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Air And Cable Lines

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Abstract: *Overhead transmission line (EUL) is a device for the transmission of electricity through wires attached to supports or brackets of engineering structures using insulators and fittings located in the open air. The main elements of the overhead line (HL) are wires, supports protective cables that protect the wires connected to the top from the extreme voltage in the atmosphere, supports for hanging wires and insulators, insulation of wires from supports.*

Keywords: Overhead line , cables, wires, stable, Split, active inductive, resistances.

I. Introduction

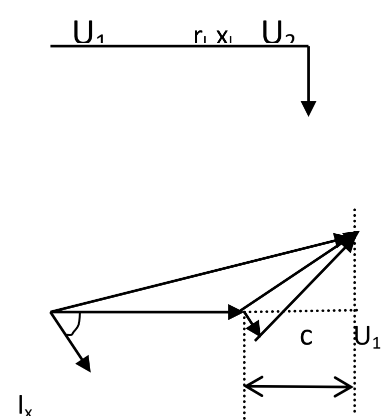
The wires are made of electrically conductive metal with a sufficiently thick core (to have an electromagnetic flexible current density) and a large curvature (to reduce corona discharge). Ultra high voltage transmission is the use of split wire. The top ground (also known as the lightning rod) is located above the signal wire used to protect the line from lightning. Important power transmission lines typically use two overhead lines. Insulation wire with a single suspension (or rod) insulator that meets the requirements of insulation resistance and mechanical strength. The number of insulators for each line is determined by the transmission voltage level.

Power transmission lines, which are usually marked with the letters “VL” - these are outdoor devices. That is, the wires themselves are passed through the air and mounted on special fittings (brackets, insulators). However, their installation can be done along columns, bridges and overpasses. It is not only necessary to calculate the "overhead lines" of the lines laid along the high-voltage poles. , Ground loop, lightning arresters, discharge devices.

II. Discussion and shortcomings:

In the event of a fire in the cable rooms, a slow development of combustion occurs in the initial period, and only after some time does the rate of spread of combustion increase significantly. Practice shows that in cable tunnels, temperatures up to 600 ° C and above are observed during a real fire. This is because in real conditions, cables that are under current load for a long time and whose insulation is heated from the inside to a temperature of 80 ° C and above will burn out. Simultaneous switching of cables can occur in multiple locations and at large lengths. This is because the cable is under load and its insulation is heated to a temperature close to the temperature of the car.

It is necessary to provide consumers with high-quality energy. One of the most important indicators of the quality of electricity is the amount of voltage supplied to consumers. Keeping the voltage at the right level is one of the most difficult parts of electrical engineering. To stabilize the voltage, it is advisable to take the cross-section of the conductors at the allowable voltage.



(Figure 1) Voltage loss in three-phase networks.

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The approximate value of voltage loss in three-phase networks is determined as follows:

$$\Delta U = \sqrt{3} \cdot I_{ish.}(r_l \cos\varphi + x_l \sin\varphi)$$

Here, Iish. - rated current; rl, xl - active and inductive resistances of the line;

cos is the power factor of the consumer.

The following figure shows a vector diagram for the case where a line with active and inductive resistance supplies energy to an inductive consumer.

The voltage at the end of the vector a line represents U2. Given the power factor of the load, we place the current vector I at an angle 2. The vector av is in phase with the vector I, indicating a voltage drop across the line active resistor. ac vector is the voltage drop across the inductive resistance of the line. The vector ac is the voltage drop across the line, U = U1-U2, i.e. the voltage drop (padenie) is the vector quantity ad the voltage drop across the intermediate line (poteri) is the algebraic difference of the voltages at the beginning and end of the line (vector not worth it).

In small sections of conductors and cable wires (up to 25 mm2) the active resistance is taken as the main resistance. In sections larger than 70 mm2, the inductive resistance must be taken into account.

The inductive resistance of the line in the range of 25-70 mm2 is taken into account in the accurate calculations.

Given only the active resistance of the line.

$$\Delta U = \sqrt{3} \cdot I_{his.} r_l \cos\varphi$$

Here it is

$$\Delta U = \frac{\sqrt{3} \cdot I_{his.} l \cos\varphi}{\gamma s}$$

In that case,

$$S = \frac{\sqrt{3} \cdot I_{his.x} l \cos\varphi}{\gamma \Delta U}$$

Here, is the relative permeability,

$\left[\frac{M}{Ом \cdot мм^2} \right]$ is the length of the line, (m)

Since the allowable voltage drop is known, the cross-section of the line can be easily determined. This formula can be used in approximate calculations with an error of up to 20%. When calculating the power grids of industrial enterprises, the error does not exceed 1.5% if the formula is used taking into account the active and inductive resistances of the lines. If the voltage of the lines exceeds 35-200 kV and the length exceeds 200 km, their capacitance resistances will have to be taken into account. Given that such lines are very common in industrial enterprises, we recommend that they be studied independently using specialized literature.

III. Analysis and results:

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The loss of electrical energy in the wires depends on the current, so when transmitting it over long distances, the voltage is multiplied by a transformer (thereby reducing the current), while transmitting the same power, the losses can be significantly reduced. However, as the voltage increases, various discharge events begin to occur.

Another important quantity that affects the efficiency of power transmission lines is cos (f), a value that characterizes the ratios of active and reactive power.There is a loss of corona (crown drop) in EHV overhead lines. These losses are largely dependent on weather conditions (losses in dry weather conditions, respectively, increase these losses during rain, sleet, snow) and in the line phases of the wire. 'linishi. Corona losses for different voltage lines have their own values (average annual corona losses for a 500 kV overhead line are DR \ u003d 9.0 -11.0 kW / km). Since the corona drop depends on the surface tension of the wire, phase separation is used to reduce this voltage in high voltage overhead lines. That is, instead of a single wire, three or more wires in phase are used. These wires are equidistant from each other. The equivalent radius of the split phase comes out, which reduces the voltage of the individual wire, which reduces the corona losses.So, let’s move on to consider a concept like cable power lines. First of all, these are not bare wires used in power transmission lines, they are insulated cables. Typically, cable transmission lines are multiple lines installed side by side parallel to each other. The length of the cable is not enough for this, so couplings are installed between the sections. By the way, it is often possible to find oil-filled cable power transmission lines, so such networks are often equipped with special filling equipment and alarms that affect the oil pressure inside the cable.If we are talking about the classification of cable lines if we talk, then they are the same as the classification of overhead lines. There are unique features, but their number is not so great. Basically, these two categories differ from each other in the method of laying, as well as in the design features. For example, according to the type of laying, cable power lines are divided into underground, underwater and structures.

(Figure 2) View of cable line layout.

The first two positions are clear, but what is included in the “structures” position?

Cable tunnels. These are special enclosed corridors in which the cable is laid along the installed supporting structures. In such tunnels, you can walk freely, performing installation, repair and maintenance of power lines.

Cable channels. Often they are buried or partially buried canals. They can be laid on the floor, under the floor, under the ceiling. These are small canals that are impassable. You will need to disassemble the ceiling to inspect or install the cable.

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VI. Summary on the topic

The diversity of power grids is divided into two main types: overhead and cable. Both options apply everywhere today, so you should not separate the other and give preference to the other. Of course, the construction of overhead lines is associated with large investments, because the laying of the route is mainly the installation of metal supports with a complex structure. In this case, it is necessary to take into account which network, under what voltage. This distance depends on the voltage of the nominal line and local conditions (inhabited, uninhabited). The distance between adjacent phases of a line depends mainly on its rated voltage. The design of the phase of an overhead line depends mainly on the number of wires in the phase. If a phase is made with multiple wires, it is called a split. The phases of high and very high voltage power lines are separated. In this case, two wires are used in one phase 330 (220) kV, three - 500 kV, four to five - 750 kV, eight, eleven - 1150 kV.The top line supports. Overhead line supports are structures designed to hold wires from the ground, water, or any engineering structure to the required height. In addition, cables connected to the steel ground are suspended at the supports to protect the wires from direct lightning strikes and appropriate overvoltages when necessary.

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