A NEW METHOD OF ADOPTING DISTRIBUTED PD MEASUREMENT IN FREQUENCY CONVERSION AND RESONANCE VOLTAGE RESISTANCE TEST OF HV CABLE

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ABSTRACT

This paper introduces a modified completion test of 220kV cable line, and explains the new method of adopting distributed PD measurement in frequency conversion and resonance voltage resistance test of high voltage cable. A joint defect was found successfully so that failure of a 220kV cable was avoided, and then expounds the significance of adopting two combined test methods in completion test,which can discover slight fault that can't be found by conventional voltage resistance test, and it provides an important referrence for improving completion test method of high voltage cable.

KEYWORDS

HV cable, completion test, frequency conversion series resonance, distributed partial discharge measurement

0 INTRODUCTION

In accordance with Chinese National Standard and IEC standard, completion test of HV cable should complete withstand voltage test within one hour, however, some tiny defects cannot be discovered in the process of withstand voltage test, these defects then develop into final failure gradually after cable operation. For instance, there are cases for failure emerging from cable operation after withstand voltage test in Beijing, Guangzhou, Sichuan and other provinces. Practices show, partial discharge test is one of valid means to inspect XLPE cable insulation defects[1-3]. It'll be more effective of association of using withstand voltage test and distributed partial discharge measurement to timely detect tiny defects existed in cable lines.

7.93km of 220kV cable line (220kV Chongming networking project, Zhouhai station ~Changxing station) is laid inside the urban tunnel. In order to ensure the safety of public tunnel during cable operation, partial discharge measurements are made simultaneously to 11 set of joints during one hour's frequency conversion series resonance test, namely creating local(11 joints) online partial discharge inspecting system. One joint defect has been successfully detected through this test method, avoided 220kV cable failure.

1 GENERAL SITUATION OF TESTED CABLE LINES

Cable type: 127/220kV-800mm^2/1000mm^2 (XLPE cable);
Among them:

Capacitance of 800 mm2 cable is about:0.155 $\mu F / km$;

Capacitance of 1000 mm2 cable is about:0.1749 $\mu F / km$

Length:18.63km, divided into 3 segments (see figure 1).

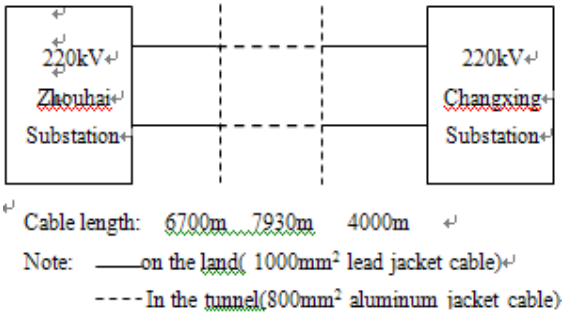

Fig.1: picture of tested cable lines

No. 13~23 joints are inside the tunnel(No.12 and 24 joints are located in the tunnel shaft), namely there are 11 insulation joints for each phase of cable inside the tunnel. Tested cable lines are seen in the figure 1.

2 TEST SCHEME

2.1 frequency conversion series resonance test

According to IEC 62067, the content of AC test after 220kV cross-linked cable installation is that, voltage sine waveform, 20~300Hz test frequency, one hour withstand voltage, 1.4 U0 or 1.7 U0for test voltage.

WRV83/260T series resonance test system in Germany company is chosen for withstand voltage test(single inductance is 16.2H), seen in Figure 2. Test performances are calculated respectively according to above two test voltages.

1) Test voltage 180kV (1.4 U_0)
Inductance: 16.2 H (single)
Test current: 78.8A
Load capacitance: 3102nF
Test frequency: 22.45 Hz
Test power: 14.18MVA
Q value estimation: 100
Transformation ratio of excitation transformer: 4.82
Modulation：73.3%
Power supply of transformer：189kVA

2) Test voltage 216kV (1.7 U_0)
Inductance: 8.1 H (double)
Test current: 133.7A
Load capacitance: 3102nF
Test frequency: 31.75 Hz
Test power: 28.87MVA
Q value estimation: 100
Transformation ratio of excitation transformer: 4.82
Modulation：88.0%
Power supply of transformer：385kVA