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Real time thermal rating of HV cables

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Résumé

Les systèmes de câbles haute tension souterrains sont généralement dimensionnés pour des régimes de charges permanents ou cycliques compatibles avec une température limite admissible du conducteur. Le contrôle en tant réel de la température du câble et de son environnement suivi d'un calcul par ordinateur permet d'ajuster la charge du câble à un niveau acceptable. Le contrôle se fait à partir de mesures de températures réparties. Le system RTTR décrit a passé avec succès des essais sur le terrain et est maintenant opérationnel sur une liaison depuis un an. Les résultats des essais effectués sont présentés et comparés avec précisions.

Abstract

High voltage underground cable systems are generally designed for conditions of maximum sustained or daily cyclic current loading such that cable conductor temperature does not exceed safe working limits. Real time thermal monitoring in service of the installed cable and its environment, plus intelligent processing of the data enables optimum and safe thermal cable loadings to be achieved. Monitoring takes advantage of distributed temperature measurement and therefore ensures that load assessment is based on identified thermal constraints The RTTR system described has successfully undergone field trials and is now operational on a commercial installation for a period of 1 year. Predictions and results from this trial are shown.

INTRODUCTION

For most high voltage underground cable systems the maximum sustained or daily cyclic current loading is determined such that the insulation temperature of the cable does not exceed safe working limits. However, whilst the thermal performance of cable components can be reliably modelled the thermal parameters of the environments in which cables operate are generally much less certain. The environment external to a cable system plays a significant role in transporting heat away from cables and is therefore critical to the rating capability of cables. For these reasons, 'worst case' environmental thermal conditions are assumed in the design.

Generally the worst case thermal conditions are not realised in practice and the cable rating capability is usually higher than the theoretical design. However, under exceptional circumstances, unforeseen adverse thermal conditions in the cable environment could result in the safe loadings being lower than the theoretical design leading to thermal runaway of the cable and its accessories.

Real time thermal monitoring of the installed cable and its environment, plus intelligent processing of the data are therefore key to removing the uncertainties and enabling optimum and safe thermal cable loadings to be achieved. Today temperature monitoring of cables is becoming increasingly popular and optical fibres are being applied to most new high voltage cable systems to obtain a distributed temperature profile of the cable serving under load and no-load conditions. More recent developments have progressed the capability such that monitored temperatures and loading data can be intelligently processed in order to provide real time thermal rating (RTTR) capability [1].

CABLE AND RATINGS