RESULTS OF EXPERIMENTAL INVESTIGATIONS ON THE BASIS OF A SYMMETRIC POWER TRANSFORMER IN IDLE MODE

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Abstract: *This article presents the results of experimental studies on the basis of a balancing power transformer in the idle mode. The obtained preliminary results of experimental studies showed that the voltage unbalance factor complies with the requirements of GOST 32144-2013.*

Key words: *power transformer, unbalance factor, voltage, idle mode.*

Currently, "at the world level, special attention is paid to the issues of improving the reliability of power transformers with a total capacity of more than 10,000 GVA" [1]. The operational reliability of such a large complex is explained by the reliability of its components that make up its main part. At the same time, one of the factors leading to the failure of 10/0.4 kV power transformers is current and voltage unbalance, and eliminating this imbalance and improving the reliability of transformers is an urgent task for the power system.

Voltage asymmetry in electrical networks 10/0.4 kV mainly occurs due to the connection of single-phase low-power consumers [2]. voltage unbalance significantly affects the state of transformers and reduces their service life [2].

With a current unbalance of 10% [2], the reduction in the insulating properties of the transformer is reduced by 16% [3] of the specified period. In this regard, the question arises of increasing the service life of power transformers by eliminating asymmetric loads.

Goal of the work - increasing the reliability of power transformers by eliminating asymmetric conditions caused by non-linear loads.

Research materials. The authors have developed a laboratory sample of a three-phase balancing power transformer with a power of 2.5 kVA with a three-pole ferromagnetic core [4-5]. An experimental study was carried out on the basis of this power transformer. The results of the experimental study (asymmetry factor, voltage, interfacial angles, etc.) were obtained using the LD DIDACTIC laboratory complex [6].

The results obtained and their discussion.

Using the laboratory complex LD DIDACTIC [3], an asymmetric voltage was created in a three-phase network. To do this, each phase is loaded with a different power. The results of this pilot study are presented in Table 1.

Table 1.

The results of voltage asymmetry in a three-phase network and their interphase.

Interval period, minute	U_A, B	U_B, B	U_C, B	φ_{UA}	φ_{UB}	φ_{UC}
0-1	243,3	246,7	208,2	0,0	110,3	-124,8
1-2	243,3	246,7	208,2	0,0	110,2	-124,7
2-3	243,3	246,8	208,2	0,0	110,2	-124,7
3-4	243,3	246,8	208,2	0,0	110,2	-124,7
4-5	243,3	246,7	208,2	0,0	110,2	-124,7
5-6	243,3	246,7	208,3	0,0	110,2	-124,7

The results obtained (table 1) were checked for compliance with the requirements of regulatory documents. According to GOST 32144-2013 [2], the asymmetry coefficient for the zero sequence of a three-phase network was determined, which amounted to K_0=10,36%. It was determined that the voltage unbalance factor exceeds the norm (4%) and does not meet the requirements of GOST 32144-2013 [7].

The next step was to study the unbalanced load using the developed laboratory symmetrical power transformer. The loads indicated in Table 1 were connected to the primary windings of the power transformer, and the secondary windings were connected to the LD DIDACTIC laboratory complex.

The study was carried out in the idle mode of the power transformer. The experimental results obtained on the secondary windings of the power transformer are shown in Table 2.

Table 2.

Obtained experimental results on the basis of a symmetrical power transformer in the idle mode

трансформатора в режиме холостого хода

Interval period, minute	U_A, B	U_B, B	U_C, B	φ_{UA}	φ_{UB}	φ_{UC}
0-1	234,4	238,3	237,8	0,0	120,1	-120,1
1-2	234,4	238,3	237,8	0,0	120,1	-120,1
2-3	234,4	238,2	237,8	0,0	120,1	-120,1
3-4	234,4	238,2	237,8	0,0	120,1	-120,1
4-5	234,4	238,2	237,8	0,0	120,2	-120,1
5-6	234,4	238,3	237,7	0,0	120,1	-120,1

The results obtained (table 2) were also checked for compliance with the requirements of regulatory documents. According to GOST 32144-2013

[2], the asymmetry coefficient for the zero sequence of a three-phase network was determined, which amounted to K0 = 1.03%. It was determined that the voltage unbalance factor does not exceed the norm (4%) and complies with the requirements of GOST 32144-2013 [2].

Conclusions.

1. The obtained preliminary results of experimental studies on the basis of a balancing power transformer in the idle mode showed that the voltage unbalance factor complies with the requirements of GOST 32144-2013.

2. It became possible to balance non-balancing voltages that can occur in a three-phase network due to various reasons.

3. This research will be continued. The next stage is an experimental study on a symmetrical power transformer in a different load mode.

LITERATURE:

1.Statistical Review of World Energy, 67th edition, June 2018.

2.Jawad Faiz, Milad Ghazizadeh, Hashem Oraee Derating of transformers under non-linear load current and non-sinusoidal voltage –an overview // ISSN 1751-8660 / IET Electric Power Applications, July 2015, pp. 486-495.

3. Kartashev I.I. and others. Power quality management. Tutorial. Moscow: MPEI Publishing House, 2017, 347 p.

4.Tuychiyev Z.Z. Yusupov D.T. Determination of asymmetrical position of 10/0.4 kV power transformers in operational condition // Scientific and Technical Journal Namangan Institute of Engineering and Technology. Volume 7, Issue 2, 2022, P. 239-244.

5. Tuychiev Z.Z. Investigation of non-linear loads using three single-phase transformers // Scientific and technical journal FerPI, 2022. Volume No. 26, Spec. issue number 1. pp.183-186.

6.www.lddidactic.com

7. GOST 32144-2013 Electromagnetic compatibility of technical means // Standards for the quality of electrical energy in general-purpose power supply systems. Moscow: Standartinform, 2014, 19 p.