SLOVENSKI STANDARD
SIST EN 60137:1997

01-november-1997

Insulated bushings for alternating voltages above 1 kV (IEC 137:1995)

Insulated bushings for alternating voltages above 1 kV

Isolierte Durchführungen für Wechselspannungen über 1kV

Traversées isolées pour tensions alternatives supérieures à 1 kV

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Ta slovenski standard je istoveten z: **EN 60137:1996**

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ICS:

29.080.20 Skoznjiki Bushings

SIST EN 60137:1997 **en**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD
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EN 60137

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Descriptors: Bushings, transformers, ceramic, glass, inorganic materials, resin, composite insulation

English version

Insulated bushings for alternating voltages above 1 kV (IEC 137:1995)

Traversées isolées pour tensions alternatives supérieures à 1 kV (CEI 137:1995)

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This European Standard was approved by CENELEC on 1995-11-28. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

The text of document 36A/45/FDIS, future edition 4 of IEC 137, prepared by SC 36A, Insulated bushings, of IEC TC 36, Insulators, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60137 on 1995-11-28.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-09-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-09-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 137:1995 was approved by CENELEC as a European Standard without any modification.

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 38 (mod)	1983	IEC standard voltages[1]	HD 472 S1	1989
IEC 50(212)	1990	International Electrotechnical Vocabulary (IEV) Chapter 212: Insulating solids, liquids and gases	-	-
IEC 50(471)	1984	Chapter 471: Insulators	-	-
IEC 59	1938	IEC standard current ratings	-	-
IEC 60-1	1989	High-voltage test techniques Part 1: General definitions and test requirements	HD 588.1 S1	1991
IEC 68-2-17	1994	Environmental testing Part 2: Tests - Test Q: Sealing	EN 60068-2-17	1994
IEC 71-1	1993	Insulation co-ordination Part 1: Definitions, principles and rules	EN 60071-1	1995
IEC 76-1	1993[2]	Power transformers Part 1: General	-	-
IEC 76-2	1993[3]	Part 2: Temperature rise	-	-
IEC 76-5 (mod)	1976	Part 5: Ability to withstand short-circuit	HD 398.5 S1	1983
IEC 216-2	1990	Guide for the determination of thermal endurance properties of electrical insulating materials Part 2: Choice of test criteria	HD 611.2 S1	1992

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1) The title of HD 472 S1 is : Nominal voltages for low voltage public electricity supply systems.

2) IEC 76-1:1976, mod. is harmonized as HD 398.1 S1:1980.

3) IEC 76-2:1976, mod. is harmonized as HD 398.2 S1:1980.

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Publication	Year	Title	EN/HD	Year
IEC 233	1974	Tests on hollow insulators for use in electrical equipment	HD 329 S1	1977
IEC 270	1981	Partial discharge measurements	-	-
IEC 354	1991	Loading guide for oil-immersed power transformers (corrigendum 1992)	-	-
IEC 505	1975	Guide for the evaluation and identification of insulation systems of electrical equipment	-	-
IEC 507	1991	Artificial pollution tests on high-voltage insulators to be used on a.c. systems	EN 60507	1993
IEC 517	1990	Gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above	EN 60517[4)]	1996
IEC 815	1986	Guide for the selection of insulators in respect of polluted conditions	-	-
IEC 943	1989	Guide for the specification of permissible temperature and temperature rise for parts of electrical equipment, in particular for terminals	-	-
IEC 1264	1994	Ceramic pressurized hollow insulators for high-voltage switchgear and controlgear	-	-

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4) IEC 517 includes the corrigendum April 1995 and A1:1994 to IEC 517.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INSULATED BUSHINGS FOR ALTERNATING VOLTAGES ABOVE 1000 V

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.

3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.

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4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

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5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 137 has been prepared by sub-committee 36A: Insulated bushings, of IEC technical committee 36: Insulators.

This fourth edition cancels and replaces the third edition published in 1984 and constitutes a technical revision.

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

FDIS	Report on voting
36A/45/FDIS	36A/55/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.

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INTRODUCTION

In this edition of IEC 137 special account is taken of the requirements for bushings to be fitted to transformers, and the range of bushings addressed in this edition has been extended to include bushings of rated voltages equal to or less than 52 kV made of ceramic, glass or inorganic materials, resin or composite insulation.

Many clauses have been modified, considering the evolution of technology, and to align with current revisions of the IEC standards. New types of bushings, e.g. gas-filled, gas-insulated and gas-impregnated bushings, are considered.

For bushings fitted to transformers special requirements not considered necessary for bushings fitted to switchgear, or used for other applications have been addressed. A high level of integrity is needed to ensure that the bushing will not fail, or be the initiator of internal flashover in the transformer under test. Dry power-frequency withstand test voltage levels for transformers bushings should be increased according to 8.3.

The dynamic current withstand test is not mentioned in the text, because insufficient experience has so far been collected to design a realistic test.

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INSULATED BUSHINGS FOR ALTERNATING VOLTAGES ABOVE 1000 V

1 General

1.1 *Scope*

This International Standard specifies the characteristics and tests for insulated bushings.

This standard is applicable to bushings, as defined in clause 2, intended for use in electrical apparatus, machinery, transformers, switchgear and installations for three-phase alternating current systems, having rated voltages above 1000 V and power-frequencies of 15 Hz up to and including 60 Hz.

Special requirements and tests for transformer bushings in this standard apply also to reactor bushings.

This standard may also be used analogously for bushings for use in other than three-phase systems, e.g. for rectifiers, testing transformers, or for terminals for power cables (potheads) and capacitors. Such bushings should be subject to special agreement between purchaser and supplier.

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This standard is not applicable to insulating structures similar to bushings, which are used as support insulators inside metal-enclosed switchgear.

This standard is applicable to bushings made and sold separately. Bushings which are a part of an apparatus and which cannot be tested according to this standard should be tested with the apparatus of which they form part.

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1.2 *Normative references*

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties involved in agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 38: 1983, *IEC standard voltages*

IEC 50(212): 1990, *International Electrotechnical Vocabulary (IEV) – Chapter 212: Insulating solids, liquids and gases*

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IEC 50(471): 1984, *International Electrotechnical Vocabulary (IEV) – Chapter 471: Insulators*

IEC 59: 1938, *IEC standard current ratings*

IEC 60-1: 1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 68-2-17: 1994, *Environmental testing – Part 2: Tests – Test Q: Sealing*

IEC 71-1: 1993, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 76-1: 1993, *Power transformers – Part 1: General*

IEC 76-2: 1993, *Power transformers – Part 2: Temperature rise*

IEC 76-5: 1976, *Power transformers – Part 5: Ability to withstand short circuit*

IEC 216-2: 1990, *Guide for the determination of thermal endurance properties of electrical insulating materials – Part 2: Choice of test criteria*

IEC 233: 1974, *Test on hollow insulators for use in electrical equipment*

IEC 270: 1981, *Partial discharge measurements*

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IEC 354: 1991, *Loading guide for oil-immersed power transformers*

IEC 505: 1975, *Guide for the evaluation and identification of insulation systems of electrical equipment*

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IEC 507: 1991, *Artificial pollution tests on high-voltage insulators to be used on a.c. systems*

IEC 517: 1990, *Gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above*

IEC 815: 1986, *Guide for the selection of insulators in respect of polluted conditions*

IEC 943: 1989, *Guide for the selection of permissible temperature and temperature rise for parts of electrical equipment, in particular for terminals*

IEC 1264: 1994, *Ceramic pressurized hollow insulators for high-voltage switchgear and controlgear*

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2 Definitions

For the definitions of generally used terms in the present standard, reference should be made to IEC 50(471).

For the purposes of this International Standard, the following definitions apply.

2.1 **bushing:** Device that enables one or several conductors to pass through a partition such as a wall or a tank, and insulates the conductors from it. The means of attachment (flange or fixing device) to the partition forms part of the bushing. [IEV 471-02-01, modified]

NOTES

1 The conductor may form an integral part of the bushing or be drawn into the central tube of the bushing.

2 The bushing may be of the types as prescribed in 2.2 to 2.20.

2.2 **liquid-filled or compound-filled bushing:** Bushing in which the space between the inside surface of the insulating envelope and the solid major insulation is filled with oil, or an insulating compound.

2.3 **liquid-insulated bushing:** Bushing in which the major insulation consists of oil or another insulating liquid.

2.4 **gas-filled bushing:** Bushing in which the space between the inside surface of the insulating envelope and the solid major insulation is filled with gas (other than ambient air) at atmospheric pressure or higher.

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NOTE – This definition includes bushings which are intended to form an integral part of gas-insulated equipment, the gas of the equipment being in communication with that of the bushing.

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2.5 **gas-insulated bushing:** Bushing in which the major insulation consists of gas (other than ambient air) at atmospheric pressure or higher.

NOTES

1 This definition includes bushings which are intended to form an integral part of gas-insulated equipment, the gas of the equipment being in communication with that of the bushing.

2 A bushing which contains solid insulating materials other than the envelope containing the gas (e.g. support for conducting layers or insulating cylinder), is a composite bushing (see 2.12).

2.6 **gas-impregnated bushing:** Bushing in which the major insulation consists of a core wound from paper or plastic film and subsequently treated and impregnated with gas (other than ambient air) at atmospheric pressure or higher, the space between the core and the insulating envelope being filled with the same gas.

2.7 **oil-impregnated paper bushing (OIP):** Bushing in which the major insulation consists of a core wound from paper and subsequently treated and impregnated with an insulating liquid, generally transformer oil. The core is contained in an insulating envelope, the space between the core and the insulating envelope being filled with the same insulating liquid as that used for impregnation.

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2.8 **resin-bonded paper bushing (RBP):** Bushing in which the major insulation consists of a core wound from resin-coated paper. During the winding process, each paper layer is bonded to the previous layer by its resin coating and the bonding achieved by curing the resin.

A resin-bonded paper bushing can be provided with an insulating envelope, in which case the intervening space shall be filled with an insulating liquid or another insulating medium.

2.9 **resin-impregnated paper bushing (RIP):** Bushing in which the major insulation consists of a core wound from untreated paper and subsequently impregnated with a curable resin.

A resin-impregnated paper bushing can be provided with an insulating envelope, in which case the intervening space shall be filled with an insulating liquid or another insulating medium.

2.10 **ceramic, glass or analogous inorganic material bushing:** Bushing in which the major insulation consists of a ceramic, glass or analogous inorganic material.

2.11 **cast or moulded resin-insulated bushing:** Bushing in which the major insulation consists of a cast or moulded organic material with or without an inorganic filler.

2.12 **composite bushing:** Bushing in which the major insulation consists of a combination of at least two different insulating materials.

2.13 **capacitance graded bushing:** Bushing, in which a desired voltage grading is obtained by an arrangement of conducting or semiconducting layers incorporated into the insulating material. [IEV 471-02-02, modified]

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2.14 **indoor bushing:** Bushing, both ends of which are intended to be in ambient air at atmospheric pressure, but not exposed to outdoor atmospheric conditions. [IEV 471-02-03, modified]

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NOTE – This definition includes bushings operating in air at temperatures above ambient, such as occur with air-insulated ducting.

2.15 **outdoor bushing:** Bushing, both ends of which are intended to be in ambient air at atmospheric pressure and exposed to outdoor atmospheric conditions. [IEV 471-02-04]

2.16 **outdoor-indoor bushing:** Bushing, both ends of which are intended to be in ambient air at atmospheric pressure. One end is intended to be exposed to outdoor atmospheric conditions, and the other end not to be exposed to outdoor atmospheric conditions. [IEV 471-02-05, modified]

2.17 **indoor-immersed bushing:** Bushing, one end of which is intended to be in ambient air but not exposed to outdoor atmospheric conditions and the other end to be immersed in an insulating medium other than ambient air (e.g. oil or gas). [IEV 471-02-06]