A.2.6

The development of an ultrasound quality monitoring process for the manufacture of enhanced reliability HV and EHV XLPE cables

SMITH C., IPEC Ltd, United Kingdom
GALLOWAY S., GREGORY B., LLOYD S., NOTMAN D., Cable Consulting International Ltd, United Kingdom

Abstract: Defects within extruded HV and EHV cable insulation are described. Larger screen defects caused failure in the factory HV acceptance test and revealed that small defects were not detected. The relationship between failure stress and service life quantified the defect sizes that shorten life. The defect dimensions were characterised into generic shapes. Stress plotting established the defect dimensions that shorten life. The development was initiated of a continuous in-line quality monitor. Ultrasound and digital signal processing technologies were combined. Successful operating experience and performance trials are summarised. This is a major advancement in quality control and reliability of EHV cables.

Keywords: Ultrasonic NDT Cable XLPE

Mots clés: Ultrasonique Câble XLPE END

1 Introduction

High cable operating stresses have been made possible by the ongoing development of a) the continuous vulcanisation equipment that extrudes and crosslinks the cable and b) the insulating and semiconducting materials [i]. The objectives are to obtain high quality in terms of consistent geometry, insulation cleanliness, conductor screen smoothness and electrical service performance. A major obstacle in the selection of EHV XLPE cable systems is the lack of significant service experience for long length circuits, particularly those laid direct in the ground and embedded on the sea bed. In the absence of significant service experience, the work of CIGRE and IEC lead to the issue of the International Standard IEC 62067, which requires that long term prequalification tests be undertaken on 100m lengths of cable together with the matching accessories installed in the configuration for the particular service application. This Standard proves the designs of cable and accessories, but cannot prove the ability of the manufacturing process and quality control systems to consistently extrude long lengths of cable without defects.

This paper describes the occurrence of serious sporadic extrusion defects and the development of an in-line quality monitor to detect them. The experience was gained from 14 factories in 12 countries. The