
Električni rotacijski stroji - 18-41. del: Kvalificiranje in preskusi pri obvladovanju kakovosti električnih izolacijskih sistemov brez delne razelektritve (tip I) v električnih rotacijskih strojih, ki jih napajajo napetostni pretvorniki

Rotating electrical machines - Part 18-41: Partial discharge free electrical insulation systems (Type I) used in rotating electrical machines fed from voltage converters - Qualification and quality control tests

Drehende elektrische Maschinen - Teil 18-41: Qualifizierung und Qualitätsprüfungen für teilentladungsfreie elektrische Isoliersysteme (Typ I) in drehenden elektrischen Maschinen, die von Spannungsumrichtern gespeist werden

Machines électriques tournantes - Partie 18-41: Systèmes d'isolation électrique sans décharge partielle (Type I) utilisés dans des machines électriques tournantes alimentées par des convertisseurs de tension - Essais de qualification et de contrôle qualité

Ta slovenski standard je istoveten z: prEN IEC 60034-18-41:2025

ICS:

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

oSIST prEN IEC 60034-18-41:2026 en,fr,de



2/2269/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:

IEC 60034-18-41 ED2

DATE OF CIRCULATION:

2025-11-14

CLOSING DATE FOR VOTING:

2026-02-06

SUPERSEDES DOCUMENTS:

2/2226/CD, 2/2252A/CC

IEC TC 2 : ROTATING MACHINERY

SECRETARIAT:

United Kingdom

SECRETARY:

Mr Charles Whitlock

OF INTEREST TO THE FOLLOWING COMMITTEES:

HORIZONTAL FUNCTION(S):

ASPECTS CONCERNED:

☒ SUBMITTED FOR CENELEC PARALLEL VOTING

☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

Attention IEC-CENELEC parallel voting

The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.

The CENELEC members are invited to vote through the CENELEC online voting system.

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 relevant "In Some Countries" clauses to be included should this proposal proceed. Recipients are reminded that the CDV stage is the final stage for submitting ISC clauses. (SEE [AC/22/2007](#) OR [NEW GUIDANCE DOC](#)).

TITLE:

Rotating electrical machines - Part 18-41: Partial discharge free electrical insulation systems (Type I) used in rotating electrical machines fed from voltage converters - Qualification and quality control tests

PROPOSED STABILITY DATE: 2029

NOTE FROM TC/SC OFFICERS:

Enclosed is the CD version I have received from the convenor.

Copyright © 2025 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	CONTENTS	1
2	FOREWORD	4
3	INTRODUCTION	6
4	1 Scope	9
5	2 Normative references	9
6	3 Terms and definitions	10
7	4 Impulse Voltage Insulation Class (IVIC) for Type I insulation systems used in converter fed machines	15
8	4.1 Rationale	15
9	4.2 Impulse Voltage Insulation Class (IVIC)	16
10	4.2.1 Phase-to-phase and phase-to-ground insulation	16
11	4.2.2 Turn-to-turn insulation	16
12	4.3 Machines with IVIC according to IEC 60034-18-41 Ed. 1	17
13	4.4 IVIC S machines	17
14	4.5 Machine plate and documentation	17
15	4.6 Guidelines for IVIC selection	18
16	4.6.1 Phase-to-phase and phase-to-ground insulation	18
17	4.6.2 Turn-to-turn insulation	18
18	5 Design qualification, type and routine (quality control) tests for Type I insulation systems	19
19	5.1 General	19
20	5.2 Design qualification test	19
21	5.3 Type tests	20
22	6 Qualification of the design of Type I insulation systems	20
23	6.1 General	20
24	6.2 Test samples	20
25	6.2.1 General	20
26	6.2.2 Twisted pair or equivalent arrangement	21
27	6.2.3 Motorette (random wound) or formette (form-wound)	21
28	6.2.4 Complete windings	21
29	6.3 Tests procedure	22
30	6.3.1 Aim	22
31	6.3.2 Diagnostic tests	22
32	6.3.3 Ageing cycle	22
33	6.3.4 PD tests	22
34	6.4 Pass criterion for the design qualification test	23
35	7 Type test procedure for Type I insulation systems	23
36	7.1 General	23
37	7.2 Impulse PD tests	24
38	8 Routine (quality control) tests	24
39	8.1 Routine withstand voltage test	24
40	8.2 Routine PD test	24
41	8.3 Special provisions for quantity produced or small sized machines	25
42	8.4 Analysis, reporting and classification	25
43	9 Test equipment	25

IEC CDV 60034-18-41 © IEC 2025

47	9.1	Voltage impulse generators.....	25
48	9.2	PD measurement during voltage impulses.....	26
49	9.3	Power frequency PD tests.....	26
50	Annex A (normative) Test circuits and voltage waveforms for impulse voltage		
51		generators.....	27
52	A.1	Test circuits and voltage settings.....	27
53	A.2	Correct setting of peak-to-peak voltage.....	27
54	A.3	Impulsive voltage rise time.....	29
55	A.4	Voltage impulse repetition frequency.....	29
56	A.5	Voltage waveform.....	29
57	Annex B (normative) Derivation of maximum allowable peak/peak voltages in service.....		32
58	Annex C (normative) Derivation of peak-to-peak voltages for qualification and		
59		type/routine (quality control) tests for two-levels machines.....	34
60	C.1	General.....	34
61	C.2	Derivation of peak-to-peak test voltages.....	35
62	C.3	Example of calculation of peak-to-peak test voltages.....	36
63	Annex D (normative) Derivation of routine withstand test voltages.....		38
64	Annex E (normative) PD-free pass/fall criteria during voltage tests.....		39
65	E.1	Impulse voltage PD tests.....	39
66	E.2	Power frequency PD tests.....	39
67	Annex F (informative) Machine terminal voltages arising from converter operation.....		40
68	F.1	General considerations.....	40
69	F.2	Calculation of DC bus voltage.....	40
70	F.3	Voltage overshoots.....	41
71	F.4	Voltage stress in the insulation system.....	42
72	F.4.1	Voltages stressing the phase-to-phase insulation.....	45
73	F.4.2	Voltages stressing the phase-to-ground insulation.....	45
74	F.4.3	Voltages stressing the turn and strand insulation.....	45
75	F.5	Terminal voltages calculation.....	45
76	F.6	Turn voltage calculation.....	46
77	F.7	Common mode stress.....	47
78	Annex G (informative) Mechanisms of insulation degradation.....		48
79	Annex H (informative) Measurement of the fraction of the terminal voltage appearing		
80		between turns ρ	49
81	H.1	General.....	49
82	H.2	Equipment Required.....	49
83	H.3	Connections.....	49
84	H.4	Measurements.....	50
85	Annex I (informative) Routes for qualification.....		51
86	I.1	General.....	51
87	I.2	Reduced functional evaluation.....	52
88	Bibliography.....		53

89
90

91	Figure 2 – Safe operation zone for a machine having IVIC C/C/B.....	18
92	Figure A.1 – Connection of the impulse voltage source. For phase-to-ground and	
93	phase-to-phase insulation tests, the rise time should exceed 500 ns.....	0
94	Figure A.2 – Impulse test voltage waveforms and the levels for applying the same	
95	peak/peak voltage of $2\rho U_j$ on the turn-to-turn insulation (schematic representation).	
96	The meaning of ρ is discussed in Annex F.5	1
97	Figure A.3 – Test voltages (V_{test} in Figure A.1) for phase-to-ground, phase-to-phase.	
98	and turn-to-turn impulse tests using a unipolar and repetitive bipolar square wave. In	
99	all figures, the peak-to-peak test voltage is the same (1000 V) but does not reflect the	
100	difference in the voltage applied during the tests due to, for instance, the different	
101	temperature enhancement factors.....	2
102	Figure F.1 – Voltage enhancement at the terminals of a motor due to reflection as a	
103	function of cable length for various impulse rise times	12
104	Figure F.2 – Example of a random wound design.....	13
105	Figure F.3 – Example of a form-wound design	13
106	Figure F.4 – Five step phase to phase voltage at the terminals of a machine fed by a 3-	
107	level converter	14
108	Figure F.5 – Jump voltage (U_j) at the machine terminals associated with a converter	
109	drive	14
110	Figure F.6 – Comparison of phase-to-phase, phase-to-ground, and turn-to-turn	
111	voltages for a 2-level converter	15
112	Figure F.8 – Worst case voltage stressing the turn-to-turn insulation in a variety of	
113	random wound stators as a function of the rise time of the impulse.....	17
114		
115	Table 1 – IVIC for the phase-to-phase and phase-to-ground insulation systems based	
116	on a 2-level converter	14
117	Table 2 – Worst case estimate of the fraction ρ based on the inverter rise time	14
118	Table A.1 – Example of settings of the impulse voltage source.....	25
119	Table B.1 – Maximum peak/peak operating voltages related to U_N for a 2-level	
120	converter according to the IVIC of Table 1	3
121	Table B.2 – Examples of maximum peak/peak operating voltage for a rated RMS	
122	voltage of 500 V winding fed from a 2-level converter, according to the IVIC of Table 1.....	3
123	Table C.1 – Summary of enhancement factors to be applied to the operating voltages.....	5
124	Table C.2 – Qualification tests: range of peak/peak voltages related to U_N for a 2-level	
125	converter according to the IVIC of Table 1	6
126	Table C.3 –Type and routine (quality control) test: range of peak/peak voltages related	
127	to U_N for a 2-level converter according to the IVIC of Table 1	6
128	Table C.4 – Examples of qualification test voltage ranges for a rated RMS voltage 500	
129	V winding fed from a 2-level converter, according to the IVIC of Table 1 and Table C.2.....	7
130	Table C.5 – Examples of type test and routine (quality control) test voltage ranges for	
131	of 500 V RMS rated winding fed from a 2-level converter, according to the stress	
132	categories of Table 1 and Table C.3.	7
133	Table D.1 – Withstand test voltages according to IVIC for Type I insulation systems.....	8
134	Table F.1 – Definition of symbols.....	10
135	Table F.2 – Reflection coefficients as a function of machine rated power (indicative	
136	values).....	11

137

138

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ROTATING ELECTRICAL MACHINES –

**Part 18-41: Partial discharge free electrical insulation systems (Type I)
used in rotating electrical machines fed from voltage converters –
Qualification and quality control tests**

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.

DISCLAIMER

This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of IEC 60034-18-41 bears the edition number 1.1. It consists of the first edition (2014-03) [documents 2/1728/FDIS and 2/1738/RVD], its amendment 1 (2019-06) [documents 2/1949/FDIS and 2/1957/RVD] and its corrigendum (2020-12). The technical content is identical to the base edition and its amendment.

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 60034-18-41 has been prepared by IEC technical committee 2: Rotating machinery.