

Specification for

Wrought aluminium And aluminium alloys for electrical purposes —

Bars, extruded round tube and sections

UDC 669.71 – 42:621.3

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Co-operating organizations

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

Aluminium Federation*	Institution of Mechanical Engineers
Association of Bronze and Brass Founders	(Automobile Division)
Association of Consulting Engineers	Institution of Mining and Metallurgy
Board of Trade	Institution of Production Engineers
British Bronze and Brass Ingot Manufacturers' Association	Institution of Structural Engineers
British Electrical and Allied Manufacturers' Association*	Lead Development Association
British Lead Manufacturers' Association	Light Metal Founders' Association
British Non-ferrous Metals Federation	London Metal Exchange
British Non-Ferrous Metals Federation—High Conductivity Copper Group	Magnesium Industry Council
British Non-ferrous Metals Research Association	Ministry of Defence, Army Department
Copper Development Association	Ministry of Defence, Navy Department
Crown Agents for Overseas Governments and Administrations	National Brassfoundry Association
Electric Cable Makers Confederation*	Non-ferrous Metal Stockists*
Institute of British Foundrymen	Post Office*
Institute of Metals	Royal Institute of British Architects
	Society of Motor Manufacturers and Traders Ltd.
	Tin Research Institute
	Zinc Development Association
	Individual manufacturer

The Government department 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 this British Standard:

British Railways Board	Institute of Iron and Steel Wire Manufacturers
Electricity Supply Industry in England and Wales	Institute of Sheet Metal Engineering

This British Standard, having been approved by the Non-Ferrous Metals Industry Standards Committee, was published under the authority of the Executive Board on 31 March 1970

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First published, September 1957
First revision, March 1970

The following BSI references relate to the work on this standard:
Committee reference NFE/24
Draft for comment 68/29134

ISBN 580 05789 5

Amendments issued since publication

Amd. No.	Date	Comments
3379	June 1980	Indicated by a sideline in the margin

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Foreword

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, fully indexed and with a note of the contents of each, will be found in the British Standards Yearbook. The BS Yearbook may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

BS 18, *Methods for the tensile testing of metals*.

BS 18-1, *Non-ferrous metals*.

BS 1499, *Sampling non-ferrous metals*.

BS 1728, *Methods for the analysis of aluminium and aluminium alloys*.

BS 3239, *Determination of resistivity of metallic electrical conductor materials*.

BS 3660, *Glossary of terms used in the wrought aluminium industry*.

This British Standard was first published in 1957 under the authority of the Non-Ferrous Metals Industry Standards Committee and at the request of the Aluminium Industry to cover aluminium material for busbar, switchgear components and other conductor applications. It previously referred to solid bars and sections but has now been extended to cover also extruded round tube and hollow sections in electrical purity aluminium and an aluminium alloy, which are required for components made to other British Standards e.g. BS 159, "*Busbars and busbar connections*".

In this edition of the standard all dimensions are given in metric units and new tables of metric tolerances have been introduced which do not represent a "translation" of the previous imperial unit tolerances. Tables of preferred sizes for rectangular bar, extruded tube and round bar have also been included. The maximum resistivity values for the two conditions of pure aluminium have both been reduced to $2.8264 \mu\Omega \text{ cm}$ (61.0 % IACS) whilst that for the aluminium alloy remains at $3.133 \mu\Omega \text{ cm}$ (55.0 % IACS).

The conditions previously covered have been retained but new designations have been introduced based on the system under consideration by ISO/TC 79 "*Light metals and their alloys*". The new designations bear the following relationship to the superseded designations.

New designation	Superseded designation	Description
M	M	As manufactured. Material which acquires some temper from shaping processes in which there is no special control over thermal treatment or amount of strain hardening.
H2	1/4H	Strain hardened. Material subjected to the application of cold work after annealing (or hot forming) or to a combination of cold work and partial annealing/stabilizing in order to secure the specified mechanical properties.
TF	WP	Solution heat-treated and precipitation-treated material.

All stresses are quoted in terms of the hectobar (hbar)¹.

This standard is one of a series of standards for wrought aluminium and aluminium alloys for electrical purposes.

¹ 1 hbar = 10 MN/m² = 10 N/mm².

As a major step towards alignment of aluminium and aluminium alloy compositions on an international basis, a substantial number of countries have agreed to adopt a 4-digit classification for alloy composition designation. This system is administered by the Aluminum Association Inc., who issue the “Registration Record of International Alloy Designations and Chemical Composition Limits for Wrought Aluminum Alloys”.

By amendment, it has been decided to introduce this system into the British Standards concerned with these types of material in place of the material designations formerly used. The details of the system are given in Appendix C. The temper designations and associated mechanical property requirements remain unaltered for the present and therefore may not necessarily align precisely with those in the standards of other countries.

Materials 1350 and 6101A therefore replace materials E1E and E91E respectively. Minor compositional changes have been made.

Other standards in this series are:

BS 2627, *Wrought aluminium for electrical purposes. Wire.*

BS 2897, *Wrought aluminium for electrical purposes. Strip with drawn or rolled edges.*

BS 3988, *Wrought aluminium for electrical purposes. Solid conductors for insulated cables.*

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 to iv, pages 1 to 15 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 General requirements

1.1 Scope

This British Standard specifies requirements for aluminium and aluminium alloy round and square bar not less than 10 mm in diameter or across flats rectangular bar of not less than 2.5 mm minor dimension, and extruded round tubes and sections, for electrical conductors, and includes details of chemical composition, mechanical properties and electrical resistivity.

Preferred sizes for rectangular bar, extruded tube and round bar are given in Appendix A.

1.2 Definitions

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

bar

a round or square solid section supplied in straight lengths and of not less than 10 mm diameter or width across flats, or a rectangular solid section supplied in straight lengths and of not less than 2.5 mm minor dimension

extruded round tube²⁾

a circular hollow extrusion of uniform wall thickness not subjected to cold drawing

hollow section²⁾

an extruded shape other than round, the cross section of which completely encloses a void or voids, and which is not subjected to cold drawing

regular section

a solid drawn or extruded section, not otherwise covered by the definition of bar, which can be conveniently divided into approximate rectangles with measurable dimensions, e.g. angles, channels, tees etc. The ratio of maximum to minimum thickness of such regular sections does not exceed 4 : 1

1.3 Freedom from defects

The material shall be free from defects prejudicial to its use as an electrical conductor.

1.4 Dimensions and tolerances

1.4.1 Tolerances on bar, regular sections, extruded round tube and hollow sections. The dimensional tolerances shall comply with the following tables:

Table 1	Tolerances on diameter, width and thickness of bars and regular sections.
Table 2	Tolerances on open ends of channels and I beams.
Table 3	Tolerances on angle for extruded sections.
Table 4	Normal radii for corners of square and rectangular bar and regular sections.
Table 5	Tolerances on wall thickness of extruded round tube.
Table 6	Tolerances on outside and inside diameter of extruded round tube.
Table 7	Tolerances on width, width across flats and thickness of hollow sections.
Table 8	Cutting to length tolerances for bars, extruded round tube and sections.
Table 9	Straightness tolerances for extruded bars, regular sections and extruded round tube.
Table 10	Twist tolerances for extruded solid and hollow sections.

For purposes of tolerances, regular sections shall be divided into a series of equivalent rectangles, an angle, for example, being divided into two rectangles. For the purpose of determining tolerances on thickness and width, the widths of each such rectangle shall be the same as the major linear dimension of the angle, and the tolerance on thickness of each leg of the angle shall be taken as if that leg were a rectangle of the same overall dimension.

1.4.2 Sections of complicated shape.

Complicated sections shall be regarded as those sections which are not covered by Table 1, Table 2, Table 5, Table 6, Table 7. In such cases the tolerances shall be agreed between the supplier and the purchaser. The tolerances shall be based, as far as possible on those for regular sections and for extruded hollow sections.

1.4.3 Tolerance on concavity and convexity. A maximum tolerance on concavity and convexity of 0.05 mm per 10 mm shall apply over the width of the section (see Figure 1).

²⁾ Extracted from BS 3660, "Glossary of terms used in the wrought aluminium industry".