

Specification for

Performance of bonds for electric power cable terminations and joints for system voltages up to 36 kV

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- Aluminium Federation
- Association of Consulting Engineers
- Association of Manufacturers of Domestic Electrical Appliances
- British Approvals Service for Electric Cables
- British Cable Makers' Confederation
- British Plastics Federation
- British Railways Board
- British Shipbuilders
- British Steel Industry
- British Telecommunications plc
- Department of the Environment (Property Services Agency)
- Department of Trade and Industry (Consumer Safety Unit, C A Division)
- Electricity Supply Industry in England and Wales
- Engineering Equipment and Materials Users' Association
- ERA Technology Ltd.
- Institution of Electrical Engineers
- London Regional Transport

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

- Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd.)
- Department of Transport
- Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
- Institution of Lighting Engineers
- Ministry of Defence

This British Standard, having been prepared under the direction of the Cables and Insulation Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 29 June 1990

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The following BSI references relate to the work on this standard:
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Foreword

This British Standard has been prepared under the direction of the Cables and Insulation Standards Policy Committee.

Power cables used for the distribution of electricity are generally provided with a metallic envelope. This envelope, generally known as a screen, functions as the protective conductor of the cable. It is designed to have an adequate current rating to enable it to carry, without damage, any fault current that may flow during the time taken for the devices protecting the cable to operate. Therefore in a cable joint, provision has to be made to connect together screens of the cables in the joint and/or terminations by means of bonds.

This specification not only specifies the general requirements of such bonds but also gives recommended cross-sectional areas of copper, aluminium and steel bonds. An appendix gives guidance on various forms of bonding.

There is currently no published International Standard for bonds covered by this standard.

It is assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

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, pages 1 to 12, 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.

1 Scope

This British Standard specifies requirements for bonds for connecting the metallic envelopes (protective conductors) of electric power cables at terminations and joints for system voltages up to 36 kV for the different types of cables covered by British Standards.

The standard describes performance test methods, tables cross-sectional areas of solid copper, aluminium and steel bonds calculated in accordance with a given formula and gives guidance on matters which affect the following.

- a) Provision of a circuit in joints between cables and between a cable and its terminal equipment for the transmission of currents which may arise under system fault conditions.
- b) Provision of bonding for neutral conductors (CNE only).
- c) Provision of overall protective conductors at joints to provide for the passage of a fault current in the event of mechanical damage or failure of the insulation and to contain the electric field around high voltage conductors.

Guidance on bonding is given in Appendix A.

The standard specifically excludes additional safety precautions necessary when jointing live cables.

NOTE The title of the publication referred to in this standard is given on the inside back cover.

2 Definitions

For the purposes of this British Standard, the definitions given in BS 4727-2:Group 08 apply, together with the following.

2.1

low voltage

a system voltage normally exceeding 50 V but not exceeding 600/1 000 V a.c.

2.2

high voltage

a system voltage exceeding 600/1 000 V a.c.

2.3

SNE (separate neutral earth)

a cable in which the neutral load carrying conductor is separate from and insulated from the earth conductor

2.4

CNE (combined neutral earth)

a cable in which the neutral load carrying conductor is also the earth conductor

2.5

straight through joint

a connection between two identical or substantially similar cables

2.6

termination

a device fitted to the end of a cable to ensure electrical connection with other parts of the system and to maintain the insulation up to the point of connection

2.7

branch joint

a connection with three cable entry ports used to connect one cable (designated branch) to a through cable (designated main), the cables being of comparable size

NOTE The geometric arrangement may be "T" or "Y" form and the main cable may be cut or uncut.

2.8

transition joint

a connection between cables having different types of insulation

2.9

service joint

similar to a branch joint but with the tap off cable (designated service) considerably smaller than the main cable and generally not greater than 35 mm²

2.10

earth conductor

the metallic conductor that may be in the form of a metallic screen, lead or aluminium sheath, armour or a separate conductor cable which is intended to form a continuous electrical connection to earth

2.11

earth bond

a connection between the earth potential components of cable, joint or termination to the cable earth conductor

2.12

earth continuity bond

- 1) A connection between the earth conductors of cables within a joint which maintains earth continuity throughout the jointed cable.
- 2) A connection between the earth conductor of a cable and a suitable earthing point at a termination.

2.13

earth screen

a metallic layer over or within a joint the principal function of which is to provide a protective screen against electric fields

2.14**earth fault current**

the prospective short time current (generally less than 3 s) that can flow to earth under system phase to earth fault conditions without permanent system damage

2.15**three phase symmetric fault current**

the prospective short time current (generally less than 3 s) that can flow between phases under system phase to phase fault conditions without permanent system damage

2.16**continuous load current**

the maximum continuous current that can flow in the system under normal operating conditions for an unrestricted time and without system damage

2.17**protective conductor**

a conductor used for some measures of protection against electric shock, and intended for connecting together any of the following parts:

- exposed conductive parts;
- extraneous conductive parts;
- the main earthing terminal;
- earth electrode(s);
- the earthed point of the source, or an artificial neutral.

3 Bonds**3.1 General**

NOTE 1 Power cables used for the distribution of electricity are generally provided with a metallic envelope(s) [protective conductor(s)]. The purpose of this envelope is:

- a) to contain the electric field around the cores where there is no dielectric screen;
- b) to ensure that in the event of a failure of the insulation of the cable, a circuit is provided to enable current to flow through the fault to the neutral point of the system supplying the cable which is usually connected to the mass of earth;
- c) to carry fault current, derived from a failure of insulation in electrical plant that is connected to the cable, to the neutral point of the system supplying the cable;
- d) for use, in certain designs of low voltage cable, as a neutral conductor which will carry the neutral current of the circuit and is rated accordingly.

The metallic envelope may be made from steel, copper or aluminium wires that are equally spaced around the circumference of the cable or cores and wound in a helix or waveform along the length of the cable or cores. Screens can also be made from lead or aluminium that has been extruded over the cable to form a metallic tube. In addition tapes of copper or aluminium may be wound in a helix around the cable or cores, or applied longitudinally along the cable or cores, and folded around the circumference of the cable to provide a complete screen.

The metallic envelope is designed to have an adequate current rating to enable it to carry, without damage, any fault current that may flow during the time taken for the protective devices to operate.

Provision shall be made in a cable joint to connect together the metallic envelope(s) of the cables in the joint by means of bonds. Collectively the bonds need to have the same fault current rating as the envelope which in turn shall be not less than the earth fault rating of the cable.

At cable terminations, connections shall be included as part of the termination to provide means whereby the envelope(s) of the cable can be connected to:

- 1) the metallic enclosure of an item of electrical plant;
- 2) any other electrical circuit that will enable fault current to return to the neutral point of the supply system.

The connections shall be rated to carry a current no less than the earth fault rating of the cable.

NOTE 2 Different types of envelope will require different methods of connection to provide adequate earth continuity bonds.

3.2 Construction**3.2.1 General**

Each bond shall consist of the following:

- a) a metallic conductor with, if necessary, protection against corrosion; and
- b) a means of connection to the cable protective conductors by either mechanical clamps, soldering or compression with, if necessary, protection against corrosion.

Alternatives, including the use of the cable protective conductor(s) itself as the joint or termination earth continuity bond, are acceptable providing they comply with this standard.

NOTE If the cable protective conductor is used its rating within a joint or at a termination might be lower than its rating within the cable. In particular, bunched armour or screen wires may have only about 50 % of the rating of the same wires applied helically in the cable.

3.2.2 Additional requirements for joints that require screening by a protective conductor

In joints that incorporate a metallic screen surrounding the insulated conductors, the metallic screen shall cover the full length of the joint from one metallic envelope to the other. The metallic screen of the joint shall be bonded to the metallic envelope of the cable and it is permitted to form all or part of the bond. Screens in joints and terminations for use on systems up to and including 12 kV shall not have any aperture greater than 8 mm width.

3.3 Avoiding mechanical damage to cable components

The bond shall be of a suitable form to allow effective connection without damaging the cable protective conductor or other cable components.