

**D.2.6. Détermination de la résistivité thermique interne d'un câble papier tripolaire**BRINCOURT T., LEROY J.-H., EDF/DER,
Moret/Loing, France**D.2.6. Determination of the internal thermal resistivity of a three-core insulated paper cable**BRINCOURT T., LEROY J.-H., EDF/DER,
Moret/Loing, France**RÉSUMÉ**

Pour les besoins des essais pratiqués sur des matériels de transition mixte HTA câble papier - câble synthétique, dans le cadre de la norme française C 33-001, la résistivité thermique d'un câble papier a été déterminée de trois façons différentes : par l'expérimentation, d'après les indications de la Publication CEI 287-2-1 et enfin par le logiciel de calcul FLUX 2D qui utilise une méthode par éléments finis. Les résultats obtenus par chacune de ces méthodes sont discutés.

ABSTRACT

For the purpose of tests conducted on MV transition equipment used to connect XLPE cables to paper-insulated cables, in the context of the French C33-001 standard, the thermal resistivity of a paper-insulated cable was determined in three different ways : by experimentation, in accordance with the indications in IEC publication 287-2-1, and finally using the FLUX 2D computer program which employs a finite elements technique. The results obtained using each of these methods are discussed.

1- INTRODUCTION

Since the eighties, the French underground cable network was no longer equipped with any cable other than the XLPE type conforming to the French C 33-223 standard, (based on the HN 33-S-23 specification from Electricité De France), the thermal characteristics of which are well known. Cables laid prior to this date were mainly of the paper-insulated type, the ageing of these cables gave rise to repairs which can be executed nowadays only with so-called transition accessories, which are capable of providing the link between the paper-insulated cables of various technologies and the C 33-223 XLPE-insulated cables.

Transition joints are now being developed in order to deal with this problem. Like all other accessories, these have to be subjected to the tests specified in the French C 33-001 standard.

The execution of these tests calls for prior knowledge of the thermal resistivity of the MV paper-insulated cable which is used for fitting the accessory.

This is the context in which we now describe the three different methods employed to determine thermal resistivity.

2 - DESCRIPTION OF THE PROBLEM

In the context of the tests, which were carried out at the Cable and Capacitor Testing Laboratory of EDF at Les Renardières, on the MV connection equipment, the standards

require that the conductor, of the cable used, be raised to a particular temperature.

During the tests, the temperature of a cable conductor can be taken by direct measurement unless the cable is live. It is also possible to use a "thermal image" of the test circuit to measure the temperature of a voltage-free cable.

A third option consists of determining the thermal resistivity of the cable beforehand, so that it then becomes possible, during the subsequent tests, to calculate the temperature of the cable conductor from simultaneous knowledge of the current and of the temperature of the outer sheath of the cable.

Among the many and varied methods for discovering the thermal resistivity of a cable, three have been used to determine that of the three-core metal tape screened paper-insulated cable used in the tests on an MV transition joint. These are an experimental method, calculation in accordance with the recommendations of IEC publication No 287-2-1 [1], and finally using the FLUX 2D computer program [2]. These three methods are presented and examined below.

3 - DESCRIPTION OF THE CABLE USED

The cable used for the tests is a solid type paper-insulated three-core metal tape screened with sector-shaped conductors. The following are its nominal characteristics :

- voltage : 12/20(24 kV)
- conductors : aluminium wire, cross-section 150 mm²
- maximum working temperature : 65°C