

INTERNATIONAL STANDARD



Insulated bushings for alternating voltages above 1 000 V

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

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

This seventh edition cancels and replaces the sixth edition, published in 2008, and constitutes a technical revision.

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

- Resin-impregnated synthetic (RIS) bushings has been introduced.
- Bushings with $U_m \leq 1,1$ kV, $U_m = 1\ 100$ kV and $U_m = 1\ 200$ kV have been introduced.
- Temperature rise testing has been included for liquid-insulated bushings according to clause to 3.4.
- Introducing dry lightning impulse testing as a routine test for all transformer bushings with $U_m > 72,5$ kV.
- The altitude correction procedure has been revised ($> 1\ 000$ m).
- An explanation about Very Fast Transient (VFT) phenomenon and its impact on bushings has been included.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
36A/187/FDIS	36A/189/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

The contents of the corrigendum of May 2018 have been included in this copy.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

In the preparation of the current edition of this standard further consideration has been given to the test requirements for power transformers as described in IEC 60076-3:2000 2013. ~~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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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~~ 2010, *International Electrotechnical Vocabulary – Part 212: Electrical 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 2-17: 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 power 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 60296, *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear*

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

IEC 60422, *Mineral insulating oils in electrical equipment – Supervision and maintenance guidance*

IEC 60480, *Guidelines for the checking and treatment of sulfur 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 TS 60815-1, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

IEC TS 60815-2, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems*

IEC TS 60815-3, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems*

IEC 61099, *Insulating liquids – Specifications for unused synthetic organic esters for electrical purposes*

IEC 61462, *Composite hollow insulators – ~~Hollow~~ Pressurized and unpressurized insulators for use in ~~outdoor and indoor~~ electrical equipment with rated voltage greater than 1 000 V – Definitions, test methods, acceptance criteria and design recommendations*

IEC TS 61463, *Bushings – Seismic qualification*

IEC 62155:2003, *Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V*

IEC 62217, *Polymeric HV 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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

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

Note 1 to entry: 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.~~

[SOURCE: IEC 60050-471:2007, 471-02-01]

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 mineral oil or other insulating liquid

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 mineral oil or another insulating liquid, enclosed by an insulating envelope

Note 1 to entry: These bushings are often of an open design which require proper processing after installation in order to avoid trapped air and subsequent partial discharges during testing or in service.

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 1 to entry: 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.