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Investigation of Steady-State Single-Phase Short Circuit Modes of Phase-Shifting Autotransformer with Hexagonal Scheme and Adjusting Autotransformer

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Abstract

An important role in assessing feasibility and other technical characteristics is played by the behavior of the transformer device during short circuits. Therefore, the purpose of this work is to study the steady-state modes of operation of proposed new device at single-phase short circuit of the load for different connection options of regulating autotransformer to hexagon circuit of main phase-shifting autotransformer. As the result of calculations, the values of voltages and currents vectors in all windings of both autotransformers were obtained for the case of load connection to the middle taps of regulating autotransformer windings. It is shown that at such short-circuit the voltages of the windings of the main autotransformer are significantly distorted and essentially depend on the connection option of the regulating autotransformer. Demonstrative vector diagrams of voltages, currents and relative magnetic fluxes are described, explaining the specific features of the considered modes of the proposed device operation. The calculations showed that in all modes of single-phase short circuit of the load, current appear in the neutral of the power supply source, which is closed through the device and the grounded neutral of the load. Thus, in such modes, significant zero-sequence currents could flow through the device. This leads to the release of significant magnetic flux from the magnetic circuit in the surrounding space.

Keywords: phase-shifting autotransformer, hexagon circuits, regulating autotransformer, single-phase short circuit of the load

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