

Overhead lines — Requirements and tests for fittings

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PEL/11, Overhead lines, upon which the following bodies were represented:

- Aluminium Federation
- Association of Consulting Engineers
- BECCAMA (BEAMA Electrical Cable Conductor Accessory Manufacturers' Association)
- British Non-ferrous Metals Federation
- British Railways Board
- Department of Trade and Industry
- Electricity Association
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
- Overhead Transmission Line Contractors (BEAMA Ltd.)

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National foreword

This British Standard has been prepared by Technical Committee PEL/11 and is the English Language version of EN 61284:1995 *Overhead lines — Requirements and tests for fittings*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1284:1995 published by International Electrotechnical Commission (IEC).

The graphic signs, symbols and letters used in this standard may be found in the following British Standards:

BS 3939	<i>Graphic symbols for electrical power, telecommunications and electronics diagrams</i> Part 1:1986 <i>General information, general index</i> Part 2:1985 <i>Symbol elements, qualifying symbols and other symbols having general application</i>
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Cross-references

Publication referred to	Corresponding British Standard
CISPR 18-2:1986	BS 5049 <i>Radio interference characteristics of overhead power lines and high-voltage equipment</i> Part 2:1994 <i>Methods of measurement and procedure for determining limits</i>
IEC 60-1:1989	BS 923 <i>Guide on high-voltage testing techniques</i> Part 1:1990 <i>General</i> ^a

^a Implements HD 588.1 S1.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 34, 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.

English version

Overhead lines — Requirements and tests for fittings

(IEC 1284:1995)

Lignes aériennes — Exigences et essais pour le
matériel d'équipement
(CEI 1284:1995)

Freileitungen — Anforderungen und
Prüfungen für Armaturen
(IEC 1284:1995)

This European Standard was approved by CENELEC on 1995-09-20. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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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

Foreword

The text of document 11/93/DIS, future edition 1 of IEC 1284, prepared by IEC TC 11, Recommendations for overhead lines, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61284 on 1995-09-20.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-07-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Annex A, Annex B, Annex C, Annex D, Annex E and Annex ZA are normative and Annex F, Annex G and Annex H are informative. Annex ZA has been added by CENELEC.

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1 Scope

This International Standard applies to fittings for overhead lines of nominal voltage above 45 kV. It may also be applied to fittings for overhead lines of lower nominal voltage and to similar fittings for substations.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication of this standard, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60-1:1989, *High-voltage test techniques — Part 1: General definitions and test requirements*.

CISPR 16:1987, *CISPR specification for radio interference measuring apparatus and measurement methods*.

CISPR 18-2:1986, *Radio interference characteristics of overhead power lines and high-voltage equipment — Part 2: Methods of measurement and procedure for determining limits*.

3 Definitions

For the purpose of this International Standard the following definitions apply. These definitions are those which do not appear in the International Electrotechnical Vocabulary (IEV) or differ from those given in the IEV.

ball and socket coupling

coupling consisting of a ball, a socket and a locking device

bimetallic fitting

device which is suitable for jointing conductors of different materials

characteristic dimension

dimension of a component of the test circuit or a fitting which characterizes its effect on the electric field. In the case of a bundle, this dimension is approximately the diameter of an enclosing circle; in the case of a corona ring or sphere, it is its largest dimension, etc.

clevis and tongue coupling

coupling consisting of a clevis, a tongue and a clevis pin or bolt

connector

device for jointing one or more conductors or earth wires. It may be a tension or non-tension fitting

corona discharge

electric discharge that only partially breaks down the gas insulation around the fittings under tests

corona extinction

voltage or conductor voltage gradient at which corona discharges cease during a decreasing test voltage sequence

corona inception

voltage or conductor voltage gradient at which corona discharges initiate during an increasing test voltage sequence

earth wire fitting

any component of an assembly for attaching an earth wire to a supporting structure other than a suspension clamp, a tension fitting or a mechanical protective fitting

factory formed helical cable fitting

fitting consisting of helically formed wires which provide the force necessary to grip the conductor or earth wire by self-tightening

insulator set fitting

any component of a suspension or tension insulator set, other than a string insulator unit, a suspension clamp, a conductor tension fitting, an insulator protective fitting or a mechanical protective fitting

joint

connector and that part of the conductor or earth wire that has been brought into intimate contact with it by compression or other mechanical means

mechanical damage load

maximum load which can be applied to a fitting without an unacceptable permanent deformation when the fitting is tested under specified test conditions

NOTE The unacceptable permanent deformation should be agreed upon between purchaser and supplier.

mechanical failure load

maximum load which can be applied to a fitting under specified test conditions

mechanical protective fitting

any device attached to a conductor or to an earth wire for their mechanical protection

radio-interference voltage (RIV)

voltage in the radio-frequency range produced by an electromagnetic disturbance and which can be measured in accordance with CISPR 16 on the test circuit equipped with the fitting

spacer damper

device which keeps apart the sub-conductors of a bundle in a given geometrical configuration and is able to reduce aeolian vibrations and subspan oscillations of the sub-conductors [IEV 466-11-02 modified]

specified maximum radio-interference voltage

maximum acceptable radio-interference voltage at a specified test voltage or conductor voltage gradient. This is specified by the purchaser or declared by the supplier

specified minimum corona extinction

minimum acceptable voltage or conductor voltage gradient at which corona discharges cease. This is specified by the purchaser or declared by the supplier

specified minimum failure load

minimum load specified by the purchaser or declared by the supplier at which mechanical failure will not take place

NOTE From the probabilistic point of view, the specified minimum failure load corresponds to the value having the probability of e % in the distribution function of the strength of the fitting. The exclusion limit e % is usually taken within 2 % to 5 % with 10 % being the upper limit (IEC 826).

specified minimum mechanical damage load

minimum load specified by the purchaser or declared by the supplier at which unacceptable permanent deformation will not take place

specified minimum slipping load

minimum load specified by the purchaser or declared by the supplier at which slipping will not take place

vibration damper

device attached to a conductor or an earth wire in order to reduce aeolian vibrations [IEV 466-11-16 modified]

4 Requirements

4.1 General requirements

4.1.1 Design

The fittings shall be designed so as to:

- avoid damaging the conductor under service conditions;

- withstand the mechanical loads relevant to installation, maintenance and service, the designed service current including short-circuit current, the service temperatures and environmental circumstances;
- ensure that individual components are secured against becoming loose in service;
- have limited corona effects.

Fittings for live line maintenance shall be suitably designed for safe and easy handling.

Surfaces of compression fittings being in contact with the conductor or earthwire shall be protected from becoming contaminated before the installation.

Brittleness of finished parts shall be avoided by adopting suitable materials and manufacturing process.

4.1.2 Materials

Fittings shall be made of any material suitable for the purpose.

4.1.2.1 Metallic materials

The materials shall meet service life requirements and shall not be liable to intergranular or stress corrosion. They shall not cause corrosion of any other parts of the conductor or earth wire.

The materials of compression fittings shall be capable of withstanding the cold working due to compression. Furthermore, the steel compression components shall also have a sufficient impact strength after the compression.

Examples of suitable materials are the following:

- aluminium or aluminium alloy;
- galvanized steel;
- galvanized malleable or ductile iron;
- stainless steel;
- copper and copper alloys.

It is recommended that ISO standards for materials be used where they exist. Examples of ISO standards for fitting materials are listed in Annex F.

4.1.2.2 Non-metallic materials

Non-metallic materials employed shall have good resistance to ageing and be capable of withstanding service temperatures without detrimental change of properties. Materials shall have adequate resistance to the effects of ozone, ultra-violet radiation and air pollution over the whole range of the service temperature.

They shall not induce corrosion in materials which are in contact with them.

4.1.3 Dimensions and tolerances

The dimensions shall be shown on contract drawings.

Particular regard shall be paid to those dimensions which involve interchangeability, correct assembly, and those for which gauges are specified. Reference shall be made to relevant standards, for example IEC 120, IEC 372, etc.

Tolerances applied to dimensions shall ensure that the fittings meet their specified mechanical and electrical requirements.

4.1.4 Protection against corrosion

All parts of insulator, conductor and earth wire fittings shall be either inherently resistant to atmospheric corrosion or be suitably protected against corrosion, such as may occur in transport, storage and in service. All ferrous parts which will be exposed to the atmosphere in service, except those made of appropriate stainless steel, shall be protected by hot dip galvanizing in accordance, for example, with ISO 1461 or other means giving equivalent protection.

Moreover, unless special measures be taken, there shall never be contact between metals for which the difference in electrochemical potential may give rise to galvanic corrosion capable of impairing the efficiency of the whole equipment. This applies especially to those parts of the fittings that are in direct contact with the conductor.

All external threads shall be cut or rolled before hot dip galvanizing. Internal threads can be cut before or after hot dip galvanizing. If cut after galvanizing they shall be oiled or greased.

4.1.5 Marking

Marking shall ensure the system of traceability for each of the component parts of the fittings.

When practicable, and unless otherwise agreed between purchaser and manufacturer, fittings shall be clearly and indelibly marked as follows:

Fittings used as individual components

Castings

- a) identification of fittings (reference number/specified minimum failure load);
- b) maker's identification;
- c) date of manufacture (month and year);
- d) cast code.

Forgings

- a) identification of fittings (reference number/specified minimum failure load);
- b) maker's identification;
- c) date of manufacture (month and year).

Links and plates

- a) identification of fittings (reference number/specified minimum failure load);
- b) maker's identification;
- c) date of manufacture (month and year).

Assemblies of fittings

- a) identification (reference number/specified minimum failure load);
- b) maker's identification;
- c) date of manufacture of individual items (month and year);
- d) conductor diameter range or conductor code(s), as agreed between purchaser and supplier;
- e) fitting bolt installation torque (unless breakaway torque bolts are used).

Conductor compression fittings

- a) identification (reference number specified minimum failure load);
- b) maker's identification;
- c) date of manufacture (month and year);
- d) conductor size or code name;
- e) compression die sizes;
- f) length to be compressed.

4.1.6 Instructions for assembly

The manufacturers shall provide the assembly instructions of the fittings as far as necessary.

4.2 Requirements for specific fittings

4.2.1 Insulator set fittings and earth wire fittings

For parts made of forged steel, holes which are under mechanical stress can be made by hot punching provided that the holes conform to tolerances on at least 70 % of punched thickness. For parts made of forged steel, holes which are not under mechanical stress can be made by cold or hot punching without the aforementioned limits.

4.2.2 Suspension clamps

The conductor or the earth wire installed in the suspension clamps can be used bare or equipped with armour rods.

The suspension clamps shall be so designed that the effects of vibration, both on the conductor or on the earth wire and on the clamps themselves, are minimized. The clamps shall be designed to avoid localized pressure or damage to the conductor or the earth wire.