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EFFICIENCY IN TRANSMISSION OF ELECTRICAL ENERGY METHODS OF INCREASE

Abstract. In the article, tasks and accuracy classes of high-voltage lines. Also, the problems of reducing the waste of electricity and increasing the efficiency of overhead lines by dividing the phase wires into several wires by reducing the inductive resistance of the power transmission lines are described.

Key words. high voltage lines, phase wires, electrical energy dissipation, power factor, phase separation, transposition, substations, inductive resistance.

Today, the world population's need for energy is increasing day by day. The main reason for this is the sharp increase in world population. Electrification is considered the basis of modern production forces, and accordingly, the high level of production and consumption of electricity in any country means its economic indicators are good and living conditions are good. The electric power transmission system includes substations and transmission lines used for various purposes. Such lines can be overhead lines suspended on special supports above the ground and underground lines buried in the ground. [1]

The voltage of 500-750 kV is transmitted from overhead power lines to the energy system from large power stations located at a great distance, and the energy systems are interconnected. Overhead lines with a voltage of 330 kV and 220 kV make it possible to establish a connection between separate energy systems or to supply large industrial regions located far away with electricity.

Overhead lines with a voltage of 110 kV usually serve to supply the regional substations of the energy system with electricity and to communicate between such substations within the energy system.

Overhead lines with a voltage of 110 kV and 35 kV are intended for providing electricity to remote enterprises or a small group of enterprises located in the same region. Rules for the construction of electrical installations (PUE). All of the above-mentioned power transmission lines are included in class I lines.

Class II lines include overhead lines with a voltage of up to 20 kV (usually 6-10 kV). These lines are used in electrical networks for supplying agricultural centers, settlements, small branches and similar places with electricity.

Class III lines include overhead lines with a voltage lower than 1000 V. [2]
As a result of increasing the voltage of power transmission lines (500-750 kV), their power transmission capacity increases. This requires increasing the cross-sectional area of the wires. Therefore, instead of one wire, several wires are pulled in a phase. The reason why the phase wires consist of several wires is to reduce the inductive resistance of the power transmission lines, to reduce the waste of electricity, and to increase the efficiency of the air lines. All overhead lines with a voltage of 500 kV are used in several wire phases.

Thus, the phase is branched. For example, three wires are laid on each phase of a line with a nominal voltage of 500 kV as an equilateral triangle with sides of 400 mm. If U= 330 kV, 2 horizontal wires are drawn from each phase; if U=750 kV, 4 wires are drawn. Sometimes 2-wire branched lines are used in lines with U= 220 kV.

The equivalent radius of branched wires is determined by the following formula

$$R_e = \sqrt[n]{R \cdot a_{sr}^{n-1}}$$

Here:

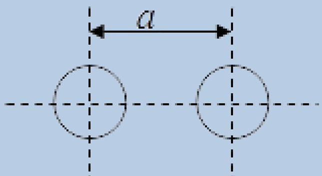
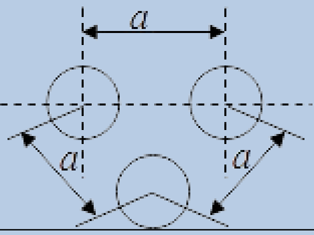
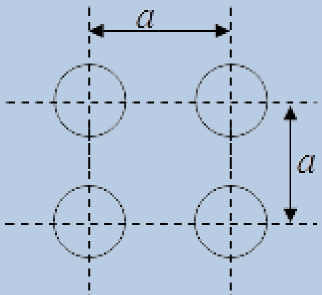
R_e - is the equivalent radius.

R - is the radius of one wire.

a_{sr} - is the average between the wires located in one phase geometric distance.

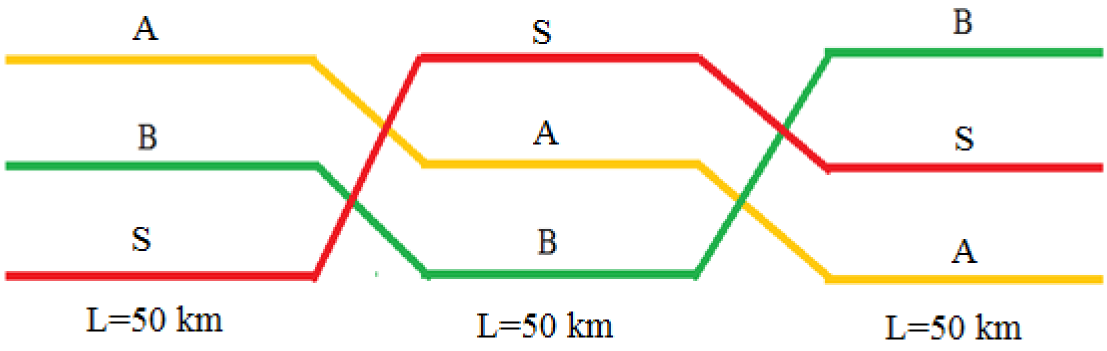
n - is the number of branch wires in one phase.

Information on networked wiring is presented in Table 1.

Wiring diagram for each phase.	**Number of wires per phase**	**Equivalent radius**	**Coefficient K**
	2	$\sqrt{2a}$	$1+2\cdot r/a$
	3	$\sqrt{r\cdot a^2}$	$1+2+2\cdot\sqrt{3}\cdot r/a$
	4	$\sqrt[4]{r\cdot a^3\sqrt{2}}$	$1+3\cdot\sqrt{2}\cdot r/a$

In electrical engineering, transposition is a change in the relative position of individual phase wires along the length of an overhead power line in order to reduce the unwanted effect of power lines on each other and on nearby communication lines. [3]

Transposition of power lines is to change the spatial position of the wires to ensure that their length is equal and, accordingly, the electromagnetic field is equal. When wrapping is done without transposition, the energy losses in the lines are significant.



Phase wiring of open-air power lines is used for voltages of 110 kV and above and line lengths of 100 km or more. This makes it possible to significantly reduce losses in power lines. One of the options for installing wires on the transposition support is shown in the figure.

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