

Relevant accelerated corrosion tests for buried low voltage power cables

Laurent KEROMNES, Sophie LEVIGOUREUX, Sophie DELATTRE, Fabien DELEU, Philippe GIFFARD, SYCABEL, (France), laurent.keromnes@nexans.com, Slevigoureux@generalcable-fr.com, sophie.wasiuta@nexans.com, fdeleu@generalcable-fr.com, philippe.giffard@sycabel.com

Delphine GUILLOU, CETIM, (France), delphine.guillou@cetim.fr

ABSTRACT

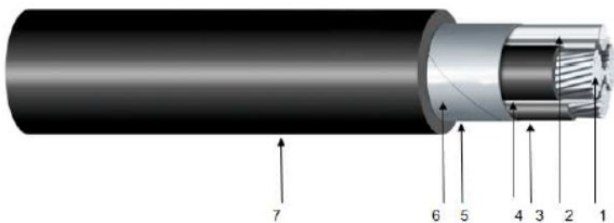
This study proposes a specific accelerated ageing procedure as a corrosion test for low voltage power cables in a salted atmosphere. This test emphasized the fast consumption of zinc and thus the weakness of the galvanized steel tape after a long period of time, leading to a possible reduction of neutral diameter. Some other materials proposed for the new design should allow a much longer lifespan of the power cable thanks to a better compatibility between screen and neutral in the cable exposed to a very stringent corrosion procedure.

KEYWORDS

ageing, corrosion, oxidation, galvanization layer, electrical contact, zinc, aluminium, neutral conductor, lead.

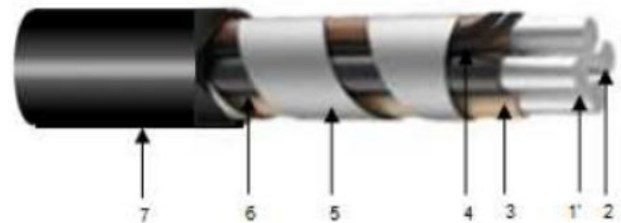
INTRODUCTION

The power cables for buried power networks in France can be split into two families. The first one with large cross-sections up to 240 mm² is called 'reseau' and is made of insulated sector-shaped stranded aluminium conductors with a neutral conductor (This neutral can be either protected by lead or can be a pure aluminium conductor). A galvanized steel screen, applied with overlapping, is in contact with this neutral conductor for electrical safety (the screen is also an armour).



The Syca A11-1 sample detailed on page 4 is an example of reseau cable with pure aluminium neutral conductor.

The second family named 'branchement' with smaller cross-sections (mainly 35 mm²) is made of cylindrical insulated aluminium conductors with a neutral conductor. Here again a galvanized steel screen is used as a screen and as an armour but this screen tape is applied with a longer pitch and there is no overlapping as shown in picture below:



In any case the neutral conductor is cylindrical. This neutral can be either protected by lead or can be a pure aluminium conductor. The Syca A8-x samples detailed on pages 2 & 3 are examples of branchement cables with lead protected neutral conductor.

The addition of lead metal (Pb) on the REACH candidate list for Authorization in June 2018 opens a new era since the procedure to get rid of Pb as a protection for neutral conductor of Low Voltage cables is now on track. It seems now urgent to compare corrosion of lead protected neutral with other new designs proposed.

These two references already implemented on the French power network have been compared in an accelerated ageing test (salted fog) to make sure we can rank performances after four weeks. These cable families have been supplied by French cable manufacturers Nexans and Prysmian Group. All samples have been prepared to partly remove (40%) protective outer sheath in some parts and then to enhance direct contact between salted fog and metallic parts. Analysis of samples have been carried out on both protected and non-protected cable pieces.

CORROSION TESTS

Tests description

The corrosion tests we introduce here are tests performed at CETIM in France on low voltage cables for French buried power networks.

Two kinds of tests have been performed.

The first test cycle was based on the VOLVO STANDARD STD 423-0014 - Accelerated corrosion test - Atmospheric corrosion. Test duration of this stage was two (2) weeks. This test is composed of several steps, for a full duration of 12 hours for each step (figure 1):

Step 2:1 – Salt fog application (NaCl 5%) for 15 min at 35°C,

Step 2:2 - Condensation phase during 1 h 45. Relative Humidity (RH) values are set between 95% and 99% at 35 °C. During this phase, the tests objects will remain wet