End of life of underground medium voltage cables on Pacific Islands

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ABSTRACT

The failure rate of medium voltage (MV) polymeric cables installed on one of the islands of French Polynesia has increased dramatically over the last two years leading to frequent power interruptions. In order to assess the condition and determine the remaining life time of the cable network, EDT (Electricité de Tahiti) decided to check all its old HV cables on this island using non-destructive testing. A visual examination of failed cables indicates that the aluminium screen tape is completely corroded. The resistance of the screen is very high. The classic measurement techniques i.e. tan delta, insulation resistance and partial discharges were applied. They did not allow to discriminate between older and more recent cables. The best way to detect the degradation is a reflectometry and resistance measurement of the screen.

INTRODUCTION

Most of the 20 kV network on the island of Moorea was built in the early eighties. During the last two years, an important increase of the medium voltage cable failure rate was detected. In order to assess the condition and determine the remaining life time of the cable network, EDT decided to measure all the old MV cables of the impacted island by means of non-destructive testing.

DESCRIPTION OF THE CABLE SYSTEM

About 60 km of cables are installed along the coast. They are laid directly in the ground (figure 1).

Fig. 1: Direct buried cables

An important fact that we have noticed is that cables that fail for a first time due to an internal fault, no longer seem to support the exploitation voltage for more than a few days or weeks after having been repaired.
The cables are manufactured according to the French Standard NF C 33-223 [1]. The conductor is in aluminium with a cross-section of 150 mm², the main insulation is cross-linked polyethylene, a powder for longitudinal water tightness is used, the screen is an aluminium longitudinally applied metal foil and the outer sheath is in PVC (figure 2).

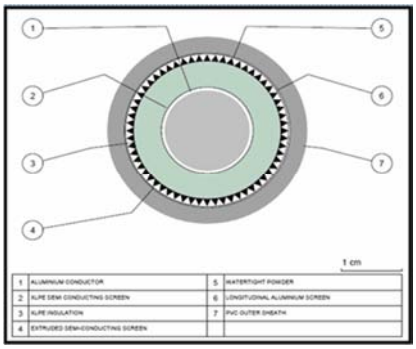

Fig. 2: Cable design

The screen of the cable is earthed at the joints. This configuration does not allow an outer sheath test.

VISUAL EXAMINATION AND LAB ANALYSES

Fig. 3: Corroded alu screen

A visual inspection of a cable after failure indicates that the cable screen is completely corroded (figure 3). This damage is still visible at several meters from the failure location.

A measurement of the screen resistance on a 1 meter long piece of cable indicates that the screen was no longer conductive. The resistance measurement by means of a high voltage insulation tester confirmed a resistance value in the range of 20 kohms.
This type of degradation is most likely due to water ingress. This assumption was verified by means of a lab analysis, which indicated the presence of impurities (figure 4).

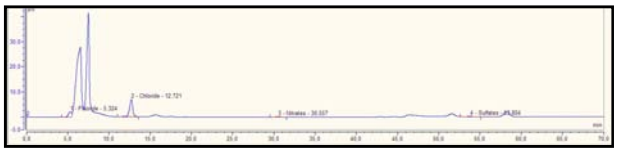

Fig. 4: Ionic chromatography