

DEVELOPMENT, QUALIFICATION AND EXPERIENCES WITH 500 KV XLPE CABLE SYSTEMS

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ABSTRACT

10 years after the first installation of a 550kV XLPE cable system in China, an advanced system has been developed and qualified. The XLPE cable system consists of a cable with a conductor cross section of 2500mm², one piece silicone rubber joint, plug-in GIS termination, plug-in dry type outdoor termination and compound filled outdoor termination with composite insulator.

Both, the type test and pre-qualification test have been carried out according the IEC62067 requirements. Additionally, tests with increased AC and impulse levels has been carried out.

The new cable system has been installed successfully at projects in Sudan, China, Columbia, Russia and other locations.

These experiences demonstrate that 550kV XLPE cable systems are state-of-the-art technology.

KEYWORDS

500 kV XLPE cable system, one piece silicone rubber joint, PD monitoring system, plug-in compact sealing end, PQ test

INTRODUCTION

10 years after the first installation of a 550 kV XLPE cable system in China in the year 2000 [1], an advanced system has been developed and qualified. The above mentioned first 550kV systems were primarily designed for short cable connections inside power plants, but with increasing need for longer cable systems an advanced system became necessary for higher transmission loads and longer cable length for the 500kV voltage level as described in [2].

The new EHV cable system shows an XLPE isolated cable with a conductor cross section of 2500mm² and prefabricated accessories of the newest generation: One piece silicone rubber joints, compact SF₆-plug-in sealing ends, plug-in dry type outdoor sealing ends and compound-filled outdoor sealing ends with composite insulators.

The main parameters of the pre-qualified cable system are:

- voltage level U_m : 550 kV
- conductor cross section (copper / segmental): 2500 mm²
- XLPE insulation thickness of cable: 27 mm

The type test has been carried out according the IEC 62067 [5] requirements for the $U_{max} = 550$ kV level. The one year prequalification (PQ) test covers different

installation conditions of the cable (buried installation, pipe installation and clamped installation). Additional PD tests has been carried out during the full test duration and high-level impulse tests with 1675 kV BIL demonstrate the dielectric performance of the cable. All qualification tests have been carried out at the independent testing institute IPH / CESI in Berlin (Germany).

Further tests with a compact plug-in sealing end installed inside the oil immersed transformer cable connection enclosure of a 500 kV transformer were carried out in 2010 in a factory installation Powertech Transformers (Pty) Ltd Pretoria (South Africa). Additional dielectric tests with increased testing parameters (AC and impulse) have been carried out with GIS-terminations at the IEH testing institute in Karlsruhe (Germany)

The new cable system has been installed successfully and went into operation around the world, in North Africa, China, Colombia, Russia (at voltage level 550 kV) and other locations demonstrating the progress and experiences in this voltage level under different installation conditions.

These experiences show that 500 kV XLPE cable systems are state-of-the-art XLPE cable technology.

ADVANCED 550 KV XLPE SYSTEM

The qualified XLPE cable show a six segmental copper conductor with a cross section of 2500 mm². The EHV-grade XLPE insulation material shows a thickness of 27mm and was applied by triplex extrusion process together with both semicon layers in a horizontal extrusion line. Figure 1 shows details of the cable design:

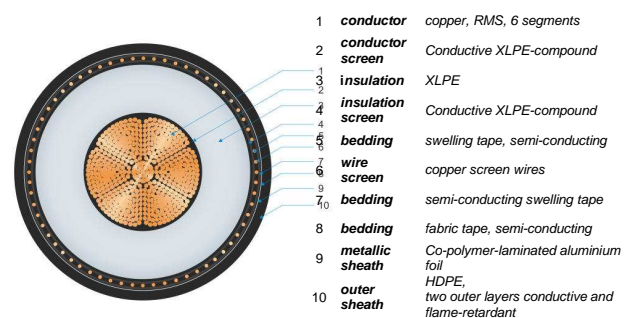


Fig. 1: Cable design for type and PQ test

The copper wire screen design is longitudinally watertight and the laminated aluminium foil design delivers a save radial water protection to the cable under all installation conditions. A strong HDPE outer jacket, which is fix bonded to the aluminium foil, provides the mechanical protection of the cable.

The well known compact sealing end of type EHSVS 550 (type F) was taken as SF₆ termination. The outside