BRITISH STANDARD

BS 7821-3: 1995

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

Part 3: Supplementary requirements for transformers with highest voltage for equipment equal to 36 kV —

(Implementation of CENELEC HD 428.3 S1:1994)

UDC 621.314.212:621.3.025.3

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PEL/14, Power transformers, upon which the following bodies were represented:

Association of Consulting Engineers
BEAMA Ltd. (Transmission and Distribution Association)
British Cable Makers Confederation
British Pump Manufacturers' Association
British Railways Board
Electricity Association
Institution of Plant Engineers
Transmission and Distribution Association (BEAMA Ltd.)

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Contents

National foreword

This British Standard has been prepared by Technical Committee PEL/14 and implements HD 428.3 S1:1994, published by the European Committee for Electrotechnical Standardization (CENELEC).

Cross-references

Publication referred to	Corresponding British Standard
	BS 171 *Power transformers*
HD 398.1:1980	Part 1:1978 *General*
HD 398.3:1986	Part 3:1987 *Specification for insulation levels and dielectric*
HD 428.1 S1:1992	BS 7821 *Three phase oil-immersed distribution transformers, 50 Hz, from 50 to 2 500 kVA with highest voltage for equipment not exceeding 36 kV* Part 1:1995 *General requirements and requirements for transformers with highest voltage for equipment not exceeding 24 kV*

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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, an inside back cover 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.

HARMONIZATION DOCUMENT

DOCUMENT D'HARMONISATION

HARMONISIERUNGSDOCUMENT

HD 428.3 S1

March 1994

UDC 621.314.212:621.3.025.3

Descriptors: Electrical transformer, power transformer, three phase transformer, immersed transformer, electrical rating, dimension, design

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 3: Supplementary requirements for transformers with highest voltage for equipment equal to 36 kV

Transformateurs triphasés de distribution immergés dans l'huile, 50 Hz, de 50 à 2 500 kVA, avec une tension la plus élevée pour le matériel ne dépassant pas 36 kV Partie 3: Prescriptions complémentaires pour les transformateurs avec une tension la plus élevée pour le matériel égale à 36 kV

Drehstrom-Öl-Verteilungs transformatoren 50 Hz von 50 bis 2 500 kVA, mit einer höchsten Spannung für Betriebsmittel von 36 kV Teil 3: Ergänzend Festlegungen für Transformatoren mit einer höchsten Spannung für Betriebsmittel von 36 kV

This Harmonization Document was approved by CENELEC on 1993-09-22. 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 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).

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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 428.3 S1:1994 E

Foreword

This Part 3 of HD 428 was prepared by WG 3 of Technical Committee CENELEC TC 14, Power transformers.

The document was submitted to the Unique Acceptance Procedure (UAP) and was approved by CENELEC as HD 428.3 S1 on 1993-09-22.

The following dates were fixed:

- latest date of announcement of the HD at national level (doa) 1994-03-01
- latest date of publication of a harmonized national standard (dop) 1994-09-01
- latest date of withdrawal of conflicting national standards (dow) 1994-09-01

1 General

1.1 Scope

This Harmonization Document covers transformers from 50 to 2 500 kVA intended for operation in three-phase distribution networks, for indoor or outdoor continuous service, 50 Hz, immersed in mineral-oil, natural cooling, with two windings:

— a primary (high-voltage) winding with a highest voltage for equipment equal to 36 kV;

— a secondary (low-voltage) winding with a highest voltage for equipment not exceeding 1,1 kV.

NOTE 1 This document may be applied, either as a whole or in part, to transformers immersed in a synthetic insulating liquid.

NOTE 2 This document may be applied, either as a whole or in part, to transformers having windings with more than one rated voltage. In this case the rated power for each rated voltage shall be specified by the purchaser.

1.2 Object

The object of this document is to lay down requirements related to electrical characteristics, dimensions and design. Other requirements may be specified in a national standard.

1.3 Compliance with current Harmonization Documents

Transformers shall be in accordance with Harmonization Documents of the HD 398 series.

Unless herein otherwise indicated the requirements specified in HD 428.1 S1 apply also to this document.

2 Electrical characteristics

2.1 Rated power

See HD 428.1 S1.

2.2 Highest voltages for equipment of windings

The values of the highest voltage for equipment are:

a) For the high-voltage winding: 36 kV

b) For the low-voltage winding: 1,1 kV

2.3 Rated voltages of windings

a) For the high-voltage winding:

The preferred range of values of the rated voltage U_r is related to the value of the highest voltage for equipment U_m as stated in Table I.

Table I

U_m (kV)	36
U_r (kV)	25 to 34,5

b) For the low-voltage winding:

See HD 428.1 S1.

2.4 Tappings

The high-voltage winding is normally provided with tappings corresponding to a tapping range of ± 2,5 % or ± 2 × 2,5 %, or + 2 × 2,5 % – 3 × 2,5 % to be specified by the purchaser. These tappings shall be connected to an off-circuit tap-changing device.

Upon special agreement between purchaser and manufacturer, internal reconnecting links can be used as an alternative.

2.5 Connections

See HD 428.1 S1.

2.6 Dimensioning of neutral connection of the low-voltage winding

See HD 428.1 S1.

2.7 Short-circuit impedance

The preferred values of the short-circuit impedance at a reference temperature of 75 °C are:

— Up to 630 kVA: 4,5 % or 6 %

— Above 630 kVA: 6 % or 7 %

NOTE Other values of short-circuit impedance may be specified by the purchaser for particular system service conditions, e.g. in the case of parallel operation.

2.8 Losses and sound power level

For transformers having preferred values of rated power and short-circuit impedance in accordance with subclauses **2.1** and **2.7**, the values of losses and sound power levels are stated in Table II (load losses) and Table III (no-load losses and sound power levels).

Table II

Rated power kVA	List D P_k W	List E P_k W	Short-circuit impedance
50	1 250	1 450	4,5 % or 6 %
100	1 950	2 350	
160	2 550	3 350	
250	3 500	4 250	
400	4 900	6 200	
630	6 650	8 800	
1 000	10 500	13 000	6 % or 7 %
1 600	17 000	19 200	
2 500	26 500	29 400	

P_k = Load loss

Table III

Rated power	List D'		List E'		Short-circuit impedance
kVA	P_o W	L_{WA} dB	P_o W	L_{WA} dB	%
50	230	52	190	52	4,5 % or 6 %
100	380	56	320	56	
160	520	59	460	59	
250	780	62	650	62	
400	1 120	65	930	65	
630	1 450	67	1 300	67	
1 000	2 000	68	1 700	68	6 % or 7 %
1 600	2 800	71	2 600	71	
2 500	4 100	76	3 800	76	

P_o = No-load Loss
L_{WA} = Sound power level

Any combination of P_o and P_k lists is allowed.

With respect to the listed loss values, deviations in the range of ± 5 % are admitted in national standards.

The losses for transformers having rated power included among the non-preferred values (subclause **2.1**) should be obtained by interpolation. The sound levels given in Table III are the maximum admitted (no tolerance). Lower sound levels can be specified by the purchaser.

When the loss values stated in the above Table II and Table III do not correspond to the actual evaluation of the energy cost, or in case of established practice in the market, or in case of special feature, the transformers can be requested and, by consequence, offered, with losses differing from the tabled losses.

In such a case, a formula for capitalization of losses shall be stated in the request.

The formula should be of the following type:

$$C_C = C_T + AP_o + BP_k$$

where:

C_C = capitalized cost

C_T = tendered price

A = value indicated by the purchaser in tender invitation expressed in monetary value per watt corresponding to no-load loss

P_o = guaranteed no-load loss in watts

B = value indicated by the purchaser in tender invitation expressed in monetary value per watt corresponding to load loss

P_k = guaranteed load loss in watts

Other terms may be introduced in the formula by a national committee or by a purchaser, to take into account other technical and financial aspects.

Within the limits of tolerances (HD 398.1), the application of penalties/bonus with regard to losses is left to the agreement between manufacturer and purchaser at the time of enquiry and order.

2.9 Insulation levels and dielectric tests

See HD 428.1 S1.

3 Design requirements

See HD 428.1 S1.

4 Dimensional characteristics

4.1 Rollers

See HD 428.1 S1.

4.2 Distance between bushings

4.2.1 Distances between high-voltage oil-air bushings

The preferred value of the distance between centres is 365 mm. For transformers with a highest voltage for equipment equal to 36 kV, the minimum distance between metallic parts of the heads shall be 315 mm and between the highest sheds 180 mm.

However, shorter distances may be agreed, subject to confirmation by test or by service experience.

NOTE 1 If the user intends to make the connections to the transformer in a way which may reduce the clearances provided by the transformer itself, then this should be brought to attention in the enquiry (See HD 398.3, clause **2**).

NOTE 2 When an oil-immersed transformer is specified for operation at an altitude higher than 1 000 m, clearances should be designed accordingly. It may then be necessary to select bushings designed for higher insulation levels than those specified for the internal insulation of the transformer windings (See HD 398.3, clause **2**).

4.2.2 Preferred distance between centres of low-voltage bushings

See HD 428.1 S1.

4.2.3 Cable boxes

For transformers in which the terminations are made in cable boxes, HD 428.2.1 applies.

5 Accessories

See HD 428.1 S1.

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List of references

See national foreword.

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W4 4AL