panels

Maintenance guidelines for the kiosks and meter panels are provided in table 2.

Table 2 Maintenance guideline for kiosks meter panel

Component sub item	Routine inspection	Routine condition Monitoring	Routine service (minor of major)	Major maintenance	Overhaul / reengineering	Opportunistic
Foundation/pad	Cracked loose	None	None	None	None	As and when
Cabinet	Rust/galvanizing Door lock/hinge Backing plates	None	None	None	None	As and when
Seal/covers	Seals broken, missing Tampering	None	None	None	None	As and when
Cable entry/exit	Loose damaged	None	None	None	None	As and when

- a) Metering kiosks/boxes should be included as part of routine inspections.
- b) Frequency of all routine inspection should be determined by the RCM studies.
- c) All Metering kiosks/box connections should be kept free of dust, weeds, grass, and spider webs.
- d) Do not use a blower as this only resettles the dust on the terminal connections.

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- e) A vacuum cleaner with the front end pipe made of an insulating material is recommended.
- f) The door seals should be inspected for deterioration and replaced if necessary.
- g) Doors should be locked and labelling should be visible.
- h) Metal metering kiosk/box should be checked for rust and, where necessary, a rust remover should be used and an approved paint should be applied to the affected area.
- i) Disused cable gland holes should be blanked off to prevent moisture and dust collecting in the box.
- j) Latching arrangements should be checked, and adjusted if necessary, to ensure the door makes a good seal when closed.
- k) Door latching arrangements, door hinges and locks should be checked and oiled regularly. This should be determined by the local conditions i.e. in areas where there is high moisture content, corrosive atmosphere or high theft incidents inspections should be more frequent.
- l) Metering kiosk/box should be secured either to the pole or splint and gland plates, cables and equipment inside the kiosk/box should be secured.
- m) Ensure, when working live, to adhere to the low voltage live work standards.
- n) Water drain holes at the bottom of the door lip should be checked to ensure that they are clear.
- o) Each metering kiosk/box should be labelled to identify the panel it is associated with.
- p) Harnesses should be tidy and secure and checked to ensure that there are no loose terminations.
- q) Access into the Metering kiosks/box should only be through the doors. All other apertures should be sealed. Vents should be insect proof and vermin proof.
- r) All unused cores should be combined together and earthed.
- s) Ensure that approved seals are applied and that the meter is not tampered with.
- t) Metal metering kiosks/boxes and doors should be effectively earthed and should not pose any danger to persons.

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Annex A

(Informative)

MV feeders

A.1 Inspection and maintenance

A.1.1 Cable route

The cable route should be inspected for signs of excavation and potential cable damage. The route should be inspected for signs of soil subsidence and erosion.

A.1.2 Outdoor terminations

WARNING: *Until proven otherwise by testing, all terminations and associated bare metal of bonding lead connections shall be assumed to be live and therefore all maintenance should be done with the MV cable isolated and earthed.*

The bushing insulator of the outdoor termination should be inspected and maintained in accordance with the local standards or procedures.

The stand-off insulators at the base of the termination should be inspected for broken sheds and signs of cracks and material degradation in the case of resin or polymeric type insulators. In the event of either being present, the problem should be referred to the respective manager for further investigation by an insulator specialist.

The outdoor termination should be inspected for evidence of oil or compound leaks. The bonding lead connection onto the termination base should be checked to ensure that it is still present and that it is tight.

WARNING: *In the event that the bonding lead is not present check the bonding and earthing line diagram to confirm the designed bonding and earthing arrangement and restore to normal.*

A.1.3 Kiosk type link boxes

WARNING: *Until proven otherwise by testing, all bare metal connections within the link disconnecting box shall be assumed to be live and therefore all internal maintenance required should be done with the MV cable isolated and earthed.*

Ensure that the kiosk is fitted with an approved access lock and has not been damaged or vandalised. The kiosk should be inspected for signs of corrosion. Surface corrosion should be sanded, treated with a corrosion resisting primer and painted. The kiosk should be replaced if it fails to meet enclosure protection standards.

It should be ensured that there are no weeds, grass, insects or animal nests within the kiosk.

All links and connections to SVL surge arresters should be checked for signs of corrosion and loose connections.

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SVL surge arresters should be inspected for signs of failure i.e. discolouring, cracks etc. It should be ensured that all phase identification sleeves are present on the bonding leads.

It should be ensured that bonding leads are clearly marked with substation (normal source) and feeder (load) identified using a durable labelling system fitted to the leads.

It should be ensured that the kiosk door is externally labelled with an electrical symbolic warning sign that is permanently attached.

A.1.4 Manhole type link boxes

WARNING: *Until proven otherwise by testing, all bare metal connections within the link disconnecting box should be assumed to be live and therefore all internal maintenance shall be done with the MV cable isolated and earthed.*

Ensure that the manhole cover is fitted.

The link box housing and lid should be inspected for signs of corrosion. Surface corrosion should be sanded, treated with a corrosion resisting primer and painted.

It should be ensured that all of the nuts, spring washers and washers are in place on the link box housing lid.

The link box should be replaced if it fails to provide an enclosure protection rating of IP 67 in accordance with SANS 60529.

WARNING: *The link box may be subjected to short periods of submersion and should be capable of functioning correctly under these conditions.*

It should be ensured that there are no weeds, grass, insect or animal nests within the manhole. All links and connections to SVL surge arresters should be checked for signs of corrosion and loose connections.

SVL surge arresters should be inspected for signs of failure i.e. discolouring, cracks, etc.

It should be ensured that all phase identification sleeves are present on the bonding leads.

It should be ensured that link boxes are clearly marked with substation (normal source) and feeder (load) identified using a durable labelling system fitted at the cable entry.

It should be ensured that the link box lid is externally labelled with an electrical symbolic warning sign that is permanently attached.

It should be ensured that the link box lid is externally labelled with an electrical address in accordance with the organisation's standards and procedures.

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Annex A

(Continued)

Table A.1 — Acceptable leakage current levels

Description	Acceptable Current
Bonding leads from terminations at solidly bonded side of end-point or double end-point bonded cable section.	< 5 Amp/km of cable installed in the section (see note 1).
Bonding leads from link box or terminations at open side/s of end-point or double end-point bonded cable section.	< 1 Amp
Bonding leads from link box or terminations at solidly bonded side of cross-bonded cable section.	< 20 % of the load current flowing in the cable (see note 2).
Bonding leads from cross-bonding link box of cross-bonded cable section.	< 20 % of the load current flowing in the cable.
<p>NOTES:</p> <p>1. The charging current of the cable is a function of the cable length and will be measured in the cable sheath and bonding lead. The charging current will be identical in each phase.</p> <p>2. The minor sections of cross-bonded cable sections are never identical in length and therefore a complete cancellation of induced voltage is never achieved. As a result a leakage current will flow and is considered to be acceptable provided it is < 20 % of the load current.</p>	

A.2.3 Outer sheath integrity testing (serving test)

WARNING: *Until proven otherwise by testing, all bare metal connections within the link disconnecting box shall be assumed to be live and therefore all tests shall be done with the MV cable isolated and earthed.*

Prior to sheath testing all links should be removed and all SVL surge arresters should be disconnected to ensure that they are not subjected to the test voltage.

A.2.4 Sheath voltage limiting (SVL) surge arrester testing

WARNING: *Until proven otherwise by testing, all bare metal connections within the link disconnecting box shall be assumed to be live and therefore all tests shall be done with the MV cable isolated and earthed.*

SVL surge arresters in link boxes shall be tested in accordance with OEM.

A.3 Documentation

The following documentation should form part of the maintenance record for each feeder cable:

- a) Completed data sheets that provide constructional and electrical data for the cable;
- b) Installation instructions and drawings for all joints used i.e. straight, sheath interrupting, stop joints, etc.;

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- c) Assembly drawings of all kiosk and manhole link boxes;
- d) Data sheets for all SVL surge arresters used;
- e) A line diagram showing the bonding and earthing arrangement of the feeder cable;
- f) In the case of an oil-filled feeder cable, a line diagram showing the hydraulic circuit and the oil alarm and trip settings;
- g) In the case of an oil-filled feeder cable, a drawing showing the hydraulic profile of the feeder cable;
- h) A cadastral map showing the location of the feeder cable and all ancillary equipment;
and
- i) A record of all previous maintenance performed on the feeder cable in accordance with this guide.

The documentation indicated in items g) and i) should be made available during routine maintenance.

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Annex B

(Informative)

Maintenance of underground cables		
The following are guidelines and recommended intervals for the various maintenance inspections to be carried out on underground networks.		
Item/Equipment	Interval	Activity
Cable terminations	Annually	Check for tracking Check connection for security
Cable above ground	Annually	Check for tracking Check attachment to pole Where fitted, ensure protective pipe is secure
Earthing	Annually	Check all earth connection for security
Earthing	5 yearly	Test all earth connections at MV and LV substations and compare to standards
Destructive testing (e.g. AC discharge)	As required	As per licensee requirements
Non-destructive testing (e.g. very low frequency)	As required	As per licensee requirements