

LIMITATION OF MAGNETIZATION CURRENT INRUSHES IN ELECTRICAL POWER SUPPLY SYSTEM OF ELECTRIC ARC STEEL- SMELTING FURNACE WITH PHASE-CONTROLLED FURNACE SWITCH

Summary

The process of steel smelting in electric arc steel-smelting furnaces (ESSF) requires frequent switching of idle furnace units, accompanied by high-multiplicity magnetization currents inrushes (MCI). Electrodynamic rushes, caused by MCI to windings of network transformers, affect loosening with subsequent failures of transformers.

The analysis of main factors that influence the value of MCI allowed to offer a way to limit them using phase-controlled furnace switch.

The paragraph herein describes time-controlling algorithm for switching phase poles of furnace switch. Turning on the furnace unit is carried out in two stages. Firstly, two phases of the unit are turned on at rated voltage of the power supply network, and one of the phases is switched to previously demagnetized magnetic core leg. Then, in 1,5-2 seconds the third phase is turned on. Limitation of MCI at the on first stage of switching process is achieved by total magnetic flux reducing in magnetic core of furnace unit and by decreasing phase voltage at the moment of switching. Though, maximum value of voltage, applied to each phase of furnace unit, is less than half of rated line voltage value. At the second stage limitation of MCI is a result of the fact that the third phase is switched to magnetic core, which is already demagnetized by influence of the remaining two phases. Preliminary demagnetization of one of magnetic core legs is performed at each unswitching of furnace unit of power supply in similar step-by-step way. Firstly the phase, magnetic core of which is subject to demagnetization, is disconnected. It is achieved by influence of remaining energized phases of electric furnace unit. Then, in 1,5-2 seconds these phases are disconnected from power supply.

The research hereinafter has been performed grounding on mathematical modelling. Named research has shown that application of phase-controlled furnace switch allows reducing the most probable maximum amplitude of magnetization current inrush in the windings of network transformer from 2,29 to 1,39 relative units. This limitation of MCI amplitude increases the reliability of network transformer by significant decreasing of electrodynamic effects in its windings.