HIGH VOLTAGE DISTRIBUTION LINES, WHICH ARE GOING THROUGH CITIES

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SUMMARY

Nobody had paid attention till nowadays on such problems like influence of High Voltage Lines (HVL) on views of cities. HVL have also an influence on people’s visions cities. Unfortunately, this problem is taken place in any big city, which has Power plant, or substations. HVL, which situated in cities (usually 35-220 kV) are absolutely alike HVL placed where people don’t live at all. Usually, this HVL consist typical steel or concrete poles. There construction form is made only for one thing – to carry links with electricity carefully. Even though this is very important, but it is not enough for HVL in cities. Constructions of this pole are not only very unpleasant to see, but make a city to look like a plant. In the same time it is necessary to maximize the electro-secure of HVL, which are situated in living districts. The modern development of line’s builder demanding extra requirements for wire, insulators, poles and foundations. Now, more useful and popular becoming insulated wires, composite insulators, V-type insulator strings, minimizing wind influence of air gaps and making more narrow line’s corridor. Now more attention has been paid on minimizing of electromagnetic pollution in environment from HVL. Progressive modern architecture, which is demanding high-level view of city, has a necessary of creation and building steel poles HVL, which will have high architecture standards. So-called city-type poles will have not traditional forms, unusual design and of course it will good influence on people view of cities. Also extra visual effect can be given with different kind of commercials on the poles, this designer decisions should be suit the architecture of the city.

Authors of this article have done first steps in creation of complex requirements for new city-type of HVL. They have been working on designer’s new thoughts and decisions on city-type poles, insulators strings phase of wires and other elements of line 35-220 kV.
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Until now the issue of negative effects that urban power lines have on the appearance of cities and their citizens hasn’t been raised. However, this problem is very typical of any big city with a Power Plant or a Substation. High Voltage Lines (usually 35-220 kV), which are situated in areas of high population density (so called “urban lines”), aren’t different from those in areas of low population or uninhabited areas, this power lines are supported by either standardized, steel or reinforced concrete poles. Their construction form has but one aim: to care wires securely. Thus, guaranteeing uninterrupted functioning of power lines. This condition is necessary, but insufficient for urban power lines. Construction forms of power line pole do not meet even minimum esthetic requirements. Thus making city districts look like construction sites. In the modern condition of progressing development of urban architecture and heightened requirements of appearance of densely populated areas, the necessity of solving this problem is very topical. Though, we should notice that with all the importance of the problem, it is not alone and represents just a part of the problem to be considered forming steel power lines poles. As stated earlier, high voltage power lines in our country is based on the usage of standardized line poles. The standardization of power line poles has significant advantages: chance to mass-produce, worked-out processes of installation, and exploitation. However, it also has disadvantages. For instance, it restrained the development of structural forms of power line poles that of new installation technologies. It also didn’t account for climatic and geographic variations of passing courses of high voltage power lines, etc. So the conception of formation of steel poles – a basis for their development and construction – appeared. Briefly the conception can be characterized as a code of general principals, on the base of which Technical Conditions of projecting of steel High Voltage Power line poles should be developed. In the base of the conception the analysis and classification of quiet a big number of factors lie. These factors can influence the constructional form of poles. They were named as influence factors and were classified on definite base, forming different groups. In one of such groups, named as “regional”, the requirements for urban High Voltage Power Lines are settled.

Complex of the main requirements, which the poles of high architectural view must meet, can be as follows.

Aesthetic requirements (architectural view).

The determinative parameter for the poles of this kind from the point of visual influence on the people is of course their form and color. But we should pay attention to the fact that form should not be at variance with safety and reliability of the lines, going through the populated areas. The form should attract people’s attention by its singularity and even eccentricity. But for all that the economical requirements for urban high voltage lines don’t have primary importance. As for the color of each pole, which can be very different, it should underline the form, be in harmony with it and so serve to attract people’s attention. The pole should be open-work, not massive. So the preference should be given to through constructions or at least combined. Hence constructive elements with symmetrical section, which ratio between max. cross size and min. cross size is one, should be used. The ideal section meeting this requirement is tubular. Without gusset coupling of construction elements or at least ball (or similar) central fixing is preferable.

“Aesthetic optimization” of the main sizes of the line: determination of the bay size and therefore frequency of poles allocation, determination of poles height and width of their foundation, on the base of aesthetic concept, linked with the architectural composition.

Minimization of poles occupied urban space.

To satisfy the requirements of minimization of the taken urban territory, it is necessary to use the special poles, for example tower type. At the same time this requirement dictates the extension of the distance between poles (this as well coordinates with electrical requirements). Diminution of phase to phase distances thus lessening of the occupied territory is possible only in case of using of the fixed wire suspension – anchor, V-type insulators strings, pin or supporting insulators, phase to phase cross piece, etc.
"Urban type" lines should have increased operational safety, electro safety, electromagnetic compatibility.

To use closed cut metal profile persistent to the mechanical damage and corrosion as poles elements.
To use polymer insulators instead glass and porcelain. Quite a great experience of usage of the polymer insulation (more than 20 years) showed their high reliability. Convenience of their installation and exploitation makes it possible to mention them as preferable insulation for urban HVL.
To use steel of higher strength – that gives the opportunity to make the pole more open - work and increase the corrosion resistance.
Constructive forms of central coupling of poles, exploitable in low temperatures, that is typical, for example, for Russia), should have high level of resistance to brittle failure of steel. The danger of brittle failure is that it is such a type of failure which has too low electro-capacity and is characterized by indefinite low level of breaking voltage, lower than that of steel.

Investigation of the questions of electromagnetic compatibility of HVL of “urban type” makes the level of interference from phase wire and connective reinforcement of the line lower. Economical current density is decreased till 0.7-0.8 A/ mm2, at the same time the radius of wire and metallic elements of work potential is increased. But the substantial increase of the surface of the current-carrying parts can cause the local heterogeneity and local corona. As a result the use of insulated or partly insulated wires and armature, colored light tones, is very promising.

The authors of the article have studied a number of constructive types of “urban” HVL. As an example on the Fig. 1, 2 pole, the construction of which is based on the usage in a role of united cross-arm – transparent special configuration – cellular ball, which has the high level of architectural view is shown. At the same time the stock in one of the variants of pole (Fig. 1) is made by through, in the second (Fig.2) – by continuous pipe section. The “urban type” poles, which conception of formation was described above, can be used for re-equipment exploitale HVL with practically spend resources, and also for new building sites on the populated territories.