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# Electrical tests of overvoltage protection devices of H.V. cables with water penetration monitoring

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**Abstract:** High voltage cables must be protected against water. In case of third party damage a water monitoring system with integrated electrical sensors in the cable is very helpful. Because of induction and transmission of electrical voltages on the sensor in normal and fault operation, overvoltage protection devices must guarantee safe operation of the monitoring system and prevent any damage. Values for testing these overvoltage protection devices are derived from design of cables and operation conditions. Results of tested devices demonstrate safe design and operation of the monitoring system.

**Keywords:** high voltage cable, water penetration monitoring, water sensor, overvoltage protection

**Résumé:** Les câbles haute tension doivent être protégés contre l'humidité. Dans le cas d'un défaut lié à une agression externe, un système de contrôle d'humidité comprenant des capteurs intégrés dans les câbles est très utile.
En raison de l'induction et de la transmission de tension sur ces détecteurs en régime normal et en régime de surtension, des systèmes de protection doivent être installés. Les conditions d'essai de ces dispositifs de protection résultent du dimensionnement du câble et de ses conditions de fonctionnement. Des résultats d'essais confirment un dimensionnement adapté et une exploitation sûre de ces systèmes de contrôle.
**Mots clés:** Cables HT, Monitorage de la pénétration d'eau, capteur d' humidité, protection de surcharge

## 1. Introduction

The expected life time of high voltage underground cables is more than 40 years, provided the cables stay dry during this period. In order to guarantee this aim high voltage cables are fitted with a metallic sheath, protecting the cable core from liquid and even vaporised water. Although the cables are buried in ground they are not automatically safe for their life time. Local pressure on the outer sheath caused by improper bedding material and frequently third party damage caused by construction work can harm the metal sheath. Depending on the presence of water in the ground, the water can penetrate undetected into the interior of the cable. Although water blocking tapes are integrated in the cable screen the affected area will become wet. Longitudinal spread of water depends on ageing of the water blocking tape.
Only immediate detection and location of water in the cable screen, performed by means of a water penetration monitoring system, is a suitable measure for effective repair of the cable and long term avoidance of water.
This technology is now commercially available. A main component are electrical water sensors (magnified detail) that are integrated in the cables (figure 1).

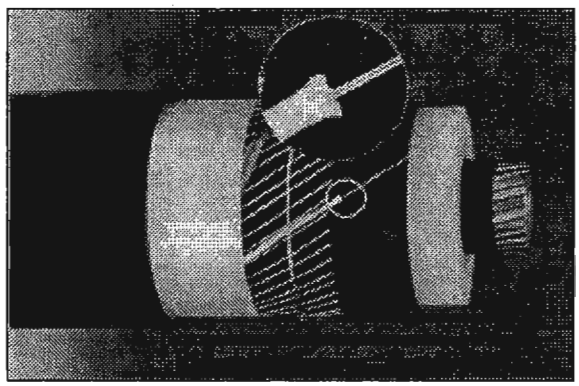

Fig.1: 110kV XLPE-cable with integrated water sensor

The water sensors consist of metal wires that are insulated with water permeable insulation and are placed close to the screen wires.
Further a measuring device (A), connected with the sensors (C), completes the monitoring system. At the end and the beginning of the cable system the sensors are connected to overvoltage protection devices (B; D), each other and to measuring leads (figure 2). The water penetration monitoring system is now available and already introduced to the market.