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Prospects for the Development of Transformer Installations in the Power System

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Can a modern person imagine his life without electricity? Probably not. Electricity surrounds us everywhere, at home, at school, at work. But a fairly small number of people imagine the process of production, distribution and supply of electricity to consumers. Power transmission lines (power lines) are used to transmit electricity over distances, and devices such as transformers are used to reduce losses during energy transmission.

A transformer is a device designed to change the voltage value up or down, consisting of a magnetic circuit, windings and a tank. Such a transformer device has remained unchanged for several decades. At the moment, changes are taking place only in the materials used for manufacturing and production technologies.

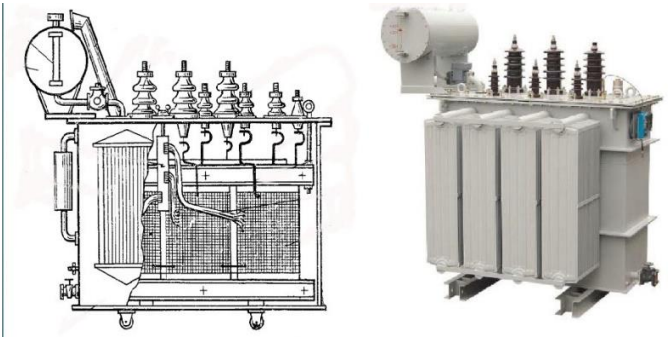

Fig. 1 – Transformer Device

At the moment, there is a confrontation between two economic criteria for the production of installations:

• The requirement to the cost cutting of the transformer as a whole;

• Significant funds are needed for equipment modernization and research.

At the moment, one of the promising ideas for reducing the costs of production and use of transformers is the use of magnetic cores made of nana-crystalline alloys. Using these alloys, it is possible to achieve a fivefold reduction in idling losses. Tests confirm this. According to experts, if nana-crystalline alloy cores were installed in all transformers operating in the world, the average annual energy savings would amount about 40 million kWh. But there are also disadvantages. Cores made of nana-crystalline materials are more expensive than analogues made of traditional metal. This is due to the undeveloped manufacturing technology, as well as the fact that the nana-crystal core itself takes up more space compared to the iron one. The next option for improving the transformer is the use of windings made of high-temperature superconducting materials. They have a number of advantages such as:

- reduction of installation dimensions;
- the property of limiting short-circuits currents;
- large overload capacity;
- reduction of reactance;
- reducing the noise level of the installation and much more.

It is worth noting that at the moment installations using these materials are at the stage of development and testing.

The third option for changing transformer installations is to use a new type of Dry Former installations. The secret of this device is hidden in the windings, which are made of a special cable, which in turn has a multi-wire copper or aluminum conductive core, on top of which a thin layer of semi-conductive

material is superimposed. The insulation of such a core is made of polyethylene. The developers also took care of the issue of fire safety. There is no oil in these transformers, and the content of fuels and lubricants is also reduced, which significantly reduces the risk of fire or explosion. These solutions make it possible to install transformer installations in places where the issue of fire safety is particularly high: protected natural areas, residential areas, etc. Another significant advantage of this type of transformers is the absence of the need for high voltage input, this is due to the fact that the winding leading to the switchgear can stretch for a long length, which affects the loss of electricity during transmission over distances. Summing up a certain result, the following points can be noted: today there are a sufficient number of ways to improve transformer installations, but each of the methods has its advantages and disadvantages. In our opinion, the use of nana-crystalline materials is the most promising option, despite the highest price. This is due to the fact that the other two improvement options are still at the early development stage, in which nuances and shortcomings may still be revealed.

In the end, we note that the solution of such an issue as reducing losses in the transmission of electricity over distances, due to the modernization of transformer installations, will solve many problems, including indirectly affecting the stopping of global warming.

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