Masleeva O.V., Pachurin G.V.

NOISE POWER TRANSFORMERS

The Nizhniy Novgorod State Technical university of a name of R.E.Alekseev

Abstract. Greater attention is now being paid to the assessment of adverse effects of power on the environment, including the impact of noise generated by power equipment. Increased noise affects the nervous system, cardio - vascular system, the human ear can cause insomnia and rapid fatigue. Power transformers are one of the sources of noise in industrial areas and the surrounding area. The noise is caused by vibration of transformer active part, as well as cooling fans. Significant effect on the noise of the transformer have resonance phenomena in its individual elements. The estimation of noise exposure transformer station, which will be equipped with 3 dry transformer of 400 kVA - 1pc, with capacity of 1000 kVA - 2pcs voltage class 10/0, 4 kV. Calculations have shown that the noise generated by the transformer substation, will be below normal for the area immediately adjacent to the university. Therefore, special measures to reduce the noise is not required.

Power transformers are the main elements of the power supply circuit. Transformers are the source of the noise which negatively impacts on the environment and humans. Noise disease is characterized by a complex of symptoms: reducing auditory sensitivity, changes in digestive function, cardiovascular failure, neuroendocrine disorder.

Noise in transformers is caused by magnetoacoustic oscillations of electrical steel plate transformer core. Generated vibration is transmitted through the oil, and pockets of resistance with active part of the tank to the tank itself and from it to the air in the form of sound waves, vibrations of different frequencies. Especially a lot of noise comes from the tank cap. Additional sources of noise are the vibrations of the tank and its associated structures.

There is the calculation of noise transformer substation (TS), which will be installed in the courtyard of the academic building Technical University. TS is

located in a brick building, which has dimensions of 6 * 6 * 4 m. TS building has a metal door of size 2 * 1 m, two metal gates measuring 2.5 * 3 m. 3 dry transformer will be installed on the TS with the nominal power 400 kVA – 2 pcs, 1000 kVA - 1pcs voltage class 10/0, 4 kV. Transformers are manufactured by CJSC "Energomash (Yekaterinburg) - Uralelectrotyazhmash." The levels of sound power of transformers are indicated in the data sheet. It constitute to 400 kVA power L_{PA} = 68 dB, for 1000kVA L_{PA} = 73 dB.

Acoustic calculation of sound pressure level on the outside of the building TS is made in accordance with SNIP 23.03.2003 "Protection against noise."

There are the following basic data for calculation: the coefficient that takes account of the near field: $\chi = 2$, the noise source directivity factor: F = 1 (for sources with a uniform radiation); the solid angle of the radiation source: $\Omega = 2\pi$ rad (for a noise source located on the floor); coefficient allowing for violation of the diffuse sound field in the room: k = 1,25; average sound absorption coefficient: $\alpha_{cp} = 0{,}15$; area of i-th surface: S = 64m^2, the equivalent absorption area a = 9.6 m^2; acoustic permanent premises: A = 11.3 m^2.

The calculated equivalent sound levels are as follows: a brick wall - 25.26 dBA, a brick wall with a metal door - 39.61 dBA, a brick wall with two gates - 48.22 dBA. According to CH 2.2.4.2.1.8.562-96 "Noise in the workplace, in residential and public buildings and residential areas" the allowable noise level in home and buildings in the area around is 50 dBA.

Thus, the comparison of numerical results with the permissible noise levels showed that the noise generated by the planned substation 10/0, 4 kV with three dry transformers total nominal capacity of 1800 kVA, from either side of the building will be below of the allowable for the area directly adjacent to the Technical University. Therefore, special measures to reduce the noise are not required.