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Determining the Temperature and Earth Fault Current of an Earth Continuity Conductor of Power Cables with Metallic Screens Bonded and Earthed at One End

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Review article

Highlights

- The paper presents examples of power cable installations using large single-core cables with metallic screens bonded and earthed at one end only
- It explains the purpose of an Earth Continuity Conductor (ECC) and outlines a method for calculating its minimum cross-sectional area
- The temperatures of selected ECCs are calculated numerically, followed by an analytical determination of the maximum permissible earth fault currents, based on the ECC's distance from the cable line

Abstract

When a power cable line comprises large single-core cables, significant circulating currents and losses may occur in the metallic screens. If cross-bonding of these screens is not technically or economically justified, they can instead be bonded and earthed at one end only. This interrupts the earth fault current path, necessitating the use of an additional protective conductor –commonly referred to as an Earth Continuity Conductor (ECC) – to interconnect the local earthing systems at both ends of the line.
To prevent thermal damage to its insulation during fault conditions, the ECC must be accurately sized. Since it is placed near the power cables, it may be exposed to high ambient temperatures. This paper performs numerical calculations to assess the thermal behaviour of copper ECCs insulated with PVC and cross-linked polyethylene (XLPE), taking into account various distances from the power cables.
Following the temperature simulations, analytical methods are used to determine the maximum permissible earth fault currents for ECCs with cross-sectional areas of 240 mm² and 300 mm². These calculations are based on single-core power cables of the Cu/XLPE/CTS/PVC/AWA/PVC 19/33 kV type (BS 6622), with conductor cross-sections of 800 mm² and 1000 mm². It is assumed that the cables are laid directly in soil, without considering soil drying, and that due to transposition at the midpoint of the line, no circulating current flows through the ECC itself.

Keywords

Earth Continuity Conductor (ECC), Finite Element Method (FEM), Metallic Screen Bonding Design, Trefoil Formation, Underground Power Cable

Notes:

The full text of this article is available only in the Serbian language.
In the English version, only its Abstract (above) is available.

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