

Technical Bulletin

TB 0205 - High impedance distribution earthing

Purpose

The purpose of this bulletin is to establish the requirements for high impedance padmount and switching station earthing design.

Background

Endeavour Energy's distribution assets are designed to be either common earthed or separately earthed. According to Annexure 11 of EDI 100 - Distribution earthing design, construction and test where the designer designates a separately earthed system they can either design a small or a large electrode system. The risks associated with both options are shown in the table below.

Large or long electrode system
- o Lower EPR magnitude - o Lower touch voltages at the asset - o Lower step voltages near the asset - o Larger EPR hazard zone - o Problematic with large soil voltage transfer hazards to nearby metallic infrastructure - o Fault clearing by two or three protection systems - D/O fuse(for pole substations only), feeder/recloser and SEF)
Small electrode system (single rod)
- o Higher EPR magnitude - o Higher touch voltages at the asset - o Higher step voltages near the asset - o Small EPR hazard zone - o Fewer problems with soil voltage transfer hazards to nearby metallic infrastructure - o Fault clearing by one or two protection systems - D/O fuse (pole substations only) and SEF

According to EDI 001 (section 5.4.4) and EDI 100 (section 5.2.6.2) it is a requirement that wherever practical the designed earth system provide sufficient earth fault current to operate upstream earth fault protection at the ZS or recloser. Where this is not practical a small electrode system can be utilised provided sufficient earth fault current to

operate sensitive earth fault (SEF) protection with a safety factor of two.

Assessment of underground distribution earthing designs has shown that more clarity is needed when designing separately earthed systems operating on SEF.

Action

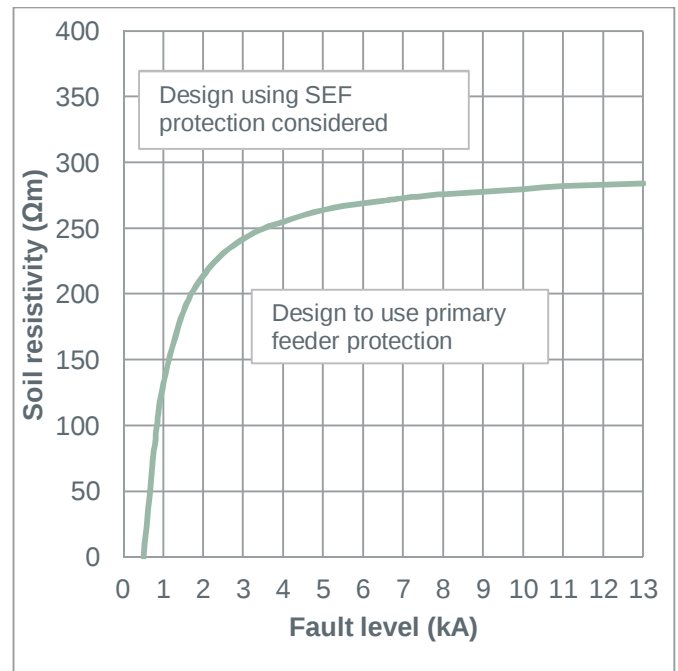
All padmount/switching station distribution earthing designs started after the time of the publication of this technical bulletin must be designed such that there is sufficient earthing to operate primary earth fault protection, unless the requirements outlined in this technical bulletin are met. Any padmount/switching stations that are designed to operate on SEF protection alone are required to be approved by the Earthing and Power Quality Manager using the dispensation process set out in Company Procedure GAM 0114 – Granting Dispensations for Engineering Documents. Designs must be submitted with the following information:

- Justification for a design to operate SEF protection vs primary earth fault protection. This must include calculated risk levels for both options in accordance with EDI 001 section 5.2.2. The Argon software tool may be used to assist.
- Modelling must use actual protection settings obtained from Endeavour Energy's protection group. The default settings are not allowed.

- Assets are to be modelled in software compliant with EDI 100 and that is capable of a two layer soil model and showing voltage contours produced by a grading ring. The 3E software tool cannot be used for this task. The software model must:
 - include the grading ring, supplementary electrodes and adjacent assets (padmounts and/or UGOHS);
 - show the touch voltage operators are exposed to; and
 - show the surface voltage contours for a minimum of the MEN limit from the substation and indicate all conductive objects in this vicinity.
- Minimum fault current into the system must be shown to be at least twice the SEF pickup and the feeder must have a confirmed SEF setting.
- All touch voltages to conductive objects be compliant with the requirements of EDI 001 and EDI 100.

Designs submitted where the fault level and soil resistivity are below the curve shown below will generally not be permitted. Note that the soil resistivity in the chart is the highest of the soil layers. It is still the designer's responsibility to maintain compliance with the safety criteria of EDI 001 even if the design meets the graph criteria below.

A current injection test may be requested by the Earthing and Power Quality Manager as a condition of approval to verify the design.



Impacted Standards

The contents of this technical bulletin will be included in the next update of EDI 100 – Distribution earthing design, construction and test.