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Cable temperature monitoring

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Résumé

Pour pouvoir utiliser en toute confiance des câbles dans toutes les circonstances jusqu'à la capacité de transmission pour laquelle ils ont été conçus, des systèmes de contrôle de température, DTS, sont installés sur les longueurs thermiques supposés critiques. En outre, afin de prédire la température maximum du conducteur, un système dynamique d'évaluation, DRS, est installé. L'expérience de la conception, de l'installation et de l'utilisation de ces systèmes sur deux installations de câbles sous-marins sera présentée. Les avantages et inconvénients de chaque système seront discutés.

Abstract

To be able to confidently use cables under all circumstances up to their design transmission capacity, temperature monitoring systems, DTS, are installed on the expected thermal bottle necks. In addition, to be able to predict the maximal conductor temperature a dynamic rating system, DRS, is installed.

The design, installation and service experience with these systems on two submarine cable installations will be presented. Based on the above a view on the advantages and disadvantages of such systems will be given.

Introduction

The transmission capacity of a buried cable system is dependent upon a number of parameters. The most unknown and unpredictable of these is the thermal resistance of the soil. The thermal resistivity may vary along the route; it may vary with the seasons or by changes in the environment. When the precursor to IEC 60287, Calculation of 100% transmission capacity, was prepared in the 50´s a sensible conservative approach to calculate the thermal resistivity was included, as the experience since witnesses. However, even this conservative approach may, in certain extreme circumstances, fail to take into account the possibility of drying out of the ground with the possible thermal runaway as result, f. ex. during prolonged dry periods. This may have been one of the roots of the cable failures in Auckland, N.Z.
It is a trend today towards the full exploitation of the cable rating and reduction of technical personnel with cable experience.

To counter balance the increased risks introduced by the trends above, distributed temperature-monitoring systems are introduced on new cable systems. At present these systems are advisory to system operators, but may in the future be fully integrated into the dispatching of energy.

Principles of Operation

Distributed Temperature Sensor The Raman scattering in an optical fibre is dependent on temperature and to some degree also on pressure. In this case the temperature dependence which is of interest. Short laser light pulses are sent into the fibre at precisely timed intervals, according to the Optical Time-Domain Reflectometry method. In a uniform fibre the intensity of the scattered light decays exponentially with time. By knowing the light speed in the fibre the distance can be calculated. The deviation from the exponential decay gives the temperature or other physical variation. The fibre is both the signal generator and the signal channel. The reflected light is shunted to a sensor and decoded. Both the distance and the temperature can be displayed on a monitor screen. The typical