LEAK LOCATION IN OIL PAPER CABLES

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ABSTRACT

The maintenance of oil cable networks requires using a successful oil leak localising method for the operation of the lines and the conservation of the environment.
Having looked exhaustively at the possible methods, the volatile tracer method, considered the most promising, has been tested.
The principle of the method outlined here consists in adding a volatile tracer to the line then seeking the presence of the tracer in the air at the surface of the line.
The use of this method has made it possible to accurately locate a leak from Self Contained Oil Filled cable. Experimenting is currently being extended to a High Pressure Fluid Filled (cable in pipe).

KEYWORDS

Location, leak, oil

INTRODUCTION

Both for the conservation of oil cables and the preservation of the environment, it is necessary to use efficient oil leak localising methods.
The various localising methods by hydraulic or acoustic measurements do not systematically allow accurate localising. The current dichotomic method consists in successive approaches to determine the leak area and requires several freezing points. It means shutting the system down for a long time with perturbations in the public highway and can generate high costs. In addition, it is difficult to apply these methods for High Pressure Fluid Filled cables.
A less demanding leak localising method limiting the unavailability of the line consists in adding a volatile tracer to the oil (detectable at very low contents and not toxic to the environment or third parties) then seeking the presence of the tracer by laboratory analysis of samples collected on line surface.
The use of this method has made it possible to accurately locate a leak from Self Contained Oil Filled cable. Experimenting is currently being extended to High Pressure Fluid Filled cable for which we will compare the two air analysis methods: analysis in the laboratory and analysis on the spot by a mobile mass spectrometer. The goal is to have an efficient method that can be applied to operational demands in terms of costs and unavailability.
This article describes the application in 2005 by RTE and EDF concerning Self Contained Oil Filled cable and the application undertaken in 2006 on a High Pressure Fluid Filled cable.

EVALUATION OF DIFFERENT LOCALISING METHODS

There is a variety of localising methods applicable to different fluids. It is important to measure the application level of these methods to the matter of oil leaks from underground electric cables.

Hydraulic methods

These methods consist in calculating the localising of the leak based on hydraulic characteristics measured at the two terminals of a section. The trouble-free operation of the method presupposes a consistent temperature and load drop along the line and at the accessories, not always found under real network conditions.
They are not applicable to High Pressure Fluid Filled cables because of the volumes of oil and the flow rate of the leak. In addition, the volume reduction for making measurements often results in stopping the leak.

Acoustic methods

Acoustic methods give good results on short water pipes. They consist in having two sensors on the pipe measure the sound generated by the line.
They presuppose that the line includes a material that propagates the acoustic waves properly. It is the case of the steel pipe used for High Pressure Fluid Filled cables. On the other hand, the lead in Self Contained Oil Filled cable sheaths is very bad at propagating acoustic waves. In addition, unlike water, oil tends to leak without giving off any sound.

Geophysical methods

Based on measurements made from the surface, this concerns situating areas where the soil characteristics differ because of oil, whose resistivity is much higher than that of the soil.
The method is likely to be sensitive to various electromagnetic interferences and to the presence of other structures in the soil. This method requires complete knowledge of the cable environment and calls for specialised skills.

Method by detecting insulation decomposition gas

Paper-oil insulation is affected by thermal and electric action, causing it to break down into a gas essentially made up of hydrogen and hydrocarbons. The principle of this localising method consists in detecting the presence of these gases at the surface.