REMEDIAL ACTION AND FURTHER QUALITY ASSURING MEASURES AFTER A FAILURE IN A 400 KV GIS CABLE TERMINATION

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ABSTRACT

After an electrical failure in a 400 kV XLPE cable termination installed into an SF_6 gas insulated switchgear extensive investigations and necessary remedial actions were to be carried out. Cleaning after the fire hazard and redesign of GIS-enclosures heavily affected the duration of the repair works. The operator also decided to replace all conventional fluid-filled sealing ends of same make by use of newer dry-type cable terminations available in the meantime. The total duration of the non-availability of the cable system was approx. 10 months.

KEYWORDS

EHV XLPE Cables, GIS Termination, Plug-in Termination, Failure, Remedial Measures

INTRODUCTION

400 kV XLPE power cables were introduced in the European market in 1996 and first longer cable systems including joints were installed in 1997 and 1998. In the meantime several 400 kV XLPE cable systems have been installed in the European transmission network with single circuit lengths up to 20 km. Prior to delivery and installation long term pre-qualification testing of the cable system components were carried out in accordance with CIGRE recommendations or IEC publication 62067.

The electrical safety and the reliability of the cables and accessories installed in the transmission network play an immense important role for the operating utilities. Operational experience and failure statistics are therefore carefully observed by the transmission system operators.

This paper describes the necessary remedial actions in a 400 kV substation after a failure in an XLPE cable termination installed into an SF_6 gas insulated switchgear (GIS). As the failure caused a fire also damaging the GIS and the surrounding civil construction extensive measures were necessary.

BERLIN'S 400 KV DIAGONAL LINK

In the seventies of the last century the power demand in the western centre of Berlin was huge so that a 400 kV oil-filled cable link (laid in pipes and water cooled) was installed. After the reunification of the Western and the Eastern part of Germany at short term notice the isolated 400 kV grid of West Berlin was synchronized with the West German grid in 1994 by again providing a safe and secure connection of oil-filled cable and overhead line systems within the city.

The increasing power demand of the centre of unified Berlin requested additional supply lines. After careful economic, technical and environmental investigations the power supply solution was found in a new 400 kV cable connection from the eastern edge of the city connected to the existing 400 cable system in the western part of Berlin. By doing so the Berlin Diagonal Transmission Link was created (Fig. 1).

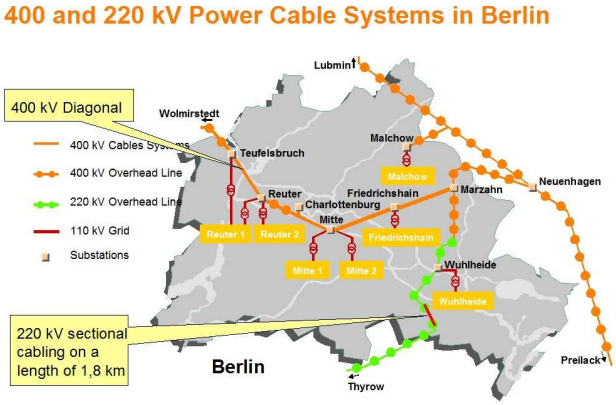

Fig.1: Berlin's 400 kV Diagonal Link

Again the option was to make reuse of the well proven 400 kV oil-filled cable technology or to dare the next technology step in extending the well known XLPE insulating technology from the 110 to the 400 kV voltage level.

The former utility Bewag decided to promote the XLPE technology and implemented four new developed XLPE 400 kV cable systems (laid in an underground tunnel and air ventilated) with three different manufactures in order to spread the technical risk of outage due to failed design, manufacturing or erection. The 400 kV XLPE cable systems were commissioned in 1998 and 2000 [1]. An overview of the different sections of the 400 kV diagonal link is shown in Fig. 2.

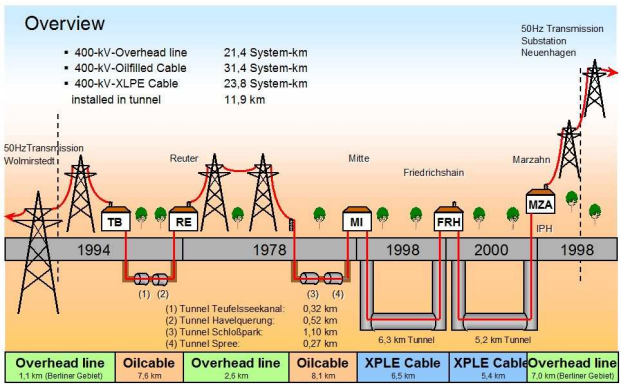

Fig. 2: Overview of 400 kV Diagonal Link

At that time no international standard for XLPE cable systems existed. That is why Bewag set up their own standard in cooperation with qualified manufactures and