

Improved design for anti-scattering in fault condition of outdoor termination

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ABSTRACT

As EHV cable system become close to our environment, the safety has arisen to be the important issue to be considered. Because an outdoor termination is particularly exposed to the outside, it has greater possibility of having more severe problem than other types of terminations and joints in case breakdown occurs. At the time of breakdown or when the voltage surges, the current is short-circuited, which inevitably causes internal arc and heavy pressure inside the termination. When there is high pressure inside the termination and causes its particles to scatter everywhere, it may result secondary damages to other terminations as well as humans. Most of the time, outdoor terminations are not far away from the downtown where many people lives. So, damaged outdoor terminations can become explosives and mechanically dangerous.

This issue has already been arisen to be the main issue for many countries, and some of the Europe electric power companies are trying to prevent secondary damage.

KEYWORDS

anti-scattering, outdoor termination, internal arc, short-circuit current

INTRODUCTION

We developed an outdoor termination to prevent a secondary damage by the short-circuit current. We had experienced several failures. But it made us to grow up. Finally, the new design was born. We passed internal arc test on between 150kV and 220kV outdoor terminations in CESI Italy 2012. This paper shows the standard for internal arc test, our outdoor termination designs and process of our test pass.

RELATED STANDARD

There is a special clause in TERNA(Italy electricity transmission system operator)'s standard UX LK208. It shows that an outdoor termination having a composite insulator should conduct an internal arc test. Test must be performed as per standard HD632 S2:2008 Part 2 paragraph 6.1.7 using following parameters.

Table 1: Parameters

Rated voltage	Short circuit current
87 / 150 kV	31.5 kA / 0.5 s
127 / 220 kV	50 kA / 0.5 s

The test is carried out on the termination installed as in service. An internal fault is initiated by drilling a hole in the main insulation of the cable within the termination. A 1.5 mm² copper wire shall connect the conductor to the metallic sheath or to a metallic piece itself connected to

the sheath. In the case of a termination having a stress cone, the fault is initiated at the top of the stress cone.

On completion of the test, no solid debris shall be observed at a distance of at least 3m from the termination.

FAILURE EXPERIENCE

The hardest part of preparing in simulating the real test in the factory was to apply the instantaneous pressure. We were able to give the pressure through hydraulic or oil with test facility we holding. And it can make high pressure level(over 3~4 Mpa). But it was not an instantaneous force due to the limitation of the medium. In July 2011, we performed internal arc test in CESI Italy. Our composite insulator was reinforced for withstand inner pressure. The experiment was performed as follows.

The apparatus under test consisted of a 150 kV composite oil cable termination and 20meters of cable sample. The cable termination was assembled on a frame representative of the actual installation in service.

The apparatus was supplied by cable core and the return circuit by the screen.



Fig. 1: Current supply

The experiment was conducted in the following circumstances.



Fig. 2: Front view