A.1.3. Essais de préqualification des systèmes de câbles 400 kV à isolation polyéthylène réticulé

HELLING K., HENNINGSEN CG.,
POLSTER K., BEWAG, Berlin, Allemagne
BOSOTTI O., MOSCA W., TELLARINI,
CESI, Milan, Italie

Résumé
L'utilisation de câbles haute tension est de nos jours conseillée et parfois requise lorsqu'on désire éviter l'impact visuel des lignes aériennes, surtout quand le système électrique traverse des endroits densément peuplés.
L'unification de l'ancienne RDA à la République Fédérale d'Allemagne rend cet aspect très actuel en particulier pour la ville de Berlin, où la demande croissante d'énergie exige l'application de techniques d'avant-garde.
L'article décrit les activités effectuées par BEWAG, la Compagnie Electrique de Berlin, pour étudier la possibilité de réaliser une connexion importante en utilisant des câbles 400 kV à isolation en XLPE.

A.1.3. Prequalification test of 400 kV XLPE cable systems

HELLING K., HENNINGSEN CG.,
POLSTER K., BEWAG, Berlin, Germany
BOSOTTI O., MOSCA W., TELLARINI, CESI,
Milan, Italy

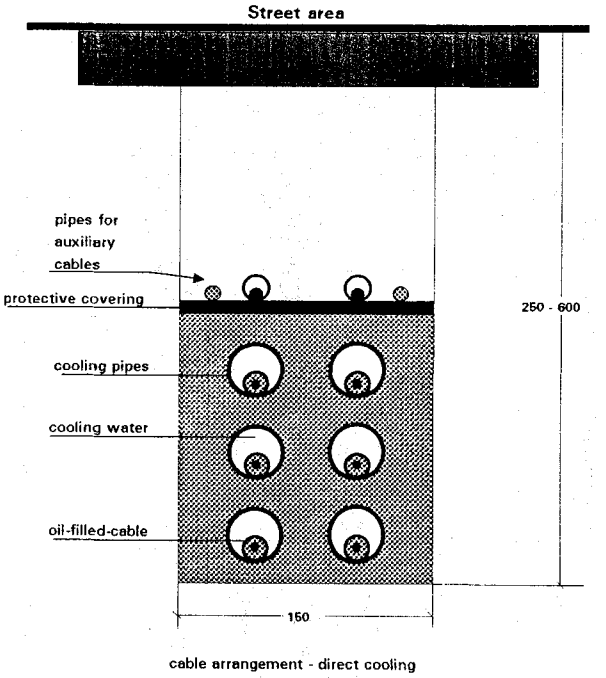
Abstract
The use of high voltage cables is to-day recommended and sometimes mandatory in order to avoid visual contamination especially when the power system is crossing areas having high density of population. The reunion of the former GDR to German Federal Republic has stimulated the interest in this settlement especially for the town of Berlin, where the increase of energy demand requires the use of innovative solutions.
The paper reports the activities and the procedures that BEWAG, the electrical utility of Berlin, has performed in order to investigate the feasibility of setting up an urban bulk power connection using 400 kV XLPE cables.

1 Introduction

BEWAG is interested in building large electrical connections for the transport of energy through the town, putting in service 400 kV XLPE cables. More precisely the project foresee a first connection having a length of 7,5 km connecting the power systems of east and west part of Berlin, formerly completely isolated, in order to optimize the exploitation of both power systems.
The use of XLPE cables in respect to the traditional oil filled cables is attractive because of lower installation cost, lower dielectric losses and thermal resistance and above all because this type of cable is considered maintenance free once has been put into operation. The disadvantage of this solution is the lack of experience on the life and on the reliability of these cables when used so extensively.
In order to overcome the risk of failure and to obtain reliable data on the good performance of the cables and accessories, BEWAG started on September 1993 a long life test program, in order to prequalify cables, joints and sealing ends. Six different european manufacturers are involved in the project. Aim of the test is to check the industrial availability of the cables and accessories on the market, their behaviour in tests simulating about 40 years of operation, to check the amount of overload with natural cooling, the influence of different laying conditions and of a special type of embedding material.
This paper is reporting both the test results after one year of tests and the testing techniques used for performing them together with the measuring systems used for a reliable and in real time interpretation of most important quantities. Furthermore the comparison between the temperature measurements obtained by thermocouples installed on the metallic sheath of the cable and those obtained by fibre optic systems, where the fibre is situated in the sheath area, is reported.
Finally the conclusion about the possibility of using this type of cable at the present stage of the technology is reported.

2 Extension of the 400 kV diagonal connection

In the year 1952 political division of Berlin led to "islanding", to isolated operation in a separate network. In the following years, an extensive 110-kV-net developed as a transport net between power plants and for distribution. Due to increasing load and transport power, the first 400-kV-cable line between power plant Reuter and substation Mitte was put into operation in 1978 in order to control short circuit power [1]. This double cable system consists of a single-conductor low-pressure oil-filled cable with 1200mm^2 copper conductor cross section. The cables were laid in cooling tubes. The tubes are filled with water for direct sheath cooling. The water is pumped through a closed circuit and is cooled down in a cooling station.The installation insures a transmission power of 1120 MVA for each cable system. Because of its remarkably good operation experience, BEWAG decided to use the well-proved conception (single-conductor oil-filled cable with direct sheath cooling) for the second step (fig. 1), model of Berlin cable route.



cable arrangement - direct cooling
- LPOF cables -

Figure 1 : 400 kV cable installations

The second 400-kV-cable installation in Berlin is part of the first powerful link to the European power interconnection (UCPTE-net). Starting from a switching station close to Helmstedt, an