SLOVENSKI STANDARD
SIST-TS CLC/TS 60034-24:2011

01-april-2011

Električni rotacijski stroji - 24. del: Sprotno odkrivanje in diagnostika mogočih odpovedi na aktivnih delih električnih rotacijskih strojev in ležajnih tokov - Navodilo za uporabo (IEC/TS 60034-24:2009)

Rotating electrical machines - Part 24: Online detection and diagnosis of potential failures at the active parts of rotating electrical machines and of bearing currents - Application guide (IEC/TS 60034-24:2009)

Drehende elektrische Maschinen - Teil 24: Erkennung und Diagnose von möglichen Schäden an den Aktivteilen drehender elektrischer Maschinen und von Lagerströmen - Anwendungsleitfaden (IEC/TS 60034-24:2009)

Machines électriques tournantes - Partie 24: Détection et diagnostic en ligne de défaillances potentielles des parties actives de machines électriques tournantes et de courants de palier - Guide d'application (CEI/TS 60034-24:2009)

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This Technical Specification was approved by CENELEC on 2011-01-25.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

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Foreword

The text of the Technical Specification IEC/TS 60034-24:2009, prepared by IEC TC 2, Rotating machinery, was submitted to the formal vote and was approved by CENELEC as CLC/TS 60034-24 on 2011-01-25.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following date was fixed:

– latest date by which the existence of the CLC/TS has to be announced at national level (doa) 2011-07-25

Endorsement notice

The text of the Technical Specification IEC/TS 60034-24:2009 was approved by CENELEC as a Technical Specification without any modification.

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ROTATING ELECTRICAL MACHINES –

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FOREWORD

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 60034-24, which is a technical specification, has been prepared by IEC technical committee 2: Rotating machinery.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
2/1537/DTS	2/1553A/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

NOTE A table of cross-references of all IEC TC 2 publications can be found in the IEC TC 2 dashboard on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Progress in design and technology has resulted in an increasing reliability of rotating electrical machines, but failures could not be eliminated completely. Since the demand for a high availability is permanently increasing, it is essential to detect deficiencies at an early stage and to recognize the origin and identify the severity of the fault in order to estimate the risk of a continuation of operation.

It would be advantageous, if the signals which are obtained by the detection methods presented in this guide, were suitable to distinguish the different failures from each other. By this means, the signal analysis can be used as input data of a complete monitoring system.

The aim of this guide is to present possible tools which are available for the intended purpose and to explain their advantages and disadvantages. The minimum requirements which shall be met by the various sensors will be discussed, whereas the detailed design rules are outside the scope of this technical specification.

This guide deals with the detection of failures at the active parts of multi-phase rotating machines (all kinds of winding faults in stator and rotor, cage deficiencies, eccentricities) and of bearing currents.

ROTATING ELECTRICAL MACHINES –

Part 24: Online detection and diagnosis of potential failures at the active parts of rotating electrical machines and of bearing currents – Application guide

1 Scope

This part of IEC 60034 is applicable to the on-line detection and diagnosis of failures at the active parts of multi-phase rotating electrical machines (induction and synchronous machines) and of bearing currents. The failure analysis includes:

– interturn faults;
– phase-to-phase short-circuits;
– double earth faults and single earth faults of motors with earth connection of the star-point;
– static and dynamic eccentricities;
– cage imperfection or defects (e.g. broken bars or end-rings);
– bearing currents.

This can be achieved by tools like search coils or other magnetic sensors or partly by the analysis of the terminal voltages and currents.

The detection of the following effects is excluded from the scope:

– vibration (covered by ISO standards, e.g. ISO 10816 and ISO 7919);
– partial discharge (covered by IEC 60034-27);
– single earth-faults of motors without earth connection of the star-point;
– core imperfection.

Also excluded are special methods applicable for specific applications only (e.g. turbo generators).

2 Normative references

There are no normative references in this technical specification.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
distribution factor
the factor, related to a distributed winding, which takes into account the reduction in the generated voltage due to the phase difference between the voltages generated in the coils in different slots

[IEV 411-38-37]

3.2
chording (pitch) factor
the factor, related to a distributed winding, which takes into account the reduction in the generated voltage, when the winding pitch is not 100 %

[IEV 411-38-38]

3.3
branch factor
the factor, related to a distributed winding, which takes into account the reduction in the generated voltage due to the phase difference between the voltages generated in the series-connected branches

4 Basis of the diagnosis

The ability of electrical machines to operate is based on the existence of a magnetic field in the air-gap, which is looping in a cross-sectional area of the laminations of stator and rotor. Flux components in the end-portions of the machine outside the cores are of a parasitic nature. Therefore available signals suitable for the detection of potential faults originate from the magnetic field in the air-gap, which shall be analyzed in order to distinguish between those components which occur under regular operating conditions and those components which are attributed to a specific failure and which do not exist in a healthy machine.

Since the winding producing the magnetic field consists of coils distributed symmetrically around the circumference and since the sum of the supplying currents is usually zero, the air-gap field forms also a periodic function along the circumference. The wave of the flux density can be considered as the superposition of a sum of sinusoidally distributed waves, which are characterized by the following features:

– amplitude,
– number of pole-pairs,
– angular velocity,
– phase-angle,
– type of wave (rotating or standing).

Table 1 shows the composition of the air-gap field in the case of a three-phase cage induction motor, which is equipped with an integral slot winding. The table can easily be extended to be valid also for fractional slot windings. Similar tables can be developed for slip-ring motors and all kinds of synchronous machines.