SELECTION RESEARCH OF SHEATH VOLTAGE LIMITER OF HIGH-VOLTAGE CABLE

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ABSTRACT

In recent years，while the High Voltage cable of 110 kV and above is increasingly applied, the number of cable faults goes up year by year in JiangSu province, China. Some design and construction departments chose inaccurate parameters for grounding protection device of high-voltage cable and it is random for them to select equipment type. Especially the grounding devices, which are used to protect the cable operating safely lack national standards or local norms. It is on account of absence of unity criterion. The unusual conditions of protector failure and damage happened over frequently.

This paper has discussed the influence on cable outer sheath and protector due to the different connection mode of cable protector. It studies the relationship between the major parameters and cable protection and the major parameters include the rate voltage of cable protector, the initial action voltage (reference voltage), maximum continuous operating voltage, the power frequency tolerance voltage, the flow capacity, residual voltage, voltage ratio, charged rate, protection ratio and so on. It proposed an optimized design scheme about the cable security layer over-voltage protector, and validates it through the engineering practice. Field application shows that the cable the parameter design of accessories and the scheme of connection mode can meet the single-core power cable to withstand the over-voltage in the cable mental sheath. Hence, it reduces the single-core cable failure effectively.

KEYWORDS

Cable layer protector; mode of connection; protector parameters; optimization design, SVL (Sheath Voltage Limiter)

1. INTRODUCTION

In recent years，with the High Voltage cable of 110 kV and above is increasingly applied, the number of cable faults goes up year by year in Jiangsu province. Some design and construction department chose inaccurate parameters for grounding protection device of high-voltage cable (SVL) and it is random for them to select equipment type. Especially the grounding devices which are used to protect the cable function safely. It is on account of absence of unity criterion. The unusual conditions of protector failure and damage happened over frequently.

It is necessary to research the influence on cable outer sheath and protector due to the different connection mode of cable protector. It studies the relationship between the major parameters and cable protection to regulate the SVL design and the major parameters include the rate voltage of cable protector, the initial action voltage (reference voltage), maximum continuous operating voltage, the power frequency tolerance voltage, the flow capacity, residual voltage, voltage ratio, charged rate, protection ratio and so on.

2. THE CHOICE OF SVL CONNECTION MODE

There is a SVL connection of 220KV line in WuXi in JiangSu province. Let us calculate the inductive voltage on cable metal layer. Its parameters as follows:
The normal working current of cable conductor: I=680A
Short circuit current: I_F=50kA
Earth resistivity: ρ =250 Ω·m
Frequency: f =50 Hz
Depth of the equivalent current: De=660$\sqrt{\rho / f}$
=660$\sqrt{250/50}$=1475.8 m
Cable distance: S=0.25m
Cable security layer length: L=0.3km
Cable metal layer radius: r_s=0.064m
Grounding resistance: R_1=R_2=R'=0.4 Ω
Earth resistance: R_g =R_g'l, R_g'=π2f×10^{-3} Ω/km

2.1 Cable interconnected grounding SVL "Y" mode

As shown in figure 1 is a cable metal security layer interconnected grounding SVL"Y" mode. In this mode, SVL just connect metal sheathes between different phases, they need not connect between metal sheath and earth. As long as the both sides of metal sheath which are interrupted by Insulation Joint can make SVL connected with earth under impulse voltage, the impulse current from cable conductor will flow through metal sheath definitely. So that the metal security layer of potential can decrease greatly.

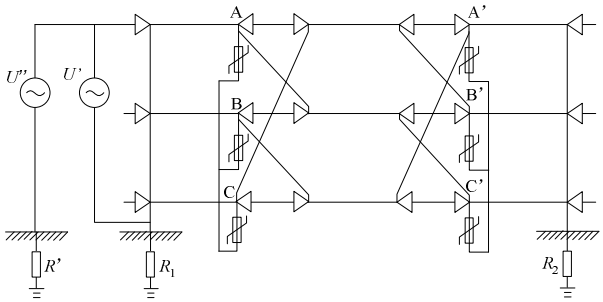

Figure 1 Cable interconnected grounding SVL "Y" mode

Self-inductor reactance of Cable metal layer:

$$X_S = \mathrm{j}2\times10^{-4}\omega\cdot l\ln\frac{De}{r_S} \qquad [1]$$

$$X_S = \mathrm{j}2\times10^{-4}\times2\pi\times50\times0.3\ln\frac{1475.8}{0.064} = \mathrm{j}0.1894\Omega;$$