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Improving the Reliability and Energy Efficiency of Rural Electric Networks using Self-Retaining Insulated Wires

Taslimov Abdurahim Dexkonovich, Davletov Ikram Yusubovich, Aminov Hamza Murod o‘g‘li.

Professor, Department of power supply, Tashkent state technical university, Uzbekistan,
Professor, Department of interfaculty technical sciences, , Urgench State University, Uzbekistan,
Assistant Professor, Department of interfaculty technical sciences, Urgench State University, Uzbekistan

ABSTRACT: The article considers the problem of increasing the reliability and energy efficiency of rural electric networks using self-supporting insulated wires.

KEY WORDS: "SIP" conductors, insulated wires, electricity supply, electrical systems, electricity consumers, waste of electricity, electric power.

I. RELATED WORK

A lot of work is being done in our country on the development of rural electricity supply systems, including coverage of rural electricity consumers with quality electricity, standardization of supply and electricity indicators, energy waste and exploitation in the network and the cost reduction is intended. Today the demands placed on the economically justified level of energy losses of rural electricity consumers are also increasing, mainly the electricity supply to rural electricity consumers is delivered via air lines, there are a number of problems during delivery including the presence of power wastage, the influence of external natural influences on overhead lines, and the complexity of technical repairs have a significant impact on the economy.

II. INTRODUCTION

At present, in our country, rural electricity networks are in an unsatisfactory condition, more than half of them are unusable or in need of capital 'requires repair. Only 60...65 percent of consumers are provided with high-quality electricity, the reason for this is mainly due to the deterioration of air lines due to the external environment and the increase in power wastage. insulated wires are designed to eliminate these problems. Self-supporting insulated wires are designed to serve for 50 years, prevent burns at cold temperatures of -45º C and at hot temperatures of +85º, +90º C, are absolutely protected from external environmental influences, including wind, snow. The above conditions are fully protected from rain, ice formation, lightning and falling power poles and consumers will continue to be supplied with electricity and provide more than 80% reduction in repair costs and prevent unauthorized connections.

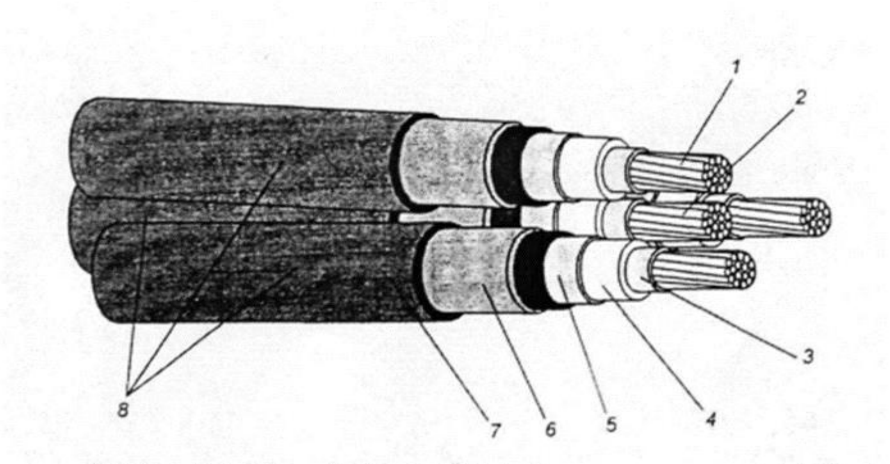
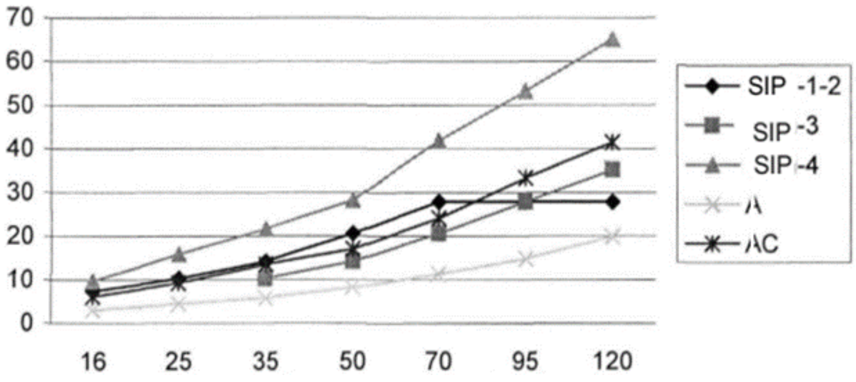


Fig. 1 Self-supporting insulated wire construction consists of the following (Fig. 1) 1-round aluminum core; 2-transport cable; 3- screen on the semiconductor plastic core; 4-main insulation of compressed polyethylene; 5-screen on the main insulation of semi-conductive plastic and tape; 6-aluminum common screen polyethylene tape; 7- shell; 8- winding three single-core wires (cables) wrapped around the suspension wire.

In order to demonstrate the reliability of the analysis of the reasons for the breakdown of 0.38 KV overhead lines, the following can be cited. We can see graphs of the dependence of the breaking strength of conductors used in 0.38 KV overhead lines on the surface of the conductor cross-section. Figure 2 is here. it can be seen that the breaking strength of "SIP" conductors is higher than that of "A" conductors used in 0.38 KV overhead lines.



The cross-sectional surface of the wires is mm^2

Fig. 2. Breaking strength of "SIP" conductors

Alternatively, insulated conductors without self-retaining riser conductors (sip-4) are the most common in 0.38 KV overhead lines, with breaking strength compared to "A" conductors used in low-voltage networks. four times larger, therefore, the number of breaks of insulated conductors can be taken as approximately four times less than the number of breaks of non-insulated conductors. If we consider that the continuity of supply is maintained through an insulated conductor even in the event of damage to the support in the event of an emergency, this indicator will change for the better. It is very suitable for the mountainous regions of our country and the regions of the Republic of Karakalpakstan, Khorezm, because in these regions, in addition to the cold or hot climate and wind, snow, ice, and other natural changes, they are effectively protected from the salt dust that occurs in these regions. In particular, a salt storm was observed in these areas on May 27, 2018, which caused the interruption of electricity supply to several consumers, and power loss was observed in some areas. Possible ways to consider the reliability of agricultural systems if we consider, according to it, the first, the reliability requirements are established in the following form. However, the decision made in this case is not always acceptable, because their effectiveness or other measures depend mainly on system parameters. Power supply needs existing regulations and corrections, which sometimes do not correspond to new design solutions. The second approach is carried out by choosing an economic solution and comparing the discounted costs of the options, considering the component that reflects the amount of damage caused by the disruption of the electricity supply:

$$З_{мин}=З_{\partial}+У_{\partial}$$

where the discounted costs to the network according to the $Z\partial$ option; U∂-discounted damage includes failures in consumers and electricity supply system. The disadvantage of this approach is the uncertainty of specific damage values. The amount of damage varies depending on the type of consumers and changes in system parameters.
The third method is the normalization of reliability indicators. In this case, technical solutions that are considered optimal and provide regulatory indicators are represented by costs.

$$З_{ж \rightarrow мин\ да}\ жє\ М \left| Ҳ_{М} \geq Ҳ_{Х} \right|$$

where M-satisfying technical solution options: H_M- not low level of regulatory reliability provided by these options. All three approaches include different tasks of optimizing the development of electric networks with their rational use area. Failures during the operation of the agricultural production facility reduce the efficiency of the power supply. The magnitude of this decrease depends on the specific characteristics of the object, technological process and parameters of power supply disruptions - frequency level, their duration, electricity supply during the year, the amount of electricity considers the probability of damage, lack of electricity. All these factors have a different effect on the decrease in efficiency, and depending on which factor has the greatest effect, the consumer chooses the appropriate reliability index. The damage caused by the disruption of the electricity supply to consumers depends on the timing of agricultural production. Duration of blackout and break in picture 3 - if there is a break during a power supply failure, the damage is insignificant and relatively small ($У_1$);); if the duration of the break is longer than the critical time, the amount of damage due to the technological process ($У_2$) increases sharply, that is, the consumer works with low efficiency.

The critical break time for agricultural production is related to the production technology of electricity supply, as well as the biological factor of production; for example, if the break in the power supply of the poultry farm is more than 15-30 minutes, it leads to the death of the bird, and this is considered a great loss; a milking period of 2 hours or more in a milking farm where power outages kill the cows, so it is considered a major loss.

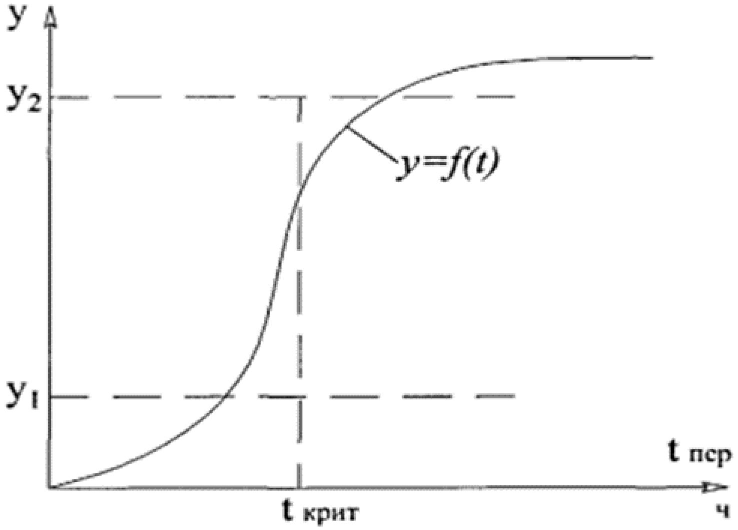


Figure 3. Power supply the amount of damage depends on the change in break time

With the time that can be used as normative indicators, ω is a low level of failure $(\tau < \tau_{\text{крит}})$ and a higher level $(\tau \geq \tau_{\text{крит}})$. The consequences of a failure can be considered proportional to the total duration, so the outages can serve as a normative indicator of the reliability of the power supply of the duration of the interruption. A measure of the efficiency of the power supply system can be as follows: the amount of electricity supplied by the system in the absence of the system, related to the amount of electricity received by consumers, is the failure of the power supply system. In practical calculations, the use of low-capacity electricity by more convenient consumers takes into account W_X - disturbances in the electricity supply. In some cases, different parameters can be determined using relative amounts of electricity as a reliability indicator for comparing power supply systems.

$$W_X=W_X/(W+W_X)\approx W_X/W,$$

here is the amount of electricity consumed in the W-system during the year. The system of standards describing the reliability of electricity supply for agricultural consumers includes the following: - for consumers of agricultural products - the failure rate with the permissible frequency time w is $(\tau < \tau_{\text{крит}})$ and can be many $(\tau \geq \tau_{\text{крит}})$ - for the rest of the agricultural consumers - the duration of the power supply interruption $T\partial$.

III. CONCLUSION

Selfholding isolated wires are effective in agricultural power supply during operation and maintenance and provide the basis for the efficient operation of agricultural production facilities, and such wires are protected from external environmental influences such as climatic influences and power outages in cases of fallen poles help to increase the efficiency of production facilities .

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