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Discipline

Engineering Standard - NSW

Category

Electrical

Title

Ground Entry Arrangements

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About This Standard

This document sets out the approved configurations and installation requirements for high voltage and 1500 V dc cables where they enter the ground.

These approved configurations minimise the risk of mechanical damage from the point at which the cable rises above its normal buried depth through to the above ground transition and to a height above ground where the risk of mechanical damage is minimal.

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1 Scope and Application

This document sets out the approved configurations and installation requirements for high voltage and 1500 V dc cables where they enter the ground.

These approved configurations minimise the risk of mechanical damage from the point at which the cable rises above its normal buried depth through to the above ground transition and to a height above ground where the risk of mechanical damage is minimal.

The requirements of this document apply to new and major rehabilitation works.

2 References

SAA HB C(b)1 – Guidelines for design and maintenance of overhead distribution and transmission lines.

C(b)2 ESAA Guide to the Installation of Cables Underground.

3 Introduction

Where cables emerge from the ground they are susceptible to mechanical damage from vehicles, plant, equipment and construction and maintenance activities. Mechanical damage to cables is the major cause of cable failure. Therefore it is necessary to provide adequate mechanical protection for the cables from below ground line to a reasonable distance above ground line to ensure the integrity of the cable and system reliability.

The level of mechanical protection will vary with the risk of damage that is determined by the physical location of the cable ground entry point. Cables located inside substation outdoor areas mostly have a lower level of risk than those cables located outside the substation outdoor areas.

For the purpose of this document sectioning hut outdoor areas are to be treated the same as substation outdoor areas.

4 Cables outside substation outdoor areas

4.1 Cables on poles

Where cables emerge from the ground and are attached to poles they shall be protected from mechanical damage.

The cable shall be installed on the pole in such a position as to minimise the risk of damage from collisions, for example, on the side of the pole away from the road or on the opposite side of the pole to approaching traffic.

The cable protection shall be designed:

- to provide mechanical protection for the cable from moderate impacts from vehicles, plant and equipment and maintenance and construction activities;

- to protect the cable continuously without gaps from a distance commencing at least 300 mm below ground and extend to a point not less than 2.5 m above ground;
- not to afford a foothold, which would allow unauthorised climbing of the pole.

Rigid heavy duty PVC conduit alone is not acceptable as mechanical protection.

To protect the cable or PVC conduit from possible damage from digging or excavating in the area, the cable or PVC conduit shall be covered with additional mechanical protection such as inverted concrete troughing or similar mechanical protection commencing at least 300 mm below ground to a distance of not less than 300 mm above ground line.

The additional mechanical protection shall be:

- securely attached to the pole with stainless steel straps at ground line;
- filled with clean sand and sealed at the top end with sand/cement mix or expanding foam to prevent the possible ingress of rocks or ballast.

Where rigid PVC conduit is used between the underground installation and the above ground installation the PVC conduit shall be UV stabilised to prevent UV damage. The rigid PVC conduit shall be filled with clean sand and sealed at the top end with sand/cement mix or expanding foam to prevent the possible ingress of rocks or ballast.

Metal cable protection covers should not be earthed. However, if it should become necessary to connect the metal protection covers to the pole earthing system, touch potentials under fault conditions must be analysed to determine that the magnitude of the touch potentials are within limits prescribed in SAA HB C(b)1 Guide for the Design and Maintenance of Overhead Distribution and Transmission Lines. Appropriate arrangements must be put into place if potentials exceed acceptable limits.

4.2 Cables on steel structures

When cables are attached to steel structures, wherever possible they shall be afforded mechanical protection in accordance with Section 4.1.

Adequate mechanical protection is afforded to cables when the cables are located between the flanges of a steel structure beam.

Where it is impractical to provide mechanical protection in accordance with Section 4.1 and the structure is located within the rail corridor, cables may be installed above ground in rigid heavy duty UV stabilised PVC conduits, covered cable trays or covered cable ladders provided that adequate crash barriers independent of the cable installation are strategically located and installed to protect the cables.

PVC conduits shall be filled with clean sand and sealed with sand/cement mix or expanding foam.

5 Cables within substation outdoor areas

5.1 Cables on poles

Where cables emerge from the ground and are attached to poles they shall be protected from mechanical damage from the point of departure from the standard underground arrangement to the above ground protection system extending to a point not less than 300 mm above ground.

The cable protection shall be of such a design as:

- to provide mechanical protection for the cable from maintenance and construction activities;
- to protect the cable continuously without gaps from the underground installation to the top of the above ground protection system.

Rigid heavy duty UV stabilised PVC conduit is acceptable as mechanical protection.

Rigid heavy duty PVC conduit used as mechanical protection shall be filled with clean sand and sealed at the top end with sand/cement mix or expanding foam to prevent the possible ingress of stones or blue metal.

5.2 Cables on steel structures

When cables are attached to steel structures, wherever possible they shall be afforded mechanical protection in accordance with Section 5.1.

Where it is impractical to provide mechanical protection in accordance with Section 5.1 cables may be installed above ground in covered cable trays or covered cable ladders.

PVC conduits shall be UV stabilised and filled with clean sand and sealed with sand/cement mix or expanding foam.