

Three-Phase Induction Motors Energy Efficiency Standards - - A Case Study -

Cássio T. C. Andrade¹, Ricardo S. T. Pontes²

¹Regulatory Agency of the Delegated Public Services of Ceará (ARCE)
Av. Santos Dumont, 1789 – Térreo – Fortaleza – CE CEP 60000
Tel. 55 85 3101-1003, fax 55 85 3101 1000, e-mail: cassiotca@arce.ce.gov.br

²Electrical Engineer Department
Ceará Federal University
Caixa Postal 6001 – Campus do Pici – Fortaleza – CE CEP 60455-760
Tel./fax 55 85 3366-9942 e-mail: ricthe@dee.ufc.br

Abstract

Currently, the voluntary or mandatory regulation of machines and equipment efficiency levels has become a tendency in different countries around the world. This process began in the 70s and evolved to a complex system of energy performance labeling and standardization. In order to harmonize these different initiatives related to motors, there is an official initiative (SEEM - Standards for Energy Efficiency of Electric Motor Systems). The Three-phase induction motors appear as a priority in these processes because they are responsible for the largest percentage of energy consumption in the world (about 30%). These motors efficiency levels standardization began with the Energy Policy Act (EPACT) in the United States, which adopted the NEMA (National Electrical Manufacturers Association) standards for machines purchased in the country. This standard has evolved to the current Premium motors, with efficiency average rates of 93.3%. After the electrical energy supply crisis in 2001, the Brazilian government began to adopt regulations to improve the energy efficiency of electricity consumer's machinery and equipments. With this initiative, Brazil inserts itself into the small group of countries that regulates this subject. The Brazilian motor regulation has already achieved some results, and all the three-phase induction motors consumed in the country since 2003 obey the efficiency standards levels. However, only 15% of the total motor sales are of the high efficiency type, which is a modest result considering that in 2010 the resolution impose that all of the three phase induction motors purchased in the country should fit its efficiency levels. This paper analyzes the standardization progress of the three-phase induction motors efficiency levels in the main world regions, highlighting the Brazilian experience and comparing them with other countries initiatives. It also describes each one of the power losses that occurs in the induction motors: resistive, magnetic, mechanical and spray load losses. And emphasizes the technical challenges to reduce this losses, which demand improvements in the volume and quality of the active materials (core and conductors), innovations in the machine design, and manufacturing processes optimizations. In order to prove the results of the improve in Motors efficiency due to the standartization program, it is shown the laboratory measurements realized in both types of motors defined in the regulation (Standard and High Efficiency), which proves the advances in the Motors efficiency. This work shows the progress achieved in the brazilian industry, but the difference between national and international (Premium) induction Motors efficiency levels warns to a necessity for progress in research on materials, design and manufacturing processes.