



SLOVENSKI STANDARD
oSIST prEN 60034-18-1:2020

01-november-2020

**Električni rotacijski stroji - 18-1. del: Funkcijsko ocenjevanje izolacijskih sistemov
- Splošne smernice**

Rotating electrical machines - Part 18-1: Functional evaluation of insulation systems -
General guidelines

Drehende elektrische Maschinen - Teil 18-1: Funktionelle Bewertung von
Isoliersystemen - Allgemeine Richtlinien

Machines électriques tournantes - Partie 18-1: Evaluation fonctionnelle des systèmes
d'isolation - Principes directeurs généraux

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Ta slovenski standard je istoveten z: prEN IEC 60034-18-1:2020

ICS:

29.080.30	Izolacijski sistemi	Insulation systems
29.160.01	Rotacijski stroji na splošno	Rotating machinery in general

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en,fr,de

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2/2015/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: IEC 60034-18-1 ED3	
DATE OF CIRCULATION: 2020-09-11	CLOSING DATE FOR VOTING: 2020-12-04
SUPERSEDES DOCUMENTS: 2/1970/CD, 2/1980A/CC	

IEC TC 2 : ROTATING MACHINERY	
SECRETARIAT: United Kingdom	SECRETARY: Mr Charles Whitlock
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY	
<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING	<input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING
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TITLE:

Rotating electrical machines – Part 18-1: Functional evaluation of insulation systems – General guidelines

PROPOSED STABILITY DATE: 2024

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ROTATING ELECTRICAL MACHINES –

**Part 18-1: Functional evaluation of insulation systems –
General guidelines**

FOREWORD

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International Standard IEC 60034-18-1 has been prepared by IEC technical committee 2: Rotating machinery.

This third edition cancels and replaces the second edition, published in 2010, and constitutes a technical revision.

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

- provides general guidelines for functional evaluation of different types of windings as before but incorporates those changes, which have been introduced for the electrical qualification and evaluation of windings which are electrically stressed by converter-supply;
- is now focused on general guidelines with all technical details of procedures and qualification principles moved to the subsequent parts;
- details additional general aspects of functional evaluation and qualification, particularly the procedure for comparison between reference and candidate insulation systems, the in-

roduction of the concept of qualification for different expected lifetimes in service and the evaluation of minor component or manufacturing changes;

The text of this standard is based on IEC 60034-18-1:2010

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.

NOTE A list 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 edition will remain unchanged until the stability 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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1

INTRODUCTION

2 IEC 60034-18 comprises several parts, dealing with different types of functional evaluation
3 and special kinds of test procedures for insulation systems of rotating electrical machines.
4 IEC 60034-18-1 provides general guidelines for such procedures and qualification principles,
5 whereas the subsequent parts IEC 60034-18-21, IEC 60034-18-31, IEC 60034-18-32,
6 IEC 60034-18-33, IEC 60034-18-34, IEC 60034-18-41 and IEC 60034-18-42 give detailed
7 procedures for the various types of windings. Beyond that, part IEC 60034-18-41 and
8 IEC 60034-18-42 contain special test procedures for electrical evaluation of windings
9 electrically stressed by converter-supply.

10 The following standards provide the basis and background for the development of the
11 previous standards:

12 IEC 60505 establishes the basis for estimating the ageing of electrical insulation systems
13 under conditions of either electrical, thermal, mechanical, environmental stresses or
14 combinations of these (multifactor stresses). It specifies the general principles and
15 procedures that should be followed defining functional test and evaluation procedures.

16 The IEC 60216 series deals with the determination of thermal endurance properties of single
17 insulating materials. On the assumption, that the Arrhenius equations describe the rate of
18 thermal ageing, test procedures and analyzing instructions for getting characteristic
19 parameters like the "Temperature index" (TI), the "Halving interval" (HIC) and the "Relative
20 thermal endurance index" (RTE) are given. For all these parameters selected properties and
21 accepted end-point-criteria are specified. Consequently, a material may be assigned with
22 more than one temperature index, derived from the measurement of different properties and
23 the use of different end-point criteria. IEC 60085 deals with thermal evaluation of electrical in-
24 sulation materials and in particular insulation systems used in electrical equipment ...". In par-
25 ticular, thermal classes of insulation systems are defined and designations are given, such as
26 130 (B), 155 (F) and 180 (H) for use in rotating machines belonging to IEC 60034-1. In the
27 past, materials for insulation systems were often selected solely on the basis of thermal en-
28 durance of individual materials performed according to the IEC 60216 series. However,
29 IEC 60085 recognizes that such selection may be used only for screening materials prior to
30 further functional evaluation of a new insulation system which is not service-proven. Evalua-
31 tion is performed on the basis of a comparison with a service-proven reference insulation sys-
32 tem. Service experience is the preferred basis for assessing the thermal endurance of an in-
33 sulation system.

34 IEC 62539 defines statistical methods to analyse times to breakdown and breakdown voltage
35 data obtained from electrical testing of solid insulation materials, for the purposes of
36 characterization of the system and comparison with other insulation systems. The methods of
37 analysis are described for the Weibull-distribution but other distributions are also presented.

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ROTATING ELECTRICAL MACHINES –

Part 18-1: Functional evaluation of insulation systems – General guidelines

44 1 Scope

45 This part of IEC 60034 deals with the general guidelines for functional evaluation of electrical
46 insulation systems, used or proposed to be used in rotating electrical machines within the
47 scope of IEC 60034-1, in order to qualify them.

48 2 Normative references

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

52 IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

53 IEC 60034-18-21, *Rotating electrical machines – Part 18-21: Functional evaluation of insula-
54 tion systems – Test procedures for wire-wound windings – Thermal evaluation and classifica-
55 tion*

56 IEC 60034-18-31, *Rotating electrical machines – Part 18-31: Functional evaluation of insula-
57 tion systems – Test procedures for form-wound windings – Thermal evaluation and classifica-
58 tion of insulation systems used in machines up to and including 50 MVA and 15 kV*

59 IEC 60034-18-32, *Rotating electrical machines – Part 18-32: Functional evaluation of insula-
60 tion systems – Test procedures for form-wound windings – Evaluation of electrical endurance
61 of insulation systems used in machines up to and including 50 MVA and 15 kV*

62 IEC 60034-18-33, *Rotating electrical machines – Part 18-33: Functional evaluation of insula-
63 tion systems – Test procedures for form-wound windings – Multifactor functional evaluation –
64 Endurance under combined thermal and electrical stresses of insulation systems used in ma-
65 chines up to and including 50 MVA and 15 kV*

66 IEC 60034-18-34, *Rotating electrical machines – Part 18-34: Functional evaluation of insula-
67 tion systems – Test procedures for form-wound windings – Evaluation of thermomechanical
68 endurance of insulation systems*

69 **IEC 60034-18-41 EDITION 1.1**, *Rotating electrical machines – Part 18-41: Partial discharge free
70 electrical insulation systems (Type I) used in rotating electrical machines fed from voltage converters -
71 Qualification and quality control tests / Combines IEC 60034-18-41 (2014-03) and AMD 1 (2019-06)*

72 **IEC 60034-18-42**, *Rotating electrical machines – Part 18-42: Partial discharge resistant electrical
73 insulation systems (Type II) used in rotating electrical machines fed from voltage converters - Qualifica-
74 tion tests IEC 60085, Thermal evaluation and designation of electrical insulation*

75 IEC 60216 (all parts), *Electrical insulating materials – Properties of thermal endurance*

76 IEC 60493-1, *Guide for the statistical analysis of ageing test data – Part 1: Methods based on
77 mean values of normally distributed test results*

78 IEC 60505:2004, *Evaluation and qualification of electrical insulation systems*

79 IEC 61858-1 (2014-02-01, valid) *Electrical insulation systems - Thermal evaluation of*

80 *modifications to an established EIS - Part 1: Wire-wound winding EIS*

81 *IEC 61858-2 (2014-02-01,valid) Electrical insulation systems - Thermal evaluation of*
82 *modifications to an established EIS - Part 2: Form-wound EIS*

83 IEC 62539, *Guide for the statistical analysis of electrical insulation breakdown data*

84 **3 Terms and definitions**

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

86 **3.1 General terms**

87 **3.1.1**

88 **class temperature**

89 temperature for which the insulation system is suitable, as defined by the thermal class in
90 IEC 60085 and as used in IEC 60505

91 **3.1.2**

92 **insulation system**

93 insulating structure containing one or more electrical insulating materials applied over con-
94 ducting parts employed in rotating electrical machines

95 [IEC 60505:2004, 3.1.1, modified]

96 NOTE 1 There may be several insulation components within the windings, each being designed for different
97 stresses in service, i.e. turn insulation, slot insulation and end-winding insulation. Different criteria may be applied
98 to the various components within the overall system.

99 NOTE 2 There may be more than one insulation system in a particular type of machine. These insulation systems
100 may have different thermal classes (e.g. stator and rotor windings).

101 **3.1.3**

102 **candidate insulation system**

103 insulation system being tested to determine its capability with respect to ageing factors

104 [IEC 60050-411, Amendment 1:2007, 411-39-26, modified]

105 **3.1.4**

106 **reference insulation system**

107 insulation system whose performance has been established by satisfactory service
108 experience

109 [IEC 60050-411, Amendment 1:2007, 411-39-27]

110 **3.1.5**

111 **coil**

112 one or more turns of insulated conductors connected in series and surrounded by common
113 insulation, arranged to link or produce magnetic flux

114 [IEC 60050-411:1996, 411-38-03, modified]

115 **3.1.6**

116 **bar**

117 either of two parts which, after placed in their slots and when connected together, will form
118 the complete form-wound coil (see 3.1.8) and which comprise a coil side and an appropriate
119 end winding

120 [IEC 60050-411:1996, 411-38-05, modified]

121 NOTE Large a.c. machines commonly use bars, and usually, though not always, they form single-turn coils in a
122 two-layer winding.

123 3.1.7

124 wire-wound winding

125 winding which is wound with one or several insulated conductors and in which the individual
126 conductors occupy random positions in the coil side

127 NOTE It is usually random-wound with round conductors.

128 [IEC 60050-411:1996, 411-38-13, modified]

129 3.1.8

130 form-wound winding

131 winding consisting of coils or bars which are preformed to shape, insulated and substantially
132 completed before they are inserted into their final places

133 NOTE Coils or bars are usually wound with rectangular conductors.

134 [IEC 60050-411:1996, 411-38-11, modified]

135 3.2 Terms relating to the objects being tested

136 3.2.1

137 test object

138 unit being tested

139 NOTE 1 It may be an actual machine or part thereof or a special test model (see 3.2.3 and 3.2.4) which can be
140 subjected to functional tests.

141 NOTE 2 A test object may contain more than one test specimen (see 3.2.2).

142 3.2.2

143 test specimen

144 individual component within a test object which can be used to generate one piece of test da-
145 ta (e.g. time to failure)

146 NOTE A test specimen may contain more than one insulation component (e.g. turn insulation and conductor to
147 earth insulation), any one of which can provide that piece of data.

148 3.2.3

149 formette

150 special test model used for the evaluation of the insulation systems for form-wound windings

151 [IEC 60050-411, Amendment 1:2007, 411-53-64]

152 3.2.4

153 motorette

154 special test model used for the evaluation of the insulation systems for wire-wound (random-
155 wound) windings

156 [IEC 60050-411, Amendment 1:2007, 411-53-65]

157 3.3 Terms relating to factors of influence and ageing factors

158 3.3.1

159 factor of influence

160 stress imposed by conditions of operation, environment or test that may affect ageing or life of
161 an insulation system

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