Replacement of porcelain bushings with polymeric bushings in HV underground XLPE cable termination box

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ABSTRACT

. As the underground power system increases, we have endeavored much to secure the high technology of the grid operation and to prevent the cable failure in O&M. In the past, we applied the porcelain insulators type to XLPE termination box. Now, however, we have installed polymeric insulators type termination box since in 2004. This change was made mainly due to the high possibility of other facilities or lives damage from scattered porcelain by explosion (Secondary damages happened about 5 times)

KEYWORDS

Porcelain insulator, polymeric insulator, replacement insulator, termination box.

INTRODUCTION

Korea Electric Power Corporation, the KEPCO, is a Korea's state-owned enterprise, which handles the biggest portion of domestic power supply, boasting 127 years' history. As a result of rapid industrialization and urbanization, underground installation of power facilities has also increased so fast in Korea that the weight of nationwide underground installation is 11.1% of total installation as of the March of 2015.

Currently a total 2,556 sets of EBA are in operation. Of them, 1,578 sets use porcelain insulator, so there are worries that in the event of any failure, scattered porcelain may cause damages to adjacent facilities or casualties.

In fact, since 1993, 8 failures of EBA have occurred and 5 secondary facility damages due to porcelain insulator have been reported.

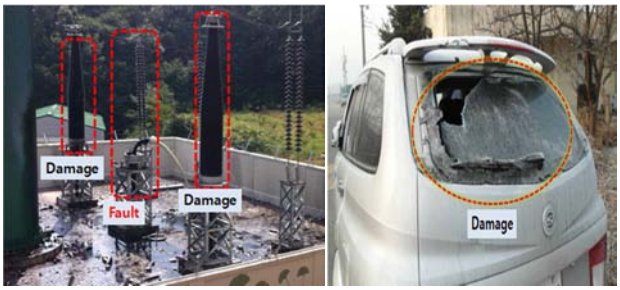

Fig. 1: The damages of facilities

Thus, for safe operation of facilities, KEPCO proceeds with the replacement of porcelain insulator of EBA used for 154kV XLPE cable with polymer insulator which does not induce secondary damages.

REVIEW OF THE REPPACEMENT OF PORCELIN INSULATOR

If the whole terminal boxes which were installed with porcelain insulator are replaced with new EBA-polymer insulator- it will result in an excessive increase in cost and construction period.

Thus, to minimize the cost and construction period, KEPCO made a decision to develop the polymer insulator with the same specifications as those of the installed porcelain insulators and replace the insulators only without replacing accessories (by reusing the accessories for porcelain insulator).

As a result, cost and construction period could be saved by about 70% and more than 57% respectively. **Table 1** below show the results of a comparison of two construction plans.

Section	Plan 1	Plan 2
Plan	Replacing the whole terminal box with porcelain insulator	Replacing porcelain insulator with polymer insulator with the same specs as those of porcelain insulator
Period	**7days/3-phase** Removal: 2 days Installation: 5 days	**3 days/3-phase** Removal: 1.5 days Installation: 1.5days
Cost	About $33,000/Phase	About $11,000/Phase
Advantages	Immediate replacement without developing a new product	Minimized period and cost for replacement
Dis-Advantages	Excessive cost and period	6 months for the development of product

Table. 1 : Comparison of Plans

DEVELOPMENT OF POLYMER INSULATOR FOR THE REAPLCEMENT

When the current porcelain insulators were compared with the existing polymer insulators in shape and specifications, the creeping distance was the same, but with respect to the total length, in case of the general type porcelain insulator was about 13mm longer than polymer insulator and in case of anti-pollution type the polymer insulator was 13 mm longer and porcelain. In addition, the shape and inner diameter of support metal for insulator were