Condition assessment of high voltage (22 kV) Aerial Bundled Cable (ABC)

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ABSTRACT

Nexans-Olex Engineering Support Services were engaged in 2014 to conduct a condition assessment of existing 22 kV rated High Voltage Aerial Bundled Cables (HV ABC).

The task assigned to Nexans-Olex entailed an on-site visual inspection of in-service cable at a number of strategically selected locations, and laboratory visual inspection and testing of cable samples collected from the site.

Although the site inspections revealed many and varied forms of damage to the cable, there was no evidence to suggest that the cable is ageing at a rate greater than would be expected for this site, which included many instances, where the cable was installed poorly (i.e. with extensive looseness in the bundle).

However sufficient evidence was gained from laboratory sample testing to point to product quality as a likely cause of one of the cable failures.

KEYWORDS

Condition assessment; non-metallic screened; high voltage aerial bundled cable; support conductor; water trees; tree retardant XLPE; Partial Discharge; Ultimate Tensile Stress.

INTRODUCTION

An outcome of the 2009 Bushfire Royal Commission (Victoria, Australia) was a directive such that all new overhead electrical services are to be installed using insulated cable systems. Due to the size of the site, electrical reticulation is carried out at 22 kV and from a cable design perspective, this limits the solution to two types of cable:

i) metallic screened (MS) HV ABC, or

ii) non-metallic screened (NMS) HV ABC

In the case of this particular site the NMS HV ABC was adopted and progressively installed from 2010 until 2012. The images below detail the construction of this product.

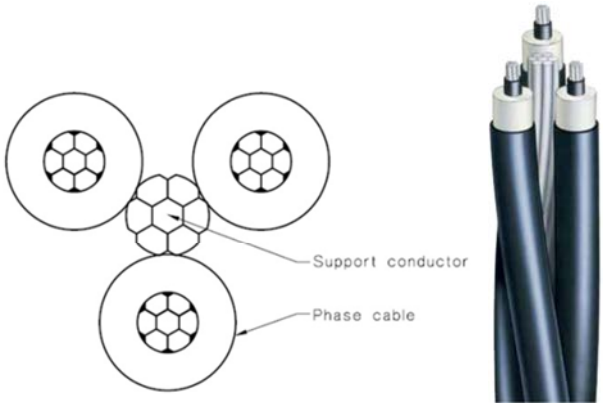

Fig. 1: High Voltage Non-Metallic Screened Aerial Bundled Cable (HV NMS ABC)

Since the NMS type of HV ABC does not have an earthed screen around each core, the support conductor plays a vital role in ensuring capacitive charging currents, and in the unlikely event of cable failure, earth fault currents are carried back to the supply voltage source. The means to conduct these currents are via the contact surface between the support conductor and the semiconductive insulation screen material.

Therefore good electrical contact between the support conductor and the insulation screen surface is critical in the long term performance of the cable and carried a strong focus in the ensuing condition assessment.

The engagement of Nexans-Olex to perform a condition assessment of the 22 kV HV ABC at the site was initiated due to recent system reliability issues and cable failures advised by our customer to be primarily due to poor or incorrect installation of the cable.

A number of visual inspections of in-service cable were conducted at a number of strategically selected locations, and laboratory visual inspection and testing of cable samples collected from the site. Both samples of failed cable and spare non-service aged were analysed.

At each inspection point the cable was visually inspected and the following key aspects of the condition were established;

1. Cable general construction appearance
2. Support conductor condition
3. Core insulation screen erosion
4. Core insulation screen surface physical anomalies (crazing, cracking etc.)
5. Core insulation screen surface chemical deposits (e.g. aluminium oxide from catenary)
6. Additional foreign material on cable
7. Any other visual finding not covered by above

After reviewing the findings, a rating on a scale of 1 to 5 (5