

The application of PD monitored AC voltage test in Beijing 500kV power cable lines acceptance

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The paper introduces the acceptance test with $1.7 U_0$ in Beijing 500kV 6.7 km-length power cable lines. This was the first time in China to apply 493kV ($1.7 U_0$) test voltage in 500kV long distance cable circuit. Four AC resonant HV systems were used with two in series and then two in parallel (Test equipments arrangement see as below), and reach test capability of output voltage 520kV, output current 166 A.



The tests were performed in June 2014, with test voltage 493kV, test current up to 137 A, test frequency 35.4 Hz and test power 67.5 MVA. In order to combine the distributed PD measurement, test voltage tests were performed at the sequence of $0.5 U_0$ for 5 minutes, at the sequence of $1.0 U_0$ for 10 minutes, at the sequence of $1.4 U_0$ for 10 minutes, and at the sequence of $1.7 U_0$ for 60 minutes. All three phases of the cable line passed the $1.7 U_0$ 60 minutes voltage test. This test is considered influential to future HV cable acceptance test in China.

A distributed PD monitored AC voltage test method is also introduced in this paper. Each phase of the cable line consist of 11 joints, 1 GIS termination and 1 outdoor termination. Therefore, 13 PDD units were installed and connected by fiber optical cables in a way of hand in hand. All PDD measurement signals were synchronized and measured by a computer located in the HV resonant system control room.

Function check of the PD Monitoring system with 13 channels was performed by injecting 10 nC PD calibration signal from each termination. The attenuated signal was measured by each PDD installed on each joints along the cable line. Signal attenuation rate at 4 MHz should be no less than 93% per km. This regulation was used for the performance check of the distributed PD monitoring system. The technical requirements and on site PD system function check methods were introduced to find out that with HFCT methods, for PD signal injected from the outdoor sealing end, the PD signal amplitude was higher measuring from in joint number 1 than from the outdoor sealing end, but the signal frequency band is higher measuring from sealing end than from joint number 1.

PD measurement criteria with no recognizable PD pattern were used for the first time in HV cable acceptance test in China. The importance of PD activity in quantity was minimized. PD signals generated by the HV connections were measured by the PD monitoring system, and no PD activity from cable and cable accessories was recognized in the test.