

## EQUIPMENT FOR ADSORBENT REGENERATION WITH APPLICATION OF HIGH-POWER UHF ELECTROMAGNETIC FIELD

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### ABSTRACT

*The technology and equipment for high-speed careful adsorbent regeneration using high-power UHF electromagnetic field is presented. It is shown, that usage the universal cartridge for transformer oil and zeolite regeneration reduces the number of manufacturing operations for scheduled maintenance of transformers. Because of this, the idle time of the transformer is reduced by 15-20%, while costs are reduced by one third*

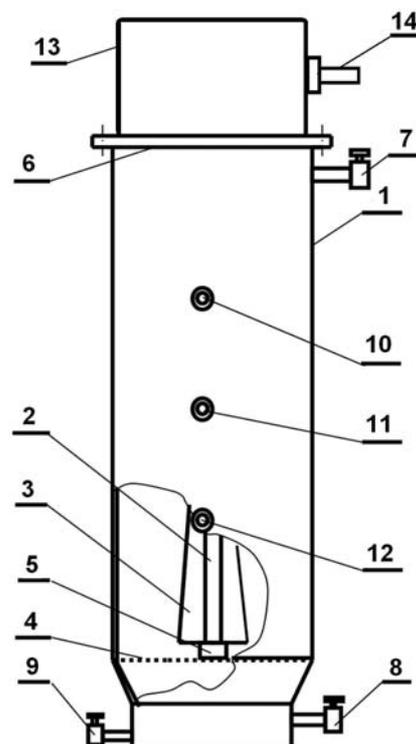
### INTRODUCTION

It is well-known, that one of the most critical problems in hi-power transformers usage is connected to quality of transformers oil. During the transformer operation oil absorbs atmospheric moisture and its dielectric strength decreases. To reduce the water content in the oil it is pumped through the tank containing the adsorbent such as zeolite or silica gel. Adsorbent, which had lost sorption capacity, can be restored by removing the moisture via heating. The treatment of the adsorbent can be produced by its calcinations on metal sheets or heating in sealed containers at reduced pressure by heating coils. Using the first method leads to destruction of the adsorbent during its transfer from the adsorber and back. Disadvantages of the second method are: adsorbent carbonization near heating coils due to overheating and lack of adsorbent drying in the area away from heaters. This is a due to low thermal conductivity of the adsorbent. To eliminate the shortcomings of the second method authors propose a technique of heating and regeneration of the adsorbent by using the HF powerful electromagnetic field.

### DESCRIPTION OF TECHNOLOGY

To accelerate the regeneration of the adsorbent we use drying at reduced pressure. Another advantage of this method is application of a cartridge for oil regeneration (“adsorber”) as drying capacity. Application of the universal cartridge allows reducing the loss of adsorbent during operations of loading and unloading. Proposed cartridge (1), on figure 1, is a coaxial resonator. To enhance the distribution of the electromagnetic field, the center conductor (2) of the resonator is equipped with four-bedded ribs (3). With such a construction the field

distribution and, consequently heating of the substance becomes more uniform. Gates 7, 8 and 9 are used for the feeding and pumping of the oil in the cleaning oil mode of operation. In the adsorbent regeneration mode the vacuum pump has connected to those gates (порядок слов изменен). Gates 10-12 are used for the emergency thermal control sensors connection. Mesh (4) prevents the adsorbent particles ingress into vacuum and oil pumps. Block (13) serves for matching of the output impedance of the generator to the input characteristic impedance of the cartridge.



**Figure 1** - Universal regeneration cartridge

1- external tube, 2 – center conductor, 3 – ribs for redistribution the electromagnetic field, 4 – filtering mesh, 5 – insulator, 6 – flange, 7-9 – oil and air gates, 10-12 – thermometer gates, 13 - device for electric matching, 14 – gate for UHF energy.

## CONCLUSION

Application of the presented equipment allows to

- Increase the initial sorption capacity of the new zeolite in 15-20%
- Increase the number of cycles of zeolite usage from 3-4 to 8-10 (in comparison to the method of drying by heating coils).
- Decrease the time of regeneration from 15-16h to 7-8h (in comparison to the method of drying by heating coils).

The construction of the universal cartridge presented on fig.1. Fig. 2 shows the outward of the device



Figure 2 - Industrial equipment for regeneration of transformer oil working on the two-cartridge scheme: one cartridge is used for transformer oil regeneration, second – for adsorbent regeneration. After the regeneration of the adsorbent in the second cartridge, this one substitutes the first one in the scheme of recovery of the transformer oil.

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