

Design of Insulator String Assembly
for High Voltage Transmission Lines of 735 kV and Above

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There have been operated many bulk-power transmission systems of 735kV and above in the world. Design of insulator string assembly is very important to ensure high reliability of the systems from the viewpoint of keeping high voltage insulation capability and mechanical strength for heavy conductor loads. Typical examples of the existing insulator string design are presented, showing insulator type, string configuration, number of insulators per string, shielding ring design, etc.

Design features of the string assembly depend on transmission line conditions and environmental conditions. Study of the design features is made on typical transmission lines of 735kV and above in the world.

One of the design features of 1000kV transmission line in Japan is a quadruple tension string assembly to sustain 8-bundle heavy conductors, which is equipped with specially designed multiple shielding rings. Another unique feature is insulation design for snow covered insulators. A lot of tests on contamination withstand voltage and switching impulse withstand voltage of the insulators covered by snow were carried out. From these investigation results, the number of the insulators was determined. For example, 46 units of 530kN cap & pin insulators in the quadruple tension string assembly in heavy snowfall area are used.

In the case of the 800kV transmission line in India, higher strength insulators of 300kN and 400kN are adopted to design the single vee string and the double tension string assemblies to make the insulator string assembly compact. Otherwise, it would have been necessary to use the double vee and the quadruple tension string assemblies.

The 800kV transmission lines in Venezuela passing through in a heavy contamination area have been designed and constructed after two years contamination survey. Measurement results were statistically analyzed and the design contamination degree was determined as $0.04\text{mg}/\text{cm}^2$ and $0.25\text{mg}/\text{cm}^2$ for light and heavy contamination areas, respectively. 210kN fog type insulators are selected for the suspension string assembly in such a heavy contamination area.

The 800kV transmission lines in South Africa are running through high lands at altitude of 1800m. Impulse voltage tests were conducted at altitude of 1800m and the insulator string assembly was designed, reflecting the reduction of electrical characteristics due to low air density at high altitude.

Taking account for the study results on existing lines in the world, procedures for designing the insulator assembly for 765kV lines are also explained, which will be useful for study of the future projects of such transmission lines.
