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INVESTIGATION OF ASYNCHRONOUS MOTOR HEATING UNDER THE INFLUENCE OF HARMONICS

Abstract: the harmonic component in power grids is an important problem due to the use of more sensitive equipment. Harmonics affect the accuracy of control circuits, false alarms of switches, and wear of wiring insulation. Therefore, research on this topic is important. A clear understanding of the negative factors and the extent of their impact on the equipment is needed to understand the problem.

Keywords: harmonics, influence, temperature

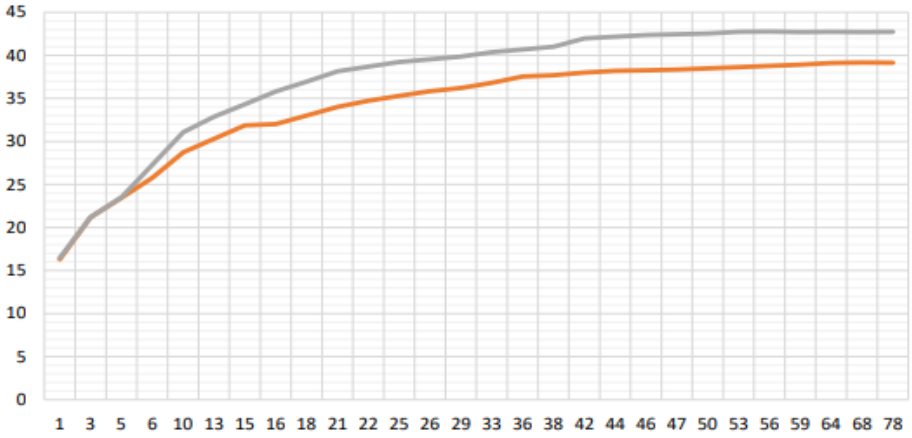
Nowadays, the designer of electrical networks sets himself the task of developing and adapting systems in connection with the increasing level of harmonics. The situation in the future will only become more complicated due to the increased use of sensitive electronics and increased load. Industry, mechanical engineering, factories and plants are having an increasing impact on the electric grid.

The above mentioned leads to costs due to unscheduled repairs or replacement of equipment, increases the danger during operation. Therefore, this topic needs to be studied.

The purpose of the work is to conduct a study of the degree of heating of an asynchronous motor in the presence of a harmonic component in the network.

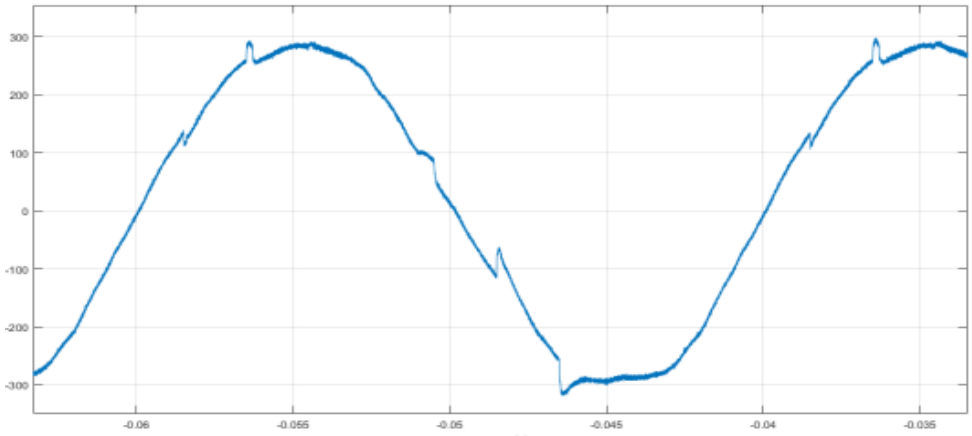
Harmonics are frequency derivatives of the main sine wave at 50 Hz and multiples of its magnitude. They arise due to transients in the electrical circuit and connected nonlinear loads. They are divided into even and odd ones, that is: No. 1 – 50 Hz, No. 2 – 100 Hz, No. 3 – 150 Hz and so on. The sources are as follows: power equipment (Drives, high-frequency melting furnaces, semiconductor converters, UPS, frequency converters), electric welding plants, arc furnaces.

The author has made an attempt to research on measuring the heating of an asynchronous electric motor when an artificially created harmonic component is applied to one of the phases. A test bench was assembled in the laboratory, consisting within the framework of this study of two asynchronous electric motors (the second for mechanical load), a harmonic generator, a control circuit (magnetic starters, buttons), a load (the possibility of connecting electrical equipment). Temperature measurement during operation of the electric motor was performed using three sensors connected to a device for displaying temperature sensor information on a seven-segment indicator. The sensors were fixed in the stator winding through holes made in the front cover. Harmonic number five (250 Hz) was mainly supplied. The harmonic was added to one of the phases using a "voltage-boosting" transformer. Experiments were conducted with and without a connected load, with and without harmonics. As a result of the experiments, it was found that in the presence of a harmonic component, the peak engine temperature increased by 8.8-9% and was achieved in less time. Also, during the research, a thermal imager was used and heating of the current-carrying parts of the assembled circuit was noticed when harmonics were applied. Experimental temperature graphs, oscillograms and spectra were used as methods of analysis and comparison. The results of the harmonic effect are given in Figure 1,2,3.



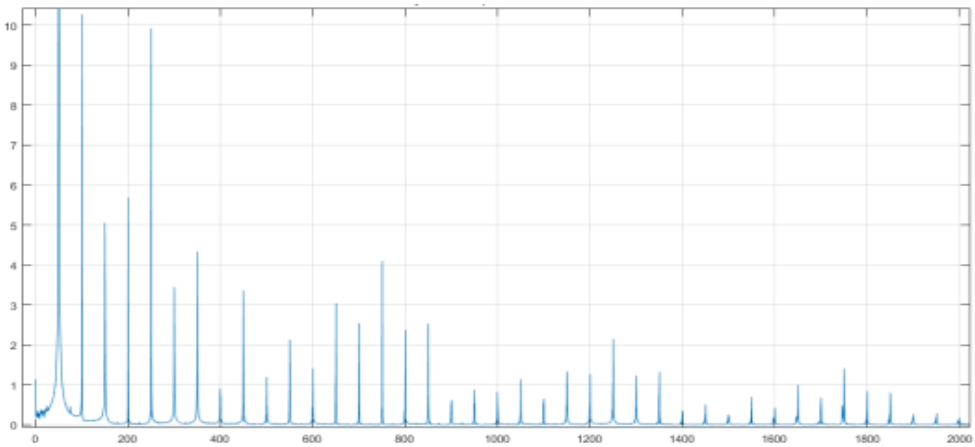
Comparison of engine heating with and without harmonic (5)

The left column characterizes the temperature in Celsius. The bottom line characterizes the time of the experiment in minutes. The orange graph shows the result of experiment number 1 (without harmonics). The gray graph shows the result of experiment number 2 (with harmonica)



The frequency of the network after the introduced harmonic (5).

Spectral analysis of harmonic components.



The amplitude value is in the left column. In the bottom line, the value of the frequency of the spectrum

Currently, it is difficult to limit the presence of harmonics in power grids, since there is a problem of using substandard welding equipment in residential areas, the overall load of power grids is increasing, and the number of industrial facilities is increasing. Hence, the influence of harmonics is becoming more and more detrimental to sensitive equipment and the operating time of all electrical equipment.

These factors should encourage more research on this topic and finding solutions to this problem to improve the quality of electricity.

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