

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Insulated bushings for alternating voltages above 1 000 V

Traversées isolées pour tensions alternatives supérieures à 1 000 V

IEC 60137:2008

<https://standards.iteh.ai/catalog/standards/iec/adb2d08d-f7af-4e41-ba52-6c1747258d4b/iec-60137-2008>



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INSULATED BUSHINGS FOR ALTERNATING
VOLTAGES ABOVE 1 000 V**

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International Standard IEC 60137 has been prepared by sub-committee 36A: Insulated bushings, of IEC technical committee 36: Insulators.

This sixth edition cancels and replaces the fifth edition, published in 2003, and constitutes a technical revision.

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

- Long duration power-frequency for transformer bushings.
- Special requirements for type and acceptance tests applicable to transformer and GIS bushings.
- Specific insulation levels for bushings fitted to transformers and GIS.
- According to IEC Guide 111, clauses relating to safety and the environment have been added.
- The altitude correction procedure has been revised ($> 1\ 000\text{ m}$).

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

FDIS	Report on voting
36A/134/FDIS	36A/135/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 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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WITHDRAWN

INTRODUCTION

In the preparation of this standard further consideration has been given to the test requirements for power transformers as described in IEC 60076-3:2000. Extensions have been made to the requirements for lightning impulse type testing and an additional test - long duration power-frequency withstand test - has been included.

In anticipation of changes in the creepage correction factors defined in IEC 60815 and currently under review by TC 36, details of the correction method have been removed from this standard.

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INSULATED BUSHINGS FOR ALTERNATING VOLTAGES ABOVE 1 000 V

1 Scope

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

This standard is applicable to bushings, as defined in Clause 3, intended for use in electrical apparatus, machinery, transformers, switchgear and installations for three-phase alternating current systems, having highest voltage for equipment above 1 000 V and power frequencies of 15 Hz up to and including 60 Hz.

Subject to special agreement between purchaser and supplier, this standard may be applied, in part or as a whole, to the following:

- bushings used in other than three-phase systems;
- bushings for high-voltage direct current systems;
- bushings for testing transformers;
- bushings for capacitors.

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

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.

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 60038:1983, *IEC standard voltages*
Amendment 2 (1997)

IEC 60050(212):1990, *International Electrotechnical Vocabulary – Part 212: Insulating solids, liquids and gases*

IEC 60059, *IEC standard current ratings*

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-2-17:1994, *Basic environmental testing procedures – Part 2: Tests – Test Q: Sealing*

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60076-5, *Power transformers – Part 5: Ability to withstand short circuit*

IEC 60076-7: *Power transformers – Part 7: Loading guide for oil-immersed transformers*

IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2: Determination of thermal endurance properties of electrical insulating materials – Choice of test criteria*

IEC 60270, *High-voltage test techniques – Partial discharge measurements*

IEC 60376, *Specification of technical grade sulfur hexafluoride (SF₆) for use in electrical equipment*

IEC 60480, *Guidelines for the checking and treatment of sulphur hexafluoride (SF₆) taken from electrical equipment and specification for its re-use*

IEC 60505, *Evaluation and qualification of electrical insulation systems*

IEC 60815, *Guide for the selection of insulators in respect of polluted conditions*

IEC 61462, *Composite insulators – Hollow insulators for use in outdoor and indoor electrical equipment – Definitions, test methods, acceptance criteria and design recommendations*

IEC 61463, *Bushings – Seismic qualification*

IEC 62155, *Hollow pressurised and unpressurised ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V*

IEC 62217, *Polymeric insulators for indoor and outdoor use with nominal voltage greater than 1 000 V – General definitions, test methods and acceptance criteria*

IEC 62271 (all parts), *High-voltage switchgear and controlgear*

IEC 62271-1, *High-voltage switchgear and controlgear – Part 1: Common specifications*

IEC Guide 109, *Environmental aspects – Inclusion in electrotechnical product standards*

IEC Guide 111, *Electrical high-voltage equipment in high-voltage substations – Common recommendations for product standards*

CISPR 16-1 (all parts), *Specification for radio disturbance and immunity measuring apparatus and methods*

CISPR 18-2, *Radio interference characteristics of overhead power lines and high-voltage equipment – Parts 2: Methods of measurement and procedure for determining limits*

3 Terms and definitions

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

3.1

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]

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

NOTE 2 The bushing may be of the types as described in 3.2 to 3.21.

3.2

liquid-filled bushing

bushing in which the space between the inside surface of the insulating envelope and the solid major insulation is filled with oil

3.3

compound-filled bushing

bushing in which the space between the inside surface of the insulating envelope and the solid major insulation is filled with an insulating compound

3.4

liquid-insulated bushing

bushing in which the major insulation consists of oil or another insulating liquid

3.5

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

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.

3.6

gas-insulated bushing

bushing in which the major insulation consists of gas (other than ambient air) at atmospheric pressure or higher

NOTE 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.

NOTE 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 combined insulation bushing (see 3.13).

NOTE 3 A bushing in which the desired voltage grading is obtained by an arrangement of conducting or semi-conducting layers incorporated in an insulating material (e.g. plastic film) is referred to as a gas insulated condenser graded bushing.

3.7

gas-impregnated bushing

bushing in which the major insulation consists of a core wound from paper or plastic film (GIF) 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

3.8

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

NOTE 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.

3.9

resin-bonded paper bushing

RBP

bushing in which the major insulation consists of a core wound from resin-coated paper

NOTE 1 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.

NOTE 2 A resin-bonded paper bushing can be provided with an insulating envelope, in which case the intervening space can be filled with an insulating liquid or another insulating medium.

**3.10
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

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

**3.11
ceramic, glass or analogous inorganic material bushing**

bushing in which the major insulation consists of a ceramic, glass or analogous inorganic material

**3.12
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

**3.13
combined insulation bushing**

bushing in which the major insulation consists of a combination of at least two different insulating materials

**3.14
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 471-02-03]

**3.15
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 471-02-05]

**3.16
outdoor bushing**

bushing, both ends of which are intended to be in ambient air at atmospheric pressure and exposed to outdoor atmospheric conditions

[IEV 471-02-07]

**3.17
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 471-02-09]

**3.18
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)