

BRITISH STANDARD 159 : 1957

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BUSBARS

AND BUSBAR CONNECTIONS

BRITISH STANDARDS INSTITUTION

BRITISH STANDARD SPECIFICATION

BUSBARS

AND BUSBAR CONNECTIONS

B.S. 159 : 1957

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THIS BRITISH STANDARD, having been approved by the Electrical Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 30th September, 1957.

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The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 5000, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook

This standard makes reference to the following British Standards :

- B.S. 116. Oil circuit-breakers for alternating current systems above 1kV.
- B.S. 125. Hard-drawn copper conductors for overhead power transmission purposes.
- B.S. 158. Marking and arrangement for switchgear bus-bars, main connections and auxiliary wiring.
- B.S. 162. Electric power switchgear for indoor and outdoor installations up to and including 220,000 volts.
- B.S. 215. Hard-drawn aluminium and steel-cored aluminium conductors for overhead power transmission purposes.
- B.S. 223. High-voltage bushings.
- B.S. 480, Pt. 1. Impregnated paper-insulated cables for electricity supply. Part 1, lead or lead-alloy sheathed cables for working voltages up to and including 33 kV.

- B.S. 1432. Copper for electrical purposes. Sheet and strip.
B.S. 1433 Copper for electrical purposes. Bar and rod.
B.S. 1977. Copper for electrical purposes. Tubes (high conductivity).
B.S. 2627. Wrought aluminium for electrical purposes, Wire.
B.S. 2725. Memorandum on the measurement of cooling-medium temperature when testing electrical machines, transformers and other electrical apparatus.
B.S. 2817. Types of enclosure of electrical apparatus.
B.S. 2898. Wrought aluminium for electrical purposes, Bars and sections.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following B.S.I. references relate to the work on this standard:—
Committee reference ELE/10, ELE/10/10
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CO-OPERATING ORGANIZATIONS

The Electrical Industry Standards Committee under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

- *Admiralty
- *Air Ministry
 - Associated Offices' Technical Committee
- *Association of Consulting Engineers (Incorporated)
 - Association of Supervising Electrical Engineers
- British Electrical and Allied Industries Research Association
- *British Electrical and Allied Manufacturers' Association
 - British Electrical Development Association
- *British Railways, The British Transport Commission
- *Cable Makers' Association
- *Central Electricity Authority and Area Boards
- *Crown Agents for Oversea Governments and Administrations
 - Electric Lamp Industry Council
 - Electric Light Fittings Association
 - Electrical Contractors' Association (Incorporated)
 - Electrical Contractors' Association of Scotland
- *Engineering Equipment Users' Association
- *General Post Office
 - Independent Cable Makers' Association
- *Institution of Electrical Engineers
- *Ministry of Power
- *Ministry of Labour and National Service (Factory Inspectorate)
- *Ministry of Supply
 - Ministry of Works
 - National Inspection Council for Electrical Installation Contracting
- *National Physical Laboratory (D.S.I.R.)
- *Oil Companies Materials Committee
 - Public Transport Association (Incorporated)
- Radio Industry Council
- *South of Scotland Electricity Board
- War Office

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of the standard.

- Aluminium Development Association
- Aluminium Industry Council
- Association of Mining, Electrical and Mechanical Engineers
- Copper Development Association
- Engineer Surveyors Association
- Lloyd's Register of Shipping
- London Transport Executive, The British Transport Commission
- National Coal Board

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BRITISH STANDARD SPECIFICATION FOR

BUSBARS AND
BUSBAR CONNECTIONS

FOREWORD

This standard revises and supersedes the 1932 edition. In this edition the requirements for busbars and busbar connections for a.c. switchgear are more precisely stated, although the standard remains applicable to d.c. switchgear.

Further, although primarily intended to apply to busbars associated with electrical power switchgear, many of the clauses may be applied to connections between other items of power equipment.

Certain Appendices to the 1932 edition are no longer included as it is felt that the subjects dealt with are now widely understood and there are sufficient reference works available for consultation.

NOTE: The figures in British units are to be regarded as the standard. The metric conversions are approximate. More accurate conversions should be based on the tables in B.S. 350, 'Conversion factors and tables'.

SPECIFICATION

SECTION ONE: GENERAL

SCOPE

1. This British Standard relates to busbars and busbar connections having current ratings of 200 amperes and above, which are components of a.c. electrical power switchgear and are composed of metal such as copper or aluminium, with air, oil, solid or semi-solid materials as principal insulation. They may or may not be provided with an enclosure of metal or insulating material.

The standard also applies in part to d.c. busbars and busbar connections and to a.c. and d.c. connections of a similar character between other items of electrical power equipment.

Insulators such as bushings and supports may comprise part of the busbar assembly, and detailed requirements for such insulators are laid down in the appropriate British Standards.

No requirements for enclosures are given in this standard but reference may be made to appropriate types of enclosure in B.S. 2817 'Types of enclosure of electrical apparatus'.

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The marking of busbars is dealt with in B.S. 158, 'Marking and arrangement of switchgear busbars, main connections and auxiliary wiring'.

The standard does not relate to insulated cables which may form a part of busbars or busbar connections.

DEFINITIONS

2. For the purposes of this British Standard the following definitions apply:

1. *Busbar*. A relatively short conductor forming a common junction between a number of circuits connected separately thereto.

2. *Busbar connection*. A conductor that forms the electrical connection between a busbar and an individual piece of apparatus that is within reasonable proximity.

3. *Open busbar*. A busbar that is not provided with a protective cover

4. *Enclosed busbar*. A busbar that is contained in a duct or casing of any material. When the material is metal the terms metal-clad and metal-enclosed are used.

5. *Air-insulated busbar*. A busbar which, except at points of support, is designed with air as the principal dielectric. It may be covered with insulating material.

6. *Oil-immersed busbar*. An enclosed busbar that is totally immersed in an insulating oil.

7. *Compound-immersed busbar*. An enclosed busbar that is totally immersed in a solid or semi-solid insulating compound.

8. *Bushing type busbar*. An enclosed busbar built up of jointed sections of tubular or solid conductor, the sections being covered with solid insulation with an external earthed sheath. The joint between sections may be air insulated, or immersed in oil or compound. The solid insulation of the sections may include coaxial conducting layers for the control of internal or external electrical stresses (see B.S. 223 'High-voltage bushings').

9. *Compressed gas-insulated busbar*. An enclosed busbar surrounded by air or other gas above atmospheric pressure.

10. *Rated voltage*. The voltage assigned by the manufacturer to indicate the nominal r.m.s. system voltage between lines for which the equipment is intended.

11. *Rated frequency*. The frequency assigned by the manufacturer to indicate the system frequency for which the equipment is intended.

12. *Rated normal current*. The r.m.s. value of the current, assigned by the manufacturer to indicate the current that a busbar or busbar connection is capable of carrying continuously under prescribed conditions.

13. *Rated short-time current*. The r.m.s. value of the current, assigned by the manufacturer to indicate the current that a busbar or busbar

connection is capable of carrying for the stated time under prescribed conditions.

14. Electrically exposed installation. An installation in which the apparatus is subject to over-voltages of atmospheric origin (see Appendix C).

NOTE 1. Such installations are usually those connected to overhead transmission lines, either directly or through a short length of cable.

NOTE 2. Apparatus may be required for installations which are semi-exposed to over-voltages of atmospheric origin, that is to over-voltages of magnitude less than those met with in an exposed installation. Such installations are usually those connected to overhead transmission lines through two-winding transformers, or a longer length of cable, which reduce the amplitude of incoming over-voltages and require special consideration. The apparatus will be chosen from the appropriate exposed or non-exposed insulation class, as a special class of insulation is not proposed for such cases.

15. Electrically non-exposed installation. An installation in which the apparatus is not subject to over-voltages of atmospheric origin (see Appendix C).

NOTE. Such installations are usually those connected to cable networks.

16. Outdoor busbar. An open busbar or a metal-enclosed busbar designed for use entirely out of doors.

17. Indoor busbar. An open busbar or an enclosed busbar designed for use entirely indoors.

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SECTION TWO : RATING

RATING OF BUSBAR AND BUSBAR CONNECTIONS

3. Busbars and busbar connections shall be rated in terms of the following:

a. Voltage

b. Normal-current.

c. Frequency.

d. Short-time current

either (i) 1-second or 3-second ;

or (ii) for busbars and busbar connections directly associated with circuit-breakers fitted with direct acting trips such as series trip coils, or other over-current devices, 1-second or a time corresponding to the maximum setting of the time-lag device (see Clause 7 b) ;

or (iii) for busbars and busbar connections directly associated with fuses, the maximum cut-off current of the fuses for the duration of its flow (see Clause 7 c).

For an enclosed busbar, where this forms a separable unit, the busbar rating shall be stated on a separate rating plate attached thereto, and where the rating of a busbar and the busbar connections differ, both ratings shall be stated on the busbar rating plate.

In other cases, the busbar ratings shall be stated on the rating plate of the main equipment with which they are associated.

RATED VOLTAGE

4. The rated voltage of busbars and busbar connections for use on three-phase a.c. systems shall be one of the standard voltages of Table 1.

TABLE 1. RATED VOLTAGES

<i>kV</i>	<i>kV</i>
0.415	44
0.6	66
3.3	88
6.6	110
11	132
15	165
22	220
33	275

NOTE 1. The voltages in bold type are preferred values.

NOTE 2. Busbars and busbar connections having rated voltages of 0.415 kV and 0.6 kV are suitable for use at 0.44 kV and 0.66 kV respectively.

RATED NORMAL CURRENT

5. Busbars and busbar connections shall be capable of carrying continuously their rated normal current with a temperature rise in accordance with the requirements of Section Three.

The rated normal current of busbars at a rated frequency of 50 c/s shall be one of the standard values of Table 2.

TABLE 2. RATED NORMAL CURRENTS*

Amperes

200
400
600
800
1 200
1 600
2 000
2 400
3 000

NOTE. At rated frequencies other than 50 c/s, standard busbars and busbar connections may have rated normal currents differing from those of the above table

When special conditions necessitate higher rated normal currents than those given in the table, increments of 1000 amperes are recommended.

RATED FREQUENCY

6. The standard value of the rated frequency is 50 c/s.

RATED SHORT-TIME CURRENT

7. Unless stated to the contrary by the manufacturer, where busbars and busbars connections are directly associated with a circuit-breaker or a switch, the value and the duration of the rated short-time current of the busbars and busbar connections shall be not less than the corresponding rating of the circuit-breaker or switch.

*As Amended
Dec., 1972*

b. A rated short-time current need not be assigned to busbars or busbar connections protected by a circuit-breaker fitted with direct-acting trips, such as series trip-coils or other over-current devices provided that, when connected to any circuit the prospective current of which is within the rated breaking-capacity of the circuit-breaker, the busbar or busbar connection is capable of carrying the resulting current for the total

* For flameproof equipments the additional rating of 300 amp is standardized.