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Rotating electrical machines -
Part 26: Effects of unbalanced voltages on the performance of three-phase cage induction motors

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IEC 60034-26 has been prepared by IEC technical committee 2: Rotating machinery. It is an International Standard.

This second edition cancels and replaces the first edition published in 2006. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) clarification that voltages are line-to-line voltages in Clause 4, Annex A and Annex B;

b) addition of design NE according to IEC 60034-12 in Clause 4.

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

Draft	Report on voting
2/2224/CDV	2/2251/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 of IEC 60034 series, 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

– reconfirmed,

– withdrawn, or

– revised.

INTRODUCTION

When the line voltages applied to a three-phase cage induction motor are not ~~equal~~ a balanced, symmetric three-phase system, the currents in the phases of the stator winding will also be unequal. A small percentage voltage unbalance will result in a much larger percentage current unbalance.

The application of unbalanced voltages to a three-phase induction motor introduces a negative sequence voltage, and this produces a flux in the air-gap~~, a flux~~ rotating against the rotation of the rotor, thus ~~tending to produce high currents~~ having a slip of almost 200 %. For high values of the slip, the motor impedance is low, thus tending to produce a high negative sequence current in the stator winding and high currents in the rotor cage. A small negative sequence voltage ~~may~~ can produce currents in the ~~windings~~ winding phases considerably in excess of those present under balanced voltage conditions. Consequently, the temperature rise of the motor operating at a particular load and a particular percentage of voltage unbalance will be ~~greater~~ higher than for the motor operating under the same conditions with balanced voltages.

The analytical and graphical methods used to calculate the symmetrical components from the voltage readings of the three phases are well-known and can be taken from textbooks. Thus, these calculation schemes are not incorporated in this document but shown in the informative Annex A. Besides, the evaluation of the symmetrical components can be done automatically by modern instrumentation.

An approximate evaluation of imbalance is given in the informative Annex B.