Design, Mechanical Aspects And Other Subjects of Compact EHV OHL Technology

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For a transmission line of given voltage its transmitting capacity could by limited by two factors:

- by its thermal current-carrying capability determined by phase conductor crossection and conductivity of used material (usually ACSR for HV and EHV lines). This capacity is independent of line length until voltage drop along the line due power losses is acceptable;
- by its stability, steady-state or dynamic, that is influenced by specific reactive parameters of line and its length. Usually this limitation is essential in long EHV lines. Compaction of HV or EHV transmission lines is able to deal effectively with this problem.

An increase in transmitting line capacity determined by stability is achieved through reducing its surge impedance. Surge impedance equals to the square root of the ratio of specific inductance of the line to its specific capacitance. In compact lines interphase distances are reduced essentially, thus increasing capacitance and reducing inductance. The back side of compaction in EHV lines is the necessity to keep gradients of electric field from conductors in acceptable limits that requires either conductors of larger size or larger number of conductors in bundled phase, and also optimized positioning of sub-conductors in phase [1-3].

A compact transmission line with elliptic positioning of subconductors in a bundle phase allows to reach the transmitting capacity exceeding one in usual line by 2 or more times.

Main operational characteristics of transmission line can be determined depending on mutual position of phase conductors and subconductors in a span.

For maximum decreasing in surge impedance it is necessary to adopt the smallest acceptable distances between bundled phases and from phase to grounded tower structure elements. In satisfying this condition it was found that the most suitable design for tangent towers of compact 330-500 kV overhead lines with horizontal phase arrangement will be portal towers of enveloping type [4]. But it should be taken into consideration that the influence on adjacent elements of the tower leads to the local increase in electric field gradient on the surfaces of subcontractors by 10-13% [1].

In compact transmission lines with phase bundle of oval configuration it is possible to use an. increased bundle radius in. the lowest point of a span and lowered bundle radius at a supporting clamp on a tangent tower (calculations and designing [2] showed that it could be reached through different tension in upper and lower subconductors leading to different mid-span sags).

In this case a conductor bundle has changing size along the span, and impedance parameters of line in determining its transmitting capacity have to be averaged for the span.

The gradient of electric field on subconductor surfaces changes along the span as the height of the subconductors over the ground respectively changes, but that change in variable bundling described above is very similar to one in traditional bundling where subconductor distance is kept constant. With different tension forces applied to subconductors and correspondingly varying distances between subconductors along the span the gradients on subconductor surfaces and specific capacitance are essentially increased at approaching the tangent tower [4].

On the built part of 330 kV compact line (Fig.1) researches executed vibration and subspan oscillation measurements with application of up-dated instrumentation. The measurements were executed on subconductors of middle phase.

Fig.1 presents a general view (a) and a view of V-insulator set (b) of the 330 kV Pskovskaya HES – Novososkolniki compact OHL.


a) General view;


b) V-insulator set

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