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A.2.2. Remblai thermique fluidisé pour augmenter la capacité de transport des câbles souterrains

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A.2.2. Fluidized thermal backfill for increased ampacity of underground power cables

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Résumé

La résistance thermique du sol couvrant les câbles souterrains dépasse souvent de 50% la résistance globale entre les câbles et l'ambiant. Par conséquent, la conception d'une installation souterraine doit être basée sur les caractéristiques réelles du sol avoisinant. Le système d'analyse des propriétés thermiques TPA "Thermal Property Analyzer" peut être utilisé pour effectuer un échantillonnage du sol le long d'un circuit projeté. Dans le cas d'un sol résistif, des remblais spéciaux FTB "Fluidized Thermal Backfill" sont recommandés pour diminuer la résistance globale, pour ainsi augmenter la charge admissible du circuit en question. Un mélange FTB bien dosé peut s'avérer économiquement rentable. Ce mélange peut être constitué sur place à l'aide d'une bétonneuse conventionnelle et des agrégats trouvés dans les environs.

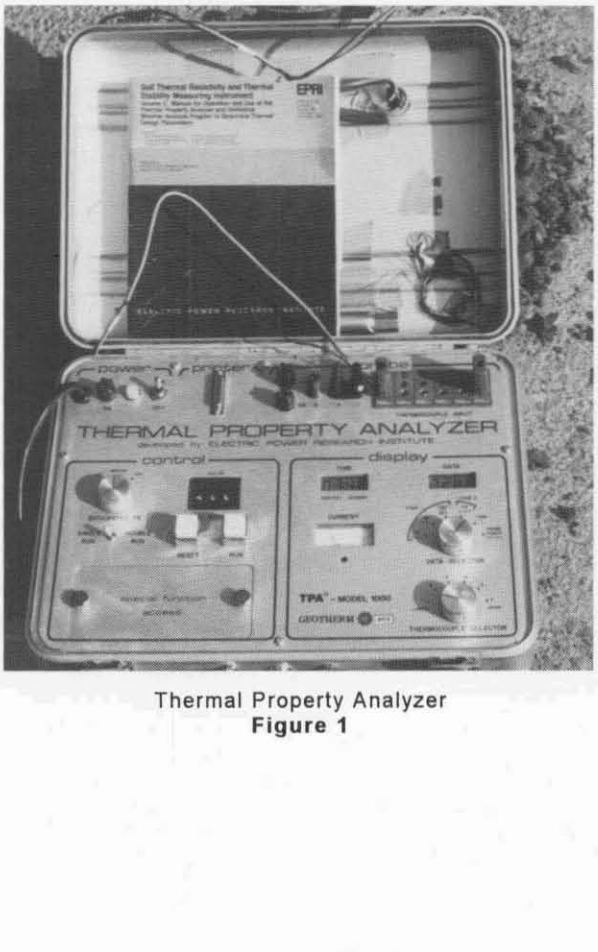
Abstract

The earth portion of the thermal circuit accounts for more than 50% of total cable system thermal losses. A cable design must be based on accurate soil thermal parameters. The Thermal Property Analyzer (TPA) can be used to make thermal surveys of the native soils. For soils having high thermal resistivity, corrective backfill and trench optimization will significantly increase ampacity while maintaining allowable operating temperatures. A well formulated Fluidized Thermal Backfill (FTB) is a cost effective means of providing the optimum thermal resistivity and thermal stability characteristics. FTB can be made from locally available aggregates, and is installed as a controlled density flowable fill using ready-mix concrete trucks.

Introduction

The classic Neher-McGrath formalism, used in the design of high voltage underground cables, gives the utmost importance to the accurate prediction of the heat transfer capability of the surrounding environment. The current carrying capacity of an underground transmission cable is strongly influenced by the earth portion of the thermal circuit, consisting of the native soil and the backfill. In general, more than 50% of the total thermal losses are attributed to this external thermal circuit, and for a given system, this portion also has by far the greatest variability with distance along the route and with time. The soil thermal resistivity may vary along a cable route by as much as five fold (ie. 40 to 200 C-cm/W) due to changes in soil composition, density, and moisture content. It is essential to measure the thermal resistivity of the native soil before the design stage.

An energized cable can, in simple terms, be treated as a heat source and the soil as the intermediate heat sink between the cable and the atmosphere. Since cable components are manufactured under controlled conditions, the quality and thermal performance are well defined. In contrast, the soil along a cable route is an unknown and quite variable. In the past the soil resistivity has often been estimated and minimal consideration has been given to the thermal quality of the backfill placed around the cables. With accurate knowledge of the thermal resistivity of the native soils and by optimizing the thermal performance of the corrective thermal backfill, significant cable ampacity and economic benefits can be realized.



Thermal Property Analyzer
Figure 1