

# Cross-Section of Metallic Tape for Substation Earthing

## Introduction

This application calculates the cross-section of steel tape to earth a conductor for a 110/30 kV substation, correct to IEC 60287-3-1 and EN 50522:2010.

Soil resistivities are given in the following table.

Type of soil	Soil Resistivity ( $\Omega$ m)
Marshy	5 - 40
Loam, clay, humus	20 - 200
Sand	200 - 2500
Gravel	2000 - 3000
Weathered rock	< 1000
Sandstone	2000 - 3000
Granite	< 50000
Moraine	< 30 000
<i>Soil resistivities for frequencies of alternating currents - range of values, which were frequently measured (table J.1 from EN 50522:2010)</i>	

## References

- EN 50522:2010 Earthing of Power Installations Exceeding 1 kV A.C.
- IEC 60287-3-1 Electric cables - Calculation of the current rating

## Parameters

Fault current

$$I_f := 25 \text{ kA} :$$

Fault time

$$t_f := 0.6 \text{ s} :$$

Soil resistivity

$\rho_e := 60 \text{ ohm m} :$

Constant depending on material of the current carrying capacity (table D.1 50522:2010 of IEC 60949)

$K := 78 \text{ As}^{1/2} \text{ mm}^{-2} :$

Reciprocal of the temperature coefficient of resistance of the current-carrying component at 0°C

$\beta := 202 \text{ degC} :$

Final temperature

$\Theta_f := 400.0 \text{ degC} :$

Initial temperature

$\Theta_i := 30.0 \text{ degC} :$

## Results

Minimum cross-section of earthing conductor on substation

$$A := \frac{I_f}{K} \cdot \sqrt{\frac{t_f}{\ln\left(\frac{\Theta_f + \beta}{\Theta_i + \beta}\right)}} = 254.25 \text{ mm}^2$$