The Application of Partial Discharge Monitored AC Voltage Acceptance Test in Beijing 500 kV Power Cable Lines

JianQiang **AN**, Zhen **LI**, Yi **DONG**, ZhanWei **ZHU**, ChangQing **SUN;** Beijing Electric Power Company, China,
ChuanQiang **XIAO;** SINDIA Instruments Co., Ltd., China, xiao@sindia.cn

ABSTRACT

The paper introduces the acceptance test with 1.7 U_0 in Beijing 500kV 6.7km-length power cable lines. A distributed Partial Discharge (PD) monitored AC voltage test method was used for this test. Performance check of the PD Monitoring system with 13 channels was completed by injecting 10nC PD calibration signal from each cable end termination. The attenuated behaviour measured by each Partial Discharge Detector (PDD) installed on each joint along the cable line demonstrated the performance of each PDD unit and also the total PD measurement system. This was the first time that PD measurement criteria with no recognizable PD pattern were used in HV cable acceptance test in China.

KEYWORDS

Acceptance test, Distributed PD Monitoring；PD pattern recognition；Performance check；

INTRODUCTION

Beijing 500kV power cable line was a double circuit line with 6.7km cable length. One circuit was made with local manufactured cable and accessories; the other one was imported from France. Cable conductor cross section was 2,500mm^2. Cable line was installed under cable tunnel conditions as shown in figure 1. Four cross bonding sections were used for grounding system. Each phase had 11 cable joints, 1 GWAS termination and 1 outdoor termination. The installation was finished in May 2014. Acceptance tests were performed in June 2014.

Figure 1: Beijing 500kV Cable tunnel

PD monitored AC voltage test was accepted as the test method. The local cable circuit passed 1.7 U_0 1 hour test with no recognizable partial discharge, while the imported cable circuit passed 1.4 U_0 1 hour test with no recognizable partial discharge. Beijing 500kV cable line became operational in June 2014.

This was the first time that PD monitored AC voltage test method was used for 500kV cable acceptance test in China. In addition, this was the first time that 4 test systems made by HIGHVOLT Germany, in parallel and series operation modes (figure 2), and 13 channel distributed PD monitoring system made by SINDIA were used in China. Finally, this was the first time to apply 493kV test voltage for 1 hour on large length transmission power cables. This test had influenced the test standards of extra HV cable acceptance tests in China.

Figure 2: Four test systems operated in parallel and series mode

PD monitored AC voltage test had been used on 110kV and 220kV power cable tests in China since 2009. SINDIA had performed such test in Shanghai for an 18.9km 220kV power cable line in 2010. Prior to this test, there was no existing standard in China for on-site PD measurement or criteria for PD evaluation for cable lines. Beijing electric power company and SINDIA have set clear PD criteria for 500kV cable test in this Acceptance Test: no recognizable PD pattern should exist under 1.7 U_0 1 hour test - a Zero acceptable criteria for PD under test voltage. Therefore this test has effectively established explicit criteria for extra high voltage cable acceptance test in China.

AC VOLTAGE TEST

Four resonant test systems were used for Beijing 500kV cable line acceptance test, and each test system had output voltage 260kV and output current 83A. This project reached output voltage of 520kV and output current of 166A with 4 systems in combination conditions, and achieved the test requirement of this project with test voltage 493kV and test current 140A as shown in figure 3.

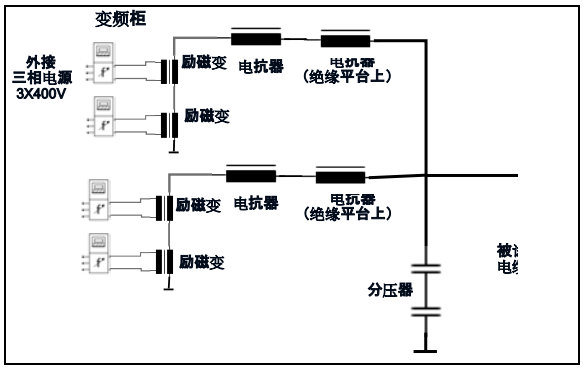

Figure 3: Test principle diagram