

Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000 V —

(Implementation of
CENELEC HD 578 S1)

UDC 621.315.624:621.3.027.4

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Power Electrical Engineering Standards Policy Committee (PEL/-) to Technical Committee PEL/70, upon which the following bodies were represented:

- Association of Consulting Engineers
- Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd.)
- British Industrial Ceramic Manufacturers' Association
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
- Electricity Association
- Transmission and Distribution Association (BEAMA Ltd.)

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

BECCAMA — BEAMA Electrical Cable Connector and Accessories Manufacturers' Association

This British Standard, having been prepared under the direction of the Power Electrical Engineering Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 January 1993

© BSI 04-2000

The following BSI references relate to the work on this standard:
Committee reference PEL/70
Draft for comment 90/24326 DC

ISBN 0 580 21454 0

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	2
Text of HD 578 S1	3
National annex NA (informative) Cross-references	Inside back cover

National foreword

This British Standard has been prepared under the direction of the Power Electrical Engineering Standards Policy Committee. It implements Harmonization Document HD 578 S1 published by the European Committee for Electrotechnical Standardization (CENELEC).

This British Standard is identical with IEC 273:1990 *Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1 000 V*, published by the International Electrotechnical Commission (IEC), which has been endorsed by CENELEC as HD 578 S1.

This British Standard supersedes BS 3297-2:1982 which is withdrawn.

A special national condition applicable to Germany is given in Annex ZB.

The graphic signs, symbols and letters used may be found in the following documents.

BS 3939 *Graphical symbols for electrical power, telecommunications and electronics diagrams*

Part 1:1986 *General Information, general index*

Part 2:1985 *Symbol elements, qualifying symbols and other symbols having general application*

Part 3:1985 *Conductors and connecting devices*

National annex NA gives details of International Standards quoted in this standard for which there is an identical or technically equivalent British Standard.

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 30, 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.

UDC 621.315.624:621.3.027.4

Descriptors: Insulators, characteristics, systems, nominal voltages greater than 1 000 V

English version

Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1 000 V

(IEC 273:1990)

Caractéristiques des supports isolants d'intérieur et d'extérieur destinés à des installations de tension nominale supérieure à 1 000 V
(CEI 273:1990)

Kenngrößen von Innenraum- und Freiluft- Stützisolatoren für Systeme mit Nennspannungen über 1 000 V
(IEC 273:1990)

This Harmonization Document was approved by CENELEC on 1991-09-23. 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).

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

Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 273:1990 could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as Harmonization Document.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as HD 578 S1 on 23 September 1991.

The following dates were fixed:

- latest date of announcement of the HD at national level (doa) 1992-04-01
- latest date of publication of a harmonized national standard (dop) 1992-10-01
- latest date of withdrawal of conflicting national standards (dow) 1992-10-01

For products which have complied with the relevant national standard before 1992-10-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1997-10-01.

Annexes designated “normative” are part of the body of the standard. In this standard, Annex ZA and Annex ZB are normative.

Contents

	Page		Page
Foreword	2	Figure 5 — Example of an outdoor pedestal post insulator	11
Section 1. General		Section 3. Characteristics of standard post insulators	
1 Scope	3	Table I — Indoor post insulators of ceramic material or glass and with internal metal fittings	12
2 Object	3	Table IA — Optional auxiliary holes in the top and/or bottom metal fitting	13
3 Electrical characteristics	3	Table II — Indoor post insulators of organic material and with internal metal fittings	13
4 Mechanical characteristics	4	Table IIA — Optional auxiliary holes in the top and/or bottom metal fitting	15
5 Dimensional characteristics	5	Table III — Outdoor cylindrical post insulators of ceramic material or glass and with internal metal fittings	15
6 Fixing arrangements	6	Table IIIA — Optional auxiliary holes in the top and/or bottom metal fittings	16
7 Plan of the standard	6	Table IV — Outdoor cylindrical post insulators of ceramic material or glass and with external metal fittings	16
8 Designation of post insulators	7	Table IVA — Standard fixing arrangements of outdoor cylindrical post insulators with external metal fittings	19
Section 2. Examples of insulator types		Table V — Outdoor pedestal post insulator units (metric units)	20
Figure 1 — Example of an indoor post insulator of ceramic material or glass	8	Table VA — Standard fixing arrangements of pedestal post insulators	21
Figure 2 — Example of an indoor post insulator of organic material	9	Table VI — Outdoor pedestal post insulator units (inch-pound units)	20
Figure 3 — Example of an outdoor cylindrical post insulator with internal metal fittings	10	Table VIA — Standard fixing arrangements of pedestal post insulators	21
Figure 4 — Example of an outdoor cylindrical post insulator with external metal fittings	11	Table VII — Outdoor pedestal post insulator units. Bending strength in stacks (metric units)	21
		Table VIII — Outdoor pedestal post insulator units. Bending strength in stacks (inch-pound units)	21
		Appendix A	22
		Table AI — Examples of composition of outdoor pedestal post insulators (metric units)	22
		Table AII — Examples of composition of outdoor pedestal post insulators (inch-pound units)	25
		Annex ZA (normative) Other international publications quoted in this standard with the references to relevant European publications	28
		Annex ZB (normative) Special national conditions	29

Section 1. General

1 Scope

This standard applies to post insulators and post insulator units of ceramic material or glass intended for indoor or outdoor service, and to post insulators of organic material intended for indoor service in electrical installations or equipment operating on alternating current systems with a nominal voltage greater than 1 000 V and a frequency not greater than 100 Hz. It may also be regarded as a provisional standard for insulators for use on direct current systems.

The insulators covered by this standard are primarily intended for use in isolators (disconnectors) or as bus-bar or fuse supports.

This standard covers five types of post insulators:

- a) indoor post insulators of ceramic material or glass and with internal metal fittings;
- b) indoor post insulators of organic material and with internal metal fittings;
- c) outdoor cylindrical post insulators of ceramic material or glass and with internal metal fittings;
- d) outdoor cylindrical post insulators of ceramic material or glass and with external metal fittings;
- e) outdoor pedestal post insulators of ceramic material or glass.

The term “cylindrical insulators” is intended to cover insulators of the truncated conical form also.

The five types of insulators are distinguished by their electrical, mechanical and dimensional characteristics. Figure 1, Figure 2, Figure 3, Figure 4 and Figure 5 illustrate typical examples of each type of insulator.

These drawings are only general illustrations and other shapes and constructions are permitted.

2 Object

This standard is intended to establish standard values of those electrical characteristics, mechanical characteristics and dimensions which are essential for the interchangeability of post insulators and post insulator units of the same type.

NOTE 1 General definitions and methods of test for insulators of ceramic material or glass are covered by IEC Publication 168. General definitions and methods of test for insulators of organic material are covered by IEC Publication 660.

NOTE 2 The values of creepage distance as well as information on design aspects are provisional. These values are not directly related to the specified electrical characteristics.

The performance of insulation under contaminated conditions has been considered, with the object of determining the significant factors influencing performance. An application guide (IEC Publication 815) has been prepared recommending the range of suitable designs. The guide also indicates:

- definitions of the site severity
- different methods for determining the site severity
- corresponding creepage distance
- the significance and influence of different parameters characterising the insulator profiles
- the influence of the diameter
- the influence of the angle of the installation of the insulator
- alternative measures to be considered such as greasing or washing.

3 Electrical characteristics

Each post insulator is designated for a specified lightning impulse withstand voltage based on the standardized values given in IEC Publication 71-1. The minimum height to be chosen is determined by one of the electrical characteristics given in the table, i.e. dry lightning impulse withstand voltage, wet power frequency withstand voltage and wet switching impulse withstand voltage as applicable and according to the relevant insulation coordination requirements. The operating voltage is not specified because depending on service conditions, especially contamination, it cannot strictly be correlated with the height of the post insulator.

The composition of the post insulator, i.e. the number, the size and the positioning of insulator units is not specified. For a given height of a post insulator, however, the composition together with insulator profile and size and shape of metal parts can all affect the electrical performance of the post insulator especially the wet switching impulse withstand voltage value.

The rated switching impulse withstand voltage values are specified taking into account the above-mentioned facts as well as the high dispersion in wet switching impulse tests. However for many post insulator designs higher switching impulse withstand voltage values are obtainable.

The rated withstand voltage requirements given in tables are for tests carried out on single post insulators in accordance with IEC Publication 168. With regard to this test arrangement the test conditions are favourable and may result in higher withstand voltages than in service applications. This applies in particular to complete disconnectors for which the actual withstand values may differ appreciably from those given in the tables. In these cases an insulator with a greater standard height may be chosen or special stress control fittings may be used.

4 Mechanical characteristics

Post insulators are standardized in mechanical strength classes based on values of the specified failing load in the bending test.

These mechanical strength classes are as follows:

a) *Indoor post insulators of ceramic material or glass and with internal metal fittings*

Strength class 2	2 000 N
Strength class 4	4 000 N
Strength class 8	8 000 N
Strength class 16	16 000 N
Strength class 25	25 000 N

b) *Indoor post insulators of organic material and with internal metal fittings*

Strength class 2	2 000 N
Strength class 4	4 000 N
Strength class 6	6 000 N
Strength class 8	8 000 N
Strength class 10	10 000 N
Strength class 16	16 000 N
Strength class 25	25 000 N

c) *Outdoor cylindrical post insulators of ceramic material or glass and with internal metal fittings*

Strength class 2	2 000 N
Strength class 4	4 000 N
Strength class 8	8 000 N
Strength class 16	16 000 N
Strength class 31,5	31 500 N

d) *Outdoor cylindrical post insulators of ceramic material or glass and with external metal fittings*

Strength class 2	2 000 N
Strength class 4	4 000 N
Strength class 6	6 000 N
Strength class 8	8 000 N
Strength class 10	10 000 N
Strength class 12,5	12 500 N
Strength class 16	16 000 N
Strength class 20	20 000 N
Strength class 25	25 000 N
Strength class 31,5	31 500 N
Strength class 40	40 000 N

e) *Outdoor pedestal post insulators of ceramic material or glass*

Strength class A	3 000 N to 5 000 N
Strength class B	5 000 N to 7 500 N
Strength class C	7 500 N to 12 000 N
Strength class D	12 000 N to 18 000 N
Strength class E	18 000 N to 30 000 N

NOTE The dimensions of outdoor cylindrical post insulators according to d) above are only specified for strength classes 2 to 20. For strength classes 25, 31,5 and 40 these dimensions are left for future consideration.

The specified strength classes are based on the minimum failing load in the bending test with the post insulator mounted upright and the load applied horizontally at the top surface of the insulator. Where insulators are to be mounted underhung, the standard values of bending strength may not be applicable except for those insulators included in Table III. Other positions of mounting (e.g. horizontal) may also affect the strength if the weight of the post insulator is not negligible. The appropriate strength rating for methods of mounting other than upright shall be subject to agreement between the manufacturer and the purchaser.

The bending strength at different points along the axis of a post insulator is defined in different ways depending on the type of insulator (see Table I to Table VI and notes).

A failing load P_x may also be specified and will refer to a load applied at x mm above the top face of the insulator. The value of such loads shall be subject to agreement between the manufacturer and the purchaser. For indoor insulators, values of P_{50} ($x = 50$ mm) are specified in the tables.

NOTE These values have been determined from the formula $P_x = P_0 \frac{h}{h+x}$ where h is the overall height of the insulator.

Mechanical strengths in tension or compression are not specified.

Mechanical strength in torsion is specified only for outdoor post insulators according to d) and e) above.

For special applications, additional mechanical characteristics may be required. In such cases, the values of these mechanical characteristics shall be subject to agreement between the manufacturer and the purchaser.

For insulators of organic material according to b) above, the following also applies:

For circular cross-sections, the specified failing loads apply for any load direction perpendicular to the axis of the insulator. If this is not the case, the applicable load direction shall be the subject of agreement between the manufacturer and the purchaser.

For non-circular cross-sections, the applicable load directions shall be specified.

Unless otherwise agreed, the specified failing loads apply at ambient temperature.

In Table II the difference in deflection between 20 % and 50 % of the failing load is given to permit the evaluation of the flexibility of post insulators of organic material.

5 Dimensional characteristics

The following dimensional characteristics are specified:

- overall height;
- maximum nominal diameter of the insulating part;
- fixing arrangements (see clause 6);
- tolerances;
- minimum nominal creepage distance (for outdoor post insulators only).

The composition of the post insulator is not specified, see Clause 3.

The nominal dimensions of an insulator shall not be greater than the specified maximum nor less than the specified minimum values. The actual dimensions of insulators are subject to the appropriate manufacturing tolerances. Tolerances of the insulator heights are given in Table I to Table IV; other tolerances shall be in accordance with Clause 24 of IEC Publication 168, except that in checking the creepage distance the nominal value shall be subject only to the negative tolerance.

The normal maximum values for the tolerances of parallelism, eccentricity and angular deviation, when measured in accordance with Appendix A of IEC Publication 168, are as follows:

Parallelism	for $h \leq 1$ m: 0,5 mm for $h > 1$ m: 0,5 h mm h in metres. Parallelism measured for diameter $D = 250$ mm.
Eccentricity	2 (1 + h) mm h in metres.
Angular deviation	1° either clockwise or anti-clockwise.

For post insulators of more than one unit, experience shows that if the units comply with the above tolerances there are usually no problems of alignment when they are used in stacks of two or more units. The above-mentioned values apply in the absence of any agreement to the contrary between the manufacturer and the user. Other values may, however, be agreed upon according to the demands which the application of the insulators makes on the accuracy.

NOTE Reference should be made to IEC Publication 168 regarding action to be taken when units do not comply with the above tolerances.

For post insulators according to Table III, Table V and Table VI, only one class of minimum creepage distance is specified.

For post insulators according to Table IV, there are two classes of creepage distance.

The amount by which the creepage distance of an insulator may be increased within the specified dimensions varies according to the design and size of the insulator, and, where increased creepage distance is required, it should be the subject of agreement between the manufacturer and the purchaser in order to avoid designs which are unsuitable for service in polluted atmospheres.

6 Fixing arrangements

The fixing arrangements of standard post insulators and post insulator units shall be in accordance with the Table I to Table VI.

Where applicable, fixing holes shall be equally spaced on the appropriate pitch circle, which shall be concentric with the axis of the insulator. Holes in top and bottom fittings shall be in line, unless otherwise specified, and they shall be so arranged as to permit the use of normal hexagon bolted heads and nuts.

The tapped holes shall be of standard size except that the diameter may be oversize by not more than 0,25 mm (0,01 in). They shall be suitable for steel bolts having standard dimensions after galvanizing. The length of full thread shall be not less than the nominal bolt diameter for outdoor post insulators and indoor post insulators of ceramic material or glass and not less than 1,5 times the nominal bolt diameter for indoor post insulators of organic material. The threads of tapped holes in galvanized fittings may be cut after galvanizing.

Standard insulators shall have ISO metric threads except for pedestal post insulator units where Unified Coarse (UNC) threads may be used.

The axial distance between the bottom mounting face of an insulator of organic material and the lower end of the bottom thread (dimension *l* in Figure 2) is assumed to be zero unless otherwise agreed between the manufacturer and the purchaser. In this case the values in the last column of Table II shall apply.

NOTE 1 Post insulators at present in service, although they are in accordance with the other characteristics specified in this standard, may have Whitworth or American National Coarse threads.

NOTE 2 To permit interchangeability, fixing screws may be supplied with each post insulator.

7 Plan of the standard

The specified characteristics are given in the following tables:

— Indoor post insulators of ceramic material or glass and with internal metal fittings	Table I.
— Indoor post insulators of organic material and with internal metal fittings	Table II.
— Outdoor cylindrical post insulators of ceramic material or glass and with internal metal fittings	Table III.
— Outdoor cylindrical post insulators of ceramic material or glass and with external metal fittings	Table IV.
— Outdoor pedestal post insulator units of ceramic material or glass	Table V to Table VIII.
— Fixing arrangements	Table IA, Table IIA, Table IIIA, Table IVA, Table VA and Table VIA.

In tables which relate to complete post insulators, all insulators of the same lightning impulse withstand voltage are grouped together. In tables relating to pedestal post insulator units, the units are arranged with the type numbers in sequence.

The basis of standardization of cylindrical post insulators is the full specification of the complete post insulator.

The basis of standardization of pedestal post insulators is the full specification of the units in Table V to Table VIII. Complete pedestal post insulators are composed of one or more of these units. For stacks of more than one unit, it is often possible to reach a given voltage and strength rating in a number of alternative ways. The alternative pedestal post insulators may differ in certain respects, such as stiffness, radio interference performance, etc., and it may be necessary to decide the most suitable composition of the post insulator by agreement between the manufacturer and the purchaser. Examples of combinations of units to form pedestal post insulators are given in Appendix A; other combinations are also possible.

8 Designation of post insulators

Each standard post insulator is assigned a reference symbol which indicates:

— Insulator type:

indoor post insulator of ceramic material or glass	designation J
indoor post insulator of organic material	designation JO
outdoor cylindrical post insulator of ceramic material or glass and with internal metal fittings	designation H
outdoor cylindrical post insulator of ceramic material or glass and with external metal fittings	designation C
outdoor pedestal post insulator unit of ceramic material or glass	designation E
outdoor pedestal post insulator of ceramic material or glass	designation P

— Mechanical strength class (see Clause 4):

2 – 4 – 8 – 16 – 25	for indoor post insulators of ceramic material or glass
2 – 4 – 6 – 8 – 10 – 16 – 25	for indoor post insulators of organic material
2 – 4 – 8 – 16 – 31,5	for outdoor cylindrical post insulators of ceramic material or glass and with internal metal fittings
2 – 4 – 6 – 8 – 10 – 12,5 – 16 – 20 – 25 – 31,5 – 40	for outdoor cylindrical insulators of ceramic material or glass and with external metal fittings
A – B – C – D – E	for outdoor pedestal post insulators of ceramic material or glass

— Creepage distance Class I - II for outdoor cylindrical insulators of ceramic material or glass and with external metal fittings

— Lightning impulse withstand voltage (in kilovolts) 60 to 2 550.

NOTE 1 The designation does not always fully specify the insulator, as sometimes alternative constructions are included in the standard.

NOTE 2 The strength class and lightning impulse withstand voltage designations are not used for pedestal post insulator units, which are designated by a reference number.

Examples: "IEC post insulator Type J4-125" indicates an indoor post insulator of ceramic material or glass of strength Class 4 and with lightning impulse withstand voltage 125 kV.

"IEC post insulator Type JO8-60" indicates an indoor post insulator of organic material of strength Class 8 and with lightning impulse withstand voltage 60 kV.

"IEC post insulator Type H16-75" indicates an outdoor cylindrical post insulator of ceramic material or glass with internal metal fittings of strength Class 16 and with lightning impulse withstand voltage 75 kV.

"IEC post insulator Type C6-1050-I" indicates an outdoor cylindrical post insulator of ceramic material or glass with external metal fittings of strength Class 6 and with lightning impulse withstand voltage 1 050 kV and Class I creepage distance.

"IEC post insulator Type PD-1050" indicates an outdoor pedestal post insulator of ceramic material or glass of strength Class D and with lightning impulse withstand voltage 1 050 kV.