IEC 60034-30-3

Edition 1.0 2024-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Rotating electrical machines –
Part 30-3: Efficiency classes of high voltage AC motors (IE-code)

Machines électriques tournantes –
Partie 30-3: Classes de rendement des moteurs à courant alternatif à haute tension (code IE)

IEC 60034-30-3:2024-02(en-fr)

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FOREWORD

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The text of this International Standard is based on the following documents:

Draft	Report on voting
2/2131/CDV	2/2160/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60034 series, published under the general title *Rotating electrical machines*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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- withdrawn, or
- revised.

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INTRODUCTION

This document provides the global harmonization of energy-efficiency classes of three-phase cage induction motors with rated voltage above 1 000 V that are rated for direct online starting and fixed-speed operation at a 50 Hz or 60 Hz supply with sinusoidal voltage.

For these motors, the demands of the power supply and of the driven equipment in many cases govern the design of the electrical machine. Due to the large size and power of high-voltage (HV) motors, these demands are more complex than for low-voltage motors and often limit the design. Vice versa, the properties of the electrical machine itself influence the grid considerably in many cases.

In order to ensure an easy applicability of this document, the scope is limited to the most relevant applications, i.e. motors for driving the vast majority of pumps, fans, or compressors, which cover approximately 80 % to 90 % of all applications. Motors for special applications, e.g. for accelerating very high load inertia, for very low supply voltage during starting, for very low locked-rotor current or for accelerating against high load torque, are therefore out of the scope of this document.

Despite this, the motor technology, namely

- rated voltage,
- method of cooling,
- locked-rotor current,

have a significant influence on the achievable motor efficiency as well as the rated frequency, the rated power and the number of poles, and are considered when specifying the efficiency class.

NOTE When specifying or designing a power drive system, low voltage motors will mostly have a higher efficiency than high voltage motors with the same rated power. However, considering the losses of the complete system, i.e. including cabling and transformer losses, high voltage solution might be advantageous.

ROTATING ELECTRICAL MACHINES –

Part 30-3: Efficiency classes of high voltage AC motors (IE-code)

1 Scope

This part of IEC 60034 specifies efficiency classes for fixed-speed three-phase high-voltage cage induction motors in accordance with IEC 60034-1 that

- have a rated voltage exceeding 1 000 V, but not exceeding 11 kV;
- have a rated power from 200 kW to 2 000 kW;

  NOTE 1 Motors with rated power above 2 000 kW are produced in such small numbers and are designed and produced with a focus on achieving an optimum efficiency anyway, even though fulfilling increasingly special requirements that assigning efficiency classes would be an additional effort without the result of any countable energy saving.
- have two, four or six poles;
- are rated for single-speed line-operation;
- are intended for direct-on-line starting at rated or at reduced voltage and rated frequency;
- are constructed to any degree of protection;
- are designed for cooling methods IC411, IC511, IC611, IC01 or IC81W;
- are capable of continuous operation at their rated operating point (torque/power, speed) with a temperature rise within the specified insulation temperature class;

  NOTE 2 Most motors covered by this document are rated for duty type S1 (continuous duty). However, some motors that are rated for other duty cycles are still capable of continuous operation at their rated power and these motors are also covered.
- are rated for any ambient temperature or coolant temperature within the range of – 20 °C to + 60 °C;

  NOTE 3 Motors rated for temperatures outside the range – 20 °C and + 60 °C are considered to be of special construction and are consequently excluded from this document.
- are rated for an operating altitude up to 2 000 m above sea level;

  NOTE 4 The rated efficiency and the efficiency class are based on a rating for altitudes up to 1 000 m above sea level.
- have a locked-rotor current I_l at stand-still and supply with rated voltage and frequency before application of any IEC or agreed tolerance in the range $I_\mathrm{l} / I_\mathrm{N} \geq 4{,}5$;
- are designed for a customer load torque during starting not exceeding an envelope with a minimum of 25 % of the rated torque at low speed and a square shape $T \sim n^2$ up to a maximum load torque at full speed of 60 % of the rated torque in case of 2 pole motors or 100 % of the rated torque in case of 4 pole or 6 pole motors, respectively, (see Figure 1), After starting is completed, the load torque of 2 pole motors is increased to 100 % of the rated torque;
- have to accelerate an external moment of inertia as defined by the customer requirements not exceeding the values given in Table 1 considering all start up conditions defined in this document for not more than three consecutive starts from cold condition or two starts from hot condition, respectively;
- are designed for a minimum locked-rotor steady state supply voltage of at least 80 % of the rated voltage during starting.