BRITISH STANDARD

BS 7821-2.2: 1998

Three phase oil-immersed distribution transformers 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV —

Part 2: Distribution transformers with cable boxes on the high voltage and/or low voltage side —

Section 2.2 Cable boxes of type 1 for use on distribution transformers meeting the requirements of BS 7821-2.1

ICS 29.180

National foreword

This British Standard reproduces verbatim HD 428.2.2 S1:1997 and implements it as the UK national Standard.

The UK participation in its preparation was entrusted to Technical Committee PEL/14, Power transformers, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the HD title page, pages 2 to 6 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on
15 February 1998

ISBN 0 580 29191 X

Amendments issued since publication

Amd. No.	Date	Comments

Contents

blank

HARMONIZATION DOCUMENT

DOCUMENT D'HARMONISATION

HARMONISIERUNGSDOKUMENT

HD 428.2.2 S1

May 1997

ICS 29.180

English version

Three-phase oil-immersed distribution transformers 50 Hz, from 50 to 2 500 kVA with highest voltage for equipment not exceeding 36 kV
Part 2: Distribution transformers with cable boxes on the high-voltage and/or low-voltage side
Section 2: Cable boxes type 1 for use on distribution transformers meeting the requirements of HD 428.2.1 S1

Transformateurs triphasés de distribution immergés dans l'huile 50 Hz de 50 à 2 500 kVA de tension la plus élevée pour le matériel ne dépassant pas 36 kV
Partie 2: Transformateurs de distribution avec des boîtes à câbles moyenne tension et/ou basse tension
Section 2: Boîtes à câbles de type 1 pour utilisation sur transformateurs de distribution conformes aux exigences du HD 428.2.1 S1

Drehstrom-Öl-Verteilungs-transformatoren 50 Hz, 50 bis 2 500 kVA, mit einer höchsten Spannung für Betriebsmittel bis 36 kV
Teil 2: Verteilungstransformatoren mit Kabelanschlußkästen auf der Ober- und/oder Unterspannungsseite Hauptabschnitt 2: Kabelanschlußkästen Typ 1 für Verteilungstransformatoren nach HD 428.2.1 S1

This Harmonization Document was approved by CENELEC on 1996-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document on a national level.

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

This Harmonization Document exists in three official versions (English, French, German).

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

Ref. No. HD 428.2.2 S1:1997 E

Foreword

This Harmonization Document was prepared by the Technical Committee CENELEC TC 14, Power transformers.

The text of the draft was submitted to the formal vote and was approved by CENELEC as HD 428.2.2 S1 on 1996-10-01.

The following dates were fixed:

- latest date by which the existence of the HD has to be announced at national level (doa) 1997-03-01
- latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement (dop) 1997-12-01
- latest date by which the national standards conflicting with the HD have to be withdrawn (dow) 1997-12-01

Contents

1 Scope

This document specifies the requirements for cable boxes, Type 1, in which the cable cores are terminated. The cable boxes are suitable for use on transformers defined in HD 428.2.1 S1, Distribution transformers with cable boxes, for side mounted or cover mounted use. The cable boxes are suitable for operation indoors and outdoors under environmental conditions specified in HD 428.1 S1. Important design and construction requirements of the cable boxes are given.

2 Normative references

This Harmonization Document 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 Harmonization Document only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 50180:1997, *Bushings above 1 kV up to 36 kV and from 250 A to 3,15 kA for liquid filled transformers.*

EN 60076, HD 398: series, *Power transformers (IEC 76 series, modified).*

HD 428.1 S1:1992, *Three-phase oil-immersed distribution transformers 50 Hz, from 50 to 2 500 kVA with highest voltage for equipment not exceeding 36 kV — Part 1: General requirements and requirements for transformers with highest voltage for equipment not exceeding 24 kV.*

HD 428.2.1 S1:1994, *Part 2: Distribution transformers with cable boxes on the high-voltage and/or low-voltage side — Section 1: General requirements.*

HD 506 S1:1989, *Bushings for liquid filled transformers above 1 kV up to 36 kV.*

HD 506 S1 + A1:1992, *Bushings for liquid filled transformers above 1 kV up to 36 kV.*

HD 607 S1:1996, *Busbar bushings up to 1 kV and from 1,25 kA to 5 kA, for liquid filled transformers.*

3 Definitions

For the purpose of this document the following definitions apply:

3.1
fully insulated cable box

a metallic cable box where those parts of the termination and bushing within the enclosure including live metal parts and cable cores are insulated by oil or compound suitable for the appropriate system voltage

3.2 air filled cable box

A metallic cable box designed to protect the ends of the cables and bushings, providing a weatherproof enclosure with a minimum rating of IP54.

3.2.1
air insulated termination

an air filled cable box within which the cable cores are electrically terminated by stress control appropriate to the cable design and voltage; air being the sole insulation for the terminal connections

3.2.2
shrouded insulation termination

an air filled cable box within which the cable cores are terminated as in **3.2.1** with additional local insulation enhancement, e.g. bushing protection, taping

NOTE Enhancement can be achieved by using insulated phase barriers, however, in this case full creepage distance air bushings are used.

4 Electrical requirements and clearances

4.1 General

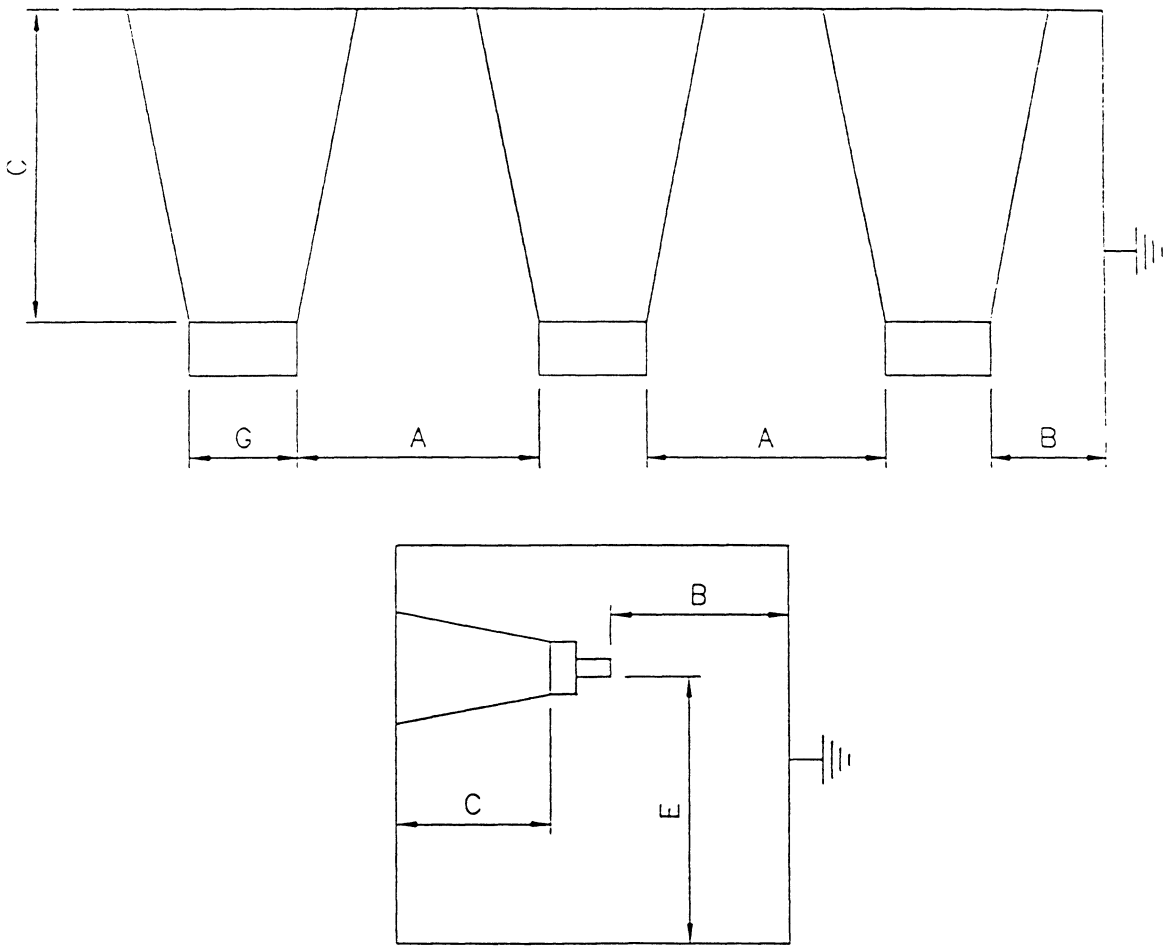
The enclosures when in position on the equipment with which they are to be used shall be capable of withstanding the high voltage tests specified in HD 428.1 S1 as well as commissioning tests to be carried out on the connected cable.

4.2 High voltage enclosures

The rated voltage of a box is the highest voltage designated for the equipment and preferred values in use are given in Table 1.

Table 1 defines the minimum clearances required between live metal parts, and between live metal parts to earth, and insulator creepage requirements. The fixing flange types are as given in HD 428.2.1 S1, Figure 1. However, shorter clearances may be agreed subject to confirmation by test.

Bushings suitable for use in high voltage enclosures are specified in document EN 50180. Other bushings can be used if agreed between manufacturer and purchaser provided the minimum limiting dimensions of Table 1 are complied with.



Dimension G: see EN 50180

Figure 1 — Clearance distances

Table 1 — Three phase cable box, type 1

(Dimensions below in mm)

Air insulation

kV	LIST I							LIST II					
	BIL	A	B	C	E		BIL	A	B	C	E		
	kVp				Single	3 Core	kVp			Min.	Max.	Single	3 Core
12	60	90	90	125	495	585	75	120	120	125	200	495	585
24	95	160	160	224	575	685	125	200	200	205	305	575	685
36	145	270	270	309	625	880	170	320	320	325	380	625	880

Fully insulated oil/compound filled

kV	BIL	LIST II				
		A	B	C	E	
	kVp				Single	3 Core
12	75	45	32	50	495	585
24	125	100	75	90	575	685
36	170	125	100	135	625	880

Shrouded

kV	BIL	LIST II				
		A	B	C	E	
	kVp				Single	3 Core
12	75	55	50	80	495	585
24	125	110	100	140	575	685
36	170	165	150	225	625	880

NOTE The above clearance dimensions are minima. The design of enclosure should take account of the actual manufacturer's dimensions for the terminals to ensure that all clearances are complied with. The distances given in the table are consistent with the minimum clearances necessary; the currently available bushings, however, as described in EN 50180 have distances, especially C, in excess of those given in the table. This fact should be taken into account when sizing the cable box.

— List I distances are for use with shedded bushings.

— The clearances given assume that the cable termination connected to the bushing cap does not reduce the clearance dimension.

— Air insulation list II – C values. Minimum values are based on BS practice and experience. Maximum values are in line with HD 506 S1/A1.

— For voltage levels below 12 kV the dimensions A, B, C and E are subject to agreement between manufacturer and purchaser.

— For application of list I and list II, see HD 398.3 S1.

Cables above 185 mm^2 should not be crossed in boxes with E dimensions equal to those given. The E dimension can be extended to a dimension agreed between manufacturer and purchaser when crossed cables are required.

4.3 Low voltage boxes

All low voltage boxes shall be capable of accepting either bushings or monobloc or single bloc busbar type terminations of the correct rating for the maximum current required from the transformer. The box flange is as given in HD 428.2.1 S1, Figure 1.

Due consideration shall be given to the effects of electromagnetic induced losses caused by high currents.

On agreement between purchaser and manufacturer, the flange types can be different to those given.

Terminations suitable for use in LV cable boxes are specified in EN 50180 and HD 607 S1.

5 Design considerations

5.1 The boxes shall be selfcontained, The bushing mounting plate is an integral part of the enclosure for HV boxes, Cast iron shall not be used.

Fully insulated cable boxes shall be suitably sealed to contain the oil or compound and allowance made for thermal expansion.

Ventilation measures are to be provided in the case of air filled boxes of IP 54 protection. Means of draining air filled boxes are to be provided. Filling measures are to be provided in the case of oil/compound filled boxes and due consideration made to the filling medium expansion due to temperature changes.

5.2 Terminal nuts and stems

The dimensions of terminal nuts and stems are related to the bushings in use for the appropriate currents and are given in relevant standards.

5.3 Provision for glanding cables

NOTE Under consideration in TC 20.

5.4 Termination of cables within enclosure

To allow for termination of cables, the minimum vertical distance from the surface of the bushing cap to the gland plate shall be as given in Figure 1. The dimension E allows for only uncrossed cables at above 185 mm^2.

6 Testing

6.1 Type tests

A new design of an enclosure shall be subject to the following type tests if clearances lower than those given in Table 1 are used. Tests are required on the cable box not necessarily connected to the transformer.

Electrical

— Rated Lightning Impulse Withstand on the high voltage box, terminated with cables as in service.

— Rated Short Duration Power Frequency Withstand on the enclosure, terminated with cables as in service.

The voltage levels for these tests will be appropriate impulse and power frequency levels for the highest system voltage as defined in HD 398.3 S1.

Mechanical

A mechnical test shall be made on oil/compound filled boxes by subjecting the box to a pressure of 1 bar for 15 minutes at room temperature. There shall be no permanent distortion when the pressure is released.

6.2 Routine tests

Dimensional checks shall be made to ensure that the enclosure is the same as the prototype tested.

All oil/compound filled boxes shall be tested with oil at room temperature at a pressure of 0,76 bar for 12 hours. No leakage shall occur into oil free spaces or any permanent deflection when the pressure is released.

7 Earthing of cable boxes

Means shall be provided to earth the cable box and the cable metallic armour, sheath, screen to the box.

The rating of the earth connection shall be appropriate for the system earth fault current.

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL