



DPC: 24 / 30494468 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 11 June 2024

Origin: International

Latest date for receipt of comments: 3 July 2024

Project No. 2024/01655

Responsible committee: PEL/2 Rotating electrical machinery

Interested committees:

Title: BS EN 60034-27-8 ED1 Rotating machinery

Part 27-8: Detection of interturn short-circuits in rotor windings of cylindrical rotor synchronous generator

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.
THIS DRAFT IS NOT CURRENT BEYOND 3 July 2024**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

Responsible Committee Secretary: **Committee Service Centre (BSI)**
Direct tel: **020 8996 7009**
E-mail: csc@bsigroup.com

AVA Documents
Document Sharing Hub

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



2/2200/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 60034-27-8 ED1

DATE OF CIRCULATION:

2024-06-07

CLOSING DATE FOR COMMENTS:

2024-08-02

SUPERSEDES DOCUMENTS:

2/2091/NP, 2/2119/RVN

IEC TC 2 : ROTATING MACHINERY

SECRETARIAT:

United Kingdom

SECRETARY:

Mr Charles Whitlock

OF INTEREST TO THE FOLLOWING COMMITTEES:

PROPOSED HORIZONTAL STANDARD:

☐

Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☐ SAFETY

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (SEE [AC/22/2007](#) OR [NEW GUIDANCE DOC](#)).

TITLE:

Rotating machinery - Part 27-8: Detection of interturn short-circuits in rotor windings of cylindrical rotor synchronous generator

NOTE FROM TC/SC OFFICERS:

Copyright © 2024 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

CONTENTS

1

2 FOREWORD 5

3 1 Scope..... 8

4 2 Normative References 8

5 3 Terms and Definitions 8

6 4 Background Explanation 11

7 5 Test Method Overview 17

8 6 Detection Method..... 14

9 7 Guidance for Interpreting Results..... 20

10

11 Annex A (informative) 21

12 Annex B (informative)..... 26

13 Bibliography 27

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ROTATING ELECTRICAL MACHINES –

Part 3-2: Detection of interturn short-circuit fault in cylindrical rotors synchronous generator

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60034-XX has been prepared by working group XX: , of IEC technical committee 2:

The text of this standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for the approval of this standard 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.

The committee has decided that the contents of this publication will remain unchanged until

66 the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data
67 related to the specific publication. At this date, the publication will be reconfirmed, withdrawn, replaced by
68 a revised edition, or amended.

INTRODUCTION

The cylindrical rotor of synchronous machine is an important product in the power industry and plays a significant role in the production of electric power globally. It is widely used in coal-fired, nuclear, gas power and biomass power generation. Because of the high rotating speed of cylindrical rotor synchronous generator, the interturn short circuit is a common fault which is a critical factor affecting the safe and stable operation of the unit. Cylindrical rotors are also used in high-speed synchronous motors.

This document establishes the testing conditions, testing methods and evaluation principles for detecting interturn short-circuit faults in the cylindrical rotors during manufacturing process, commissioning, maintenance and operation of synchronous machines. It is applicable to cylindrical rotor synchronous generators driven by steam turbines, or gas turbines, as well as synchronous motors and compensators. This document does not specify pass/fail criteria.

The test methods include the following:

- Air-gap magnetic flux method
- Vibration vs rotor current method
- Excitation current amplitude test
- Rotor AC impedance and power loss test
- Recurrent Surge Oscillography (RSO)
- Pole voltage and coil voltage drop test
- Turn voltage distribution test

ROTATING ELECTRICAL MACHINES –

Part 3-2: Detection of interturn short-circuit fault in cylindrical rotors synchronous machines

1 Scope

This document establishes the testing conditions, testing methods and evaluation principles for interturn short-circuit faults in the cylindrical rotors during manufacturing process, commissioning, maintenance and operation of synchronous machines.

This document is applicable to 2 and 4 pole cylindrical-rotor synchronous machines.

2 Normative References

The following referenced documents are indispensable for the application of this document, For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034-3 Rotating electrical machines-Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines and for synchronous compensators.

IEC 60034-2-1 Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles).

IEC 60050-411 International electrotechnical vocabulary-Part 411:Rotating electrical machines.

3 Terms and definitions

For the purposes of this document, the terms and definitions apply as given in IEC 60034-3, IEC 60050-411.

3.1

Field coil

For cylindrical rotor synchronous machines, a group of turns in a field winding, occupying one pair of slots.

3.2

Typical wave peaks

A group of voltage wave peaks induced from the detection coil and corresponding to the magnetic flux of each rotor slot.

3.3

Rotor/Stator slot wedge

A strip of material inserted in the slot space above the rotor/stator winding and which, by its keying or locking action, restrains the winding against radial movement.

3.4

Damping winding

A winding which is short-circuited, usually in the form of a cage, or can be short-circuited, the purpose of which is to suppress rapid changes in the flux linking it.

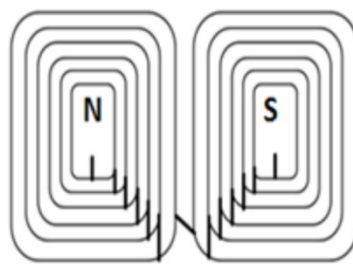


Figure 1 - Scheme connections of Rotor coil

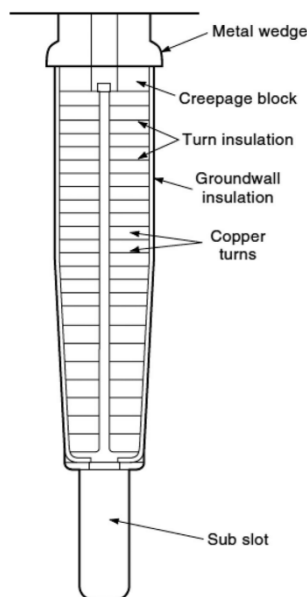


Figure 2 - Typical cross section of a turbine generator rotor slot

4 Background Explanation

The winding diagram for a 2 pole rotor is shown in Figure 1, and the cross section of a single slot on the rotor body showing the winding components is in Figure 2.

4.1 Impact of inter turn short circuit

Electrical faults (shorts) between the rotor winding turns may have little initial impact on the normal operation of the generator, and are often ignored. However, if the generator operates with inter turn shorts for a long time, local heating may cause the affected area to expand, lowering the resistance of the short. If additional inter turn shorts occur the shorts could deteriorate during operation and might cause a significant increase in the excitation current of the rotor, a relative decrease in reactive power, lead to a rotor winding earth fault and/or a significant increase in vibration. The deterioration of inter turn insulation in the rotor winding during operation can cause imbalanced heating of rotors in operation leading to excess vibration due to thermal bending of the rotor, as well as the magnetic force imbalance of two rotor poles. An increasing number of interturn faults over time indicates aging is occurring which could cause earth faults in the rotor and lead to a machine outage. Ground faults may magnetize the rotor shaft, and in severe cases with more than one ground fault, it will also cause catastrophic damage to the bearings and have a threat to the safe and stable operation of the unit.

4.2 Fault location

From numerous cases of generator rotor inter turn short circuits, a significant percentage of the inter turn short circuit fault happen at the corner of the rotor end winding (Figure 3). In some other cases, the interturn short circuit fault is located in the slot section of the rotor winding.