SLOVENSKI STANDARD
SIST EN 50336:2022

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Nadomešča:
SIST EN 50336:2004

Skoznjiki za transformatorje in reaktorska kabelska ohišja do vključno 36 kV

Bushings for transformers and reactor cable boxes not exceeding 36 kV

Durchführungen für Kabelanschlusskästen von Transformatoren und Drosselspulen bis 36 kV

Traversées pour boîtes à câbles de transformateurs et bobines d'inductance ne dépassant pas 36 kV

Ta slovenski standard je istoveten z: **EN 50336:2021**

ICS:

29.080.20	Skoznjiki	Bushings
29.180	Transformatorji. Dušilke	Transformers. Reactors

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EUROPEAN STANDARD

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EN 50336

April 2021

ICS 29.080.20; 29.180

Supersedes EN 50336:2002 and all of its amendments and corrigenda (if any)

English Version

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Durchführungen für Kabelanschlusskästen von Transformatoren und Drosselspulen bis 36 kV

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

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European foreword

This document (EN 50336:2021) has been prepared by CLC/TC 36A “Insulated bushings”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2022-03-30
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2024-03-30

This document supersedes EN 50336:2002 and all of its amendments and corrigenda (if any).

EN 50336:2021 includes the following significant technical changes with respect to EN 50336:2002:

— 3.1 – Minimum IP rating removed from air filled cable boxes.

— 3.4 and 3.5 – EN 60137 added as a reference specification.

— 4.1 – Clarification that transformer side bushing connection is to be fully immersed in insulating liquid.

— 4.3.1 – EN 62155 referenced as standard rather than HD.

— Table 1 – Material corrected on the 400 and 630A rated items from brass to copper.

— 4.4.2 – Time frame for temperature cycle testing added.

— 4.4.3.3 – Test criteria clarified for applications over 1.1kV.

— Table 2 – Corrected L3 dimension on 36kV bushings from 250 mm - 350 mm.

— Figure 9 / Table 9 – D2 dimension added to show required plain connection size for the range of terminals.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

1 Scope

This document is applicable to insulated bushings, excluding those plug-in bushings specified by EN 50180 series, for use in air insulated, shroud insulated and fully insulated cable boxes for liquid filled transformers and reactors for rated voltages up to 36 kV, and rated currents up to 4 000 A at frequencies from 15 Hz to 60 Hz.

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.

EN 60137, *Insulated bushings for alternating voltages above 1 000 V (IEC 60137)*

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

IEC 60296, *Fluids for electrotechnical applications - Mineral insulating oils for electrical equipment*

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:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
air insulated cable box
metallic weatherproof enclosure designed to protect the ends of cables and their associated bushings using air as the primary source of insulation

3.2
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

[SOURCE: EN 60137:2017, 3.13]

3.3
ceramic, glass or analogous inorganic material bushing
bushing in which the major insulation consists of a ceramic, glass or analogous inorganic material

[SOURCE: EN 60137:2017, 3.12]

3.4
fully insulated cable box
metallic weatherproof enclosure as in 3.1 where those parts of the termination and bushing within the enclosure including live metal parts and cable cores are insulated by a liquid or compound suitable for the appropriate system voltage

Note 1 to entry: The box shall be suitably sealed to contain the liquid or compound and allow for their expansion due to temperature changes.

3.5
shroud insulated cable box
metallic weatherproof enclosure as in 3.1 but within which the cable cores are terminated with local insulation enhancement, e.g. phase barrier, bushing protection or taping

4 Requirements

4.1 General requirements

Bushings specified by this document shall be installed with the transformer side of the bushing fully immersed in insulating liquid and the other end either;

— fully immersed in an insulating liquid;

— or with shrouded insulation in air;

— or in air but not exposed to external atmospheric conditions.

All current-carrying parts shall be tin plated in accordance with customer requirements.

NOTE IEC Guide 109 and EN 62542 provide guidance which could be used to minimize the impact of bushings on the environment during all phases of their life (including manufacturing, operation during service life, dismantling after their end life and disposal or recycling).

4.2 Ratings

4.2.1 Standard values of rated voltage for ceramic insulators (U_r)

The value of U_r of a bushing shall be chosen from the standard values of the highest voltage for transformers and reactors U_m given below in kilovolts:

12 - 24 - 36

— For values of U_m less than 12kV bushings with U_r = 12kV shall be chosen

— For values of U_m greater than 12kV and less than or equal to 24kV bushings with U_r = 24kV shall be chosen.

— For values of U_m greater than 24kV and less than or equal to 36kV bushings with U_r = 36KV shall be chosen.

4.2.2 Standard values of rated voltage for resin-insulated bushings (U_r)

The value of U_m is 12kV in oil but the same item can be used at 1,1kV in air.

4.2.3 Standard values of rated current (I_r)

The value I_r of a bushing shall be chosen from the standard values given below in amperes:

250 - 400 - 630 - 800 - 1 250 - 1 600 - 2 000 - 2 500 - 3 150 - 4 000

4.3 Ceramic bushings

4.3.1 General requirements

Ceramic bushings shall meet the requirements for both type and routine tests laid out in EN 60137 and in addition the following shall also apply:

Bushings shall be capable of sealing a liquid filled chamber. The design of 24 kV and 36 kV bushings shall be such that free entry of liquid is allowed into the space between the conductor and the ceramic. In such instances the sealing integrity of the bushing shall be maintained.

Table 1 defines the conductor size, material and the dimensions of nuts for a given current rating of bushing.

Ceramic insulators in accordance with Figure 1 shall be used in air insulated cable boxes as defined in 3.1.

Ceramic insulators in accordance with Figure 2 shall be used in shrouded cable boxes as defined in 3.5 and fully insulated cable boxes as defined by 3.4.

The ceramic insulator will be in accordance to EN 62155. The glaze, which shall not be depended upon for insulation, shall cover all surfaces except the flat surfaces of the flange and the ends of the ceramic. The glaze colour shall be brown unless otherwise specified.

It is recommended that the mounting hole is of diameter D2 + 3 mm.

Each ceramic insulator shall be marked with the name or trade mark of the manufacturer and the month and year of manufacture. These marks shall be clearly legible after glazing and firing and not appear on the flange faces or end surfaces.

All ceramic insulators shall be subjected to tests in accordance with EN 62155.

4.3.2 Clamping arrangements

Bushing clamps shall be selected in accordance with Figure 3 or Figure 4 as appropriate. They shall be fitted to the transformer side unless otherwise specified. Bushing clamps fitted to the cable box side shall be subject to electrical testing in accordance with EN 60137.

4.3.3 Terminals

Bushing terminal arrangements for the cable box side are shown in Figures 5, 6 and 7. Terminal arrangements for the transformer side are shown in Figures 8 and 9.

Table 1 — Bushing conductor and nut specifications

Current I_r	Conductor			Brass nuts		
	Diameter	Material	Screw thread and pitch	Across flats	Across corners	Thickness
A	mm		mm	mm	mm	mm
250	12	Brass	12 × 1,75	19	21,90	7
400	16	Copper	16 × 2,0	24	27,70	8
630	20	Copper	20 × 2,0	30	34,60	9
800	24	Copper	24 × 2,0	36	41,60	10
1 250	30	Copper	30 × 2,0	46	53,10	12
1 600	36	Copper	36 × 2,0	55	63,50	14
2 000	42	Copper	42 × 3,0	65	75,10	18
2 500	45	Copper	45 × 3,0	70	80,80	18
3 150	48	Copper	48 × 3,0	75	86,60	18

4.4 Resin-insulated bushings

4.4.1 General requirements

Resin-insulated bushings shall meet the requirements for both Type and Routine tests as laid out in EN 60137 and in addition the following shall also apply:

The dimensions, style and arrangement of resin-insulated bushings shall be in accordance with Figure 10.

The conductor material shall be hard drawn high conductivity copper. Other materials may be used by agreement between customer and manufacturer.

Resin-insulated bushings shall not be adversely affected by continuous immersion in insulating liquids in accordance with the requirements of IEC 60296, and any other liquid by agreement with the customer.

Liquid temperatures shall not exceed 100 °C continuously neither shall they be affected by insulating compounds having a pouring temperature not exceeding 160 °C.

Each resin-insulated bushing shall have both ends of each conductor clean and free from resin for the whole of their length from 3 mm clear of the moulding.

Each resin-insulated bushing shall be marked in a legible and in a permanent manner with the name or trade mark of the manufacturer, a unique identification code to ensure material traceability and numerals and/or letters to indicate the period of manufacture. These marks shall not appear on the flange faces.

4.4.2 Type test (temperature cycle)

A resin-insulated bushing of each design shall be subjected to a temperature cycle test consisting of 10 tests consecutively (no current is applied during testing). Each cycle shall comprise three stages:

— 10 °C;

— 105 °C;

— ambient temperature.

The duration of each stage shall be between 20 min and 30 min. On completion the bushing shall not exhibit signs of cracking and shall withstand the liquid leakage, air leakage and over voltage tests detailed in 4.4.3.

4.4.3 Routine tests

4.4.3.1 Liquid leakage sample test

Each resin-insulated bushing selected for sample testing shall be subjected to a liquid leakage test for 6 h. The liquid shall comply with the requirements of IEC 60296 or any other insulating liquid by agreement with the customer and shall be maintained at 75 °C with an applied pressure of (1 ± 0,1) bar. The pressure shall be applied to the transformer side of the bushing with the other end exposed to atmosphere. At the end of this test, no leakage or liquid ingress into normally liquid free spaces shall have occurred.

This sample test shall be carried out on at least one assembly from each day's production or 2 % of all units manufactured in each batch, whichever is greater.

4.4.3.2 Air leakage routine test

Each resin-insulated bushing shall be subjected to an air leakage test for 15 min at a pressure of (1,5 ± 0,1) bar on the transformer side of the bushing with the other side exposed to atmosphere. At the conclusion of this test no leakage of air shall have occurred.

4.4.3.3 Power frequency withstand voltage test

Each resin-insulated bushing shall withstand a dry power frequency withstand voltage test of 28 kV for 1 min between adjacent conductors and between conductors and earth.

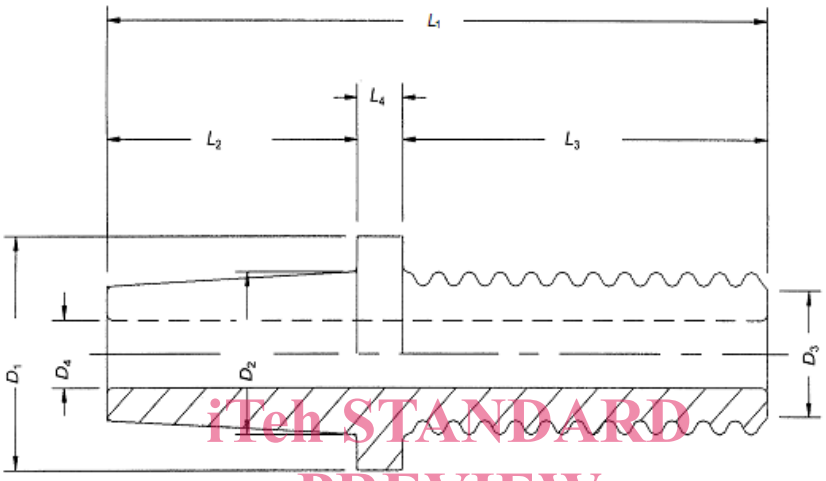
4.4.3.4 Routine partial discharge test

Each resin-insulated bushing shall be subject to a partial discharge test in accordance with EN 60137.

5 Ceramic busing dimensions

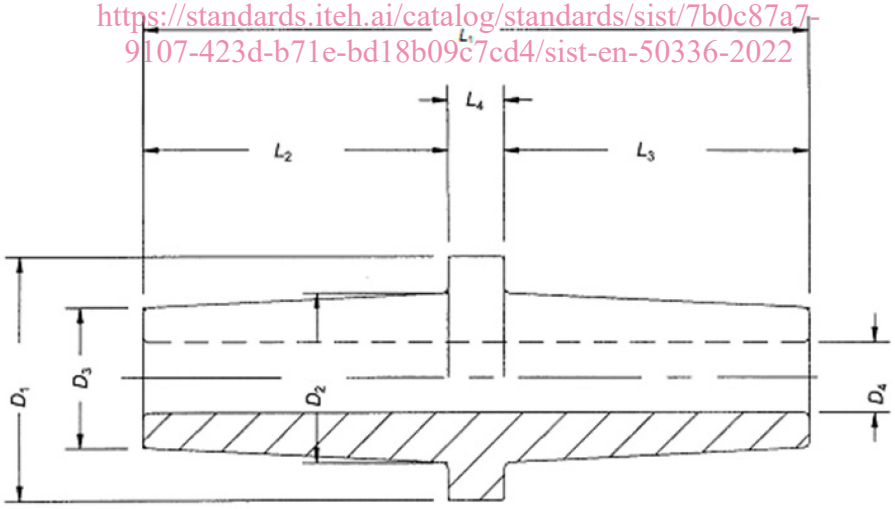
5.1 Ceramic insulator

Table 2 lists the dimensions of ceramic insulators for cable boxes in Figures 1 and 2.



Transformer side Cable box side

Figure 1 — Ceramic insulators for cable boxes as defined in 3.1



Transformer side Cable box side

Figure 2 — Ceramic insulators for cable boxes as defined in 3.1, 3.4 and 3.5