A.9.4.

Cable crossings

E. DORISON
Electricité de France – Les Renardires – 77 818 MORET - FRANCE

The permissible current-carrying capacity of a buried cable is strongly affected by the thermal environment of the cable. As a consequence, the current rating of an underground link has to take into account the thermal influence of heat sources, such as steam pipes or electrical links, installed in its vicinity.

On one hand, neglecting the thermal influence of a crossing heat source on a cable may lead to excessive overheating, detrimental for the cable, even when the crossing occurs at 90°. On the other hand, applying formulae which are valid for parallel routes would turn into overestimate the thermal influence, and oversize the cable.

The difference between parallelism and crossing lies in the longitudinal heat dissipation in the core of the cable, which does not occur in case of parallel routes. In case of a crossing, as a consequence of the varying temperature rise along the cable length, a longitudinal heat flux is generated in the conductor, which leads to a reduction of the conductor temperature rise at the crossing, compared to the case when this longitudinal flux is ignored.

IEC Working Group 19 is preparing an extension of existing IEC 60287 standards to deal with this problem : based on previously published works, a method will be presented to estimate the reduction of the permissible current-carrying capacity of a cable crossed by heat sources.

This paper reports on some studies and tests performed by EDF, as a contribution to this Working Group concerns.

First, a general and simple algorithm allowing to take into account the longitudinal heat dissipation in the core when rating a cable with one or several crossing heat sources, is briefly reported : starting from the expressions of the longitudinal and radial heat flux, based on Fourier’s law and energy balance principle, the equation governing the temperature rise of the conductor along its route in the area close to the crossing location is worked out and a solving method is described.

Then, an extension is presented, in order to consider the longitudinal heat flow not only in the cable core, but in both the core and metallic screen. In that case, a set of 2 equations has to be solved, in a similar way.

And a method is proposed to deal with cyclic loads and possible soil drying around the cable, at the crossing location, based on superposition principle.

Measurements performed on a full-scale cable test installation involving crossings of 2 high voltage cables are displayed.