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New Trends in Energy Efficient Electrical Machines

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Abstract

Today high efficiency electrical machines are a new and mandatory trend in the motor production in Europe and United States of America. Lately there are developed also higher efficiency classes as IE4 (Super Premium Efficiency) and IE5 (Ultra-Premium Efficiency). It is well known that IE4 electrical motors are available on the market and IE5 machines are taken into account by several big producers. Efficiency upgrade of the motors has very good consequences on the environmental problems. The efficiency classes (IE1-IE4) are described in the international standard IEC 60034-30. Line-start permanent magnet machines and Squirrel Cage induction motors can be upgraded, in order to have a bigger efficiency, according to IE4 specifications. In the case of variable speed machines variable reluctance synchronous motors are also included in the efficiency class IE4. In order to improve a motor to comply with the IE5 efficiency NdFeB or Ferrite magnets should be used.

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1. Introduction

The energy consumption of the electrical machines in industry is almost 40% of the total worldwide generated electrical energy and represents approximately 70% of the consumed energy in the EU (Fig. 1) [1, 2].

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Nomenclature

EcoDesign	it sets out the minimum mandatory requirements for the energy efficiency of products in EU
EN50347	an European standard, which defines the most important construction sizes of electrical machines
EU	European Union
IE1	standard efficiency
IE2	high efficiency
IE3	premium efficiency
IE4	super premium efficiency
IE5	ultra-premium efficiency
IEC	International Electrotechnical Commission
JIS	Japanese Industrial Standard
LSPM	synchronous Line-Start Permanent Magnet motors
LV	Low Voltage
MEPS	Minimum Energy Performance Standards
MV	Medium Voltage
NBR17094	Brazilian standard for three-phase squirrel cage induction motors
NdFeB	Neodymium Iron Boron alloy
NEMA	National Electrical Manufacturers Association
PO	Policy Options
PM	Permanent Magnet
PWM	Pulse Width Modulation
SANS	South African National Standard
SCIM	Squirrel Cage Induction Motors
SRM	Switched Reluctance Motors
VFD	Variable Frequency Drive
VRSM	Variable Reluctance Motors
VSD	Variable Speed Drive

The three phase squirrel cage induction motor is the most used type of electrical machine that has the largest market share and, an improvement of its energy efficiency could lead to a significant reduction of the consumed electricity. To achieve the energy saving policy limits, the electrical machine manufacturers introduce the variable-speed drive technology and in EU it is adopted in almost 30 % of the newly installed motors [3, 4].

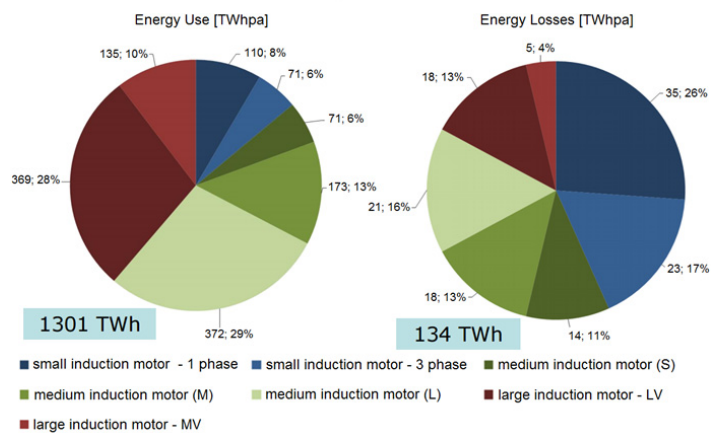


Fig. 1. Worldwide energy consumption and losses in different types of induction motors [1].

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