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WAYS TO IMPROVE POWER QUALITY UNDER THE CONDITIONS OF INDUSTRIAL ENTERPRISES

Wide experience has been accumulated by now in the field of research concerning power quality effect on the operation of cage-rotor asynchronous motors. For instance, while studying the problems, connected with qualitative estimation of damage by the abovementioned electromechanical converters operating under the conditions of supply voltage asymmetry, authors of paper [1] have concluded that at k_{2U} =3.5% value, motor winding temperature increases by 25%. Paper [2] has determined that operation life of an asynchronous motor halves, if voltage unbalance ratio increases by 4% in terms of negative k_{2U} sequence.

Paper [3] points out that operation of an asynchronous motor (AM) under the conditions of supply voltage anharmonicity involves such negative factors as decrease in the power coefficient and in the torque on the electric machine shaft. It has been defined that each 2.5% of voltage increment factors into 3-3.9% loss in the asynchronous motor as well as in almost 5% increase of the consumed reactive power which influences negatively its power efficiency [3].

It is also known that if noisy supply voltage takes place, attention should be paid to electrical drive systems since the abovementioned results in their decreased reliability and efficiency with the following significant decrease in technical-and-economic indices of numerous production operations. Increase in the capacity loss within asynchronous motors with their excessive heat happens when power quality deteriorates. In turn, that favours intensive insulation deprecation and its fault.

Specifically, during a year, low- and average-power transverter consumes the amount of electric power that exceeds the cost of the motor by 3-5 times. At the same time, up to 75% of the production power is consumed by AM of the capacity (i.e. up to 75 kW). Thus, even 1% decrease in the motor efficiency due to noisy electricity is substantial economic damage for any enterprise.

Therefore, it is understood that power motors of enterprises face the necessity to implement measures reducing negative effect of noisy electricity on the energy efficiency of an enterprise. Use of “individual” LC-filters to protect extra important electric drives; use of “group” devices to compensate negative effect of noisy electricity at a workshop level (power active rectifiers are meant with their potential integration into the available converters for the controlled electric drives); and to inhibit voltage distortions within the areas of their origination (i.e. the mains protection against the root cause) are possible means to solve the problems. The latter is determined by the specific nature of the considered facilities. Moreover, it may involve modernization of a power part of electric drive as well as systems of the automated control; proper selection of the electric drive parameters etc.

The refusal to implement certain measures can also be permissible if they are not expedient economically. Indeed, each of the alternations is characterized by its specific measures: implementation cost and economic efficiency. Nevertheless, despite the problem topicality, Ukraine has not the unified methods to make economically sound decisions to reduce negative effect of noisy electricity on the energy efficiency of an enterprise.

It is known the basic available methods to improve power quality within the mains of enterprises or their workshops. They are classified in terms of quality indices which improvement is supposed: asymmetry, harmonicity distortion etc. The current tendencies involve the most promising developments in the area: active filtration of supply voltage and use of passive resonant filters.

References

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