BRITISH STANDARD

BS 1474:1987

Reprinted, incorporating Amendment Nos. 1, 2 and 3

Specification for

Wrought aluminium and aluminium alloys for general engineering purposes: bars, extruded round tubes and sections

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Non-ferrous Metals Standards Committee (NFM/-) to Technical Committee NFM/35, upon which the following bodies were represented:

Aluminium Federation
Aluminium Stockholders' Association
Association of Light Alloy Refiners Limited
Department of Trade and Industry (Minerals and Metals Division)
Light Metal Founders' Association
Magnesium Industry Council
Royal Institute of British Architects
Society of Motor Manufacturers and Traders Limited

The following body was also represented in the drafting of the standard, through subcommittees and panels:

Institution of Structural Engineers

This British Standard, having been prepared under the direction of the Non-ferrous Metals Standards Committee, was published under the authority of the Board of BSI and comes into effect on 23 December 1987

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The following BSI references relate to the work on this standard:
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Amendments issued since publication

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Contents

Foreword

This British Standard has been prepared under the direction of the Non-ferrous Metals Standards Committee. It is the fourth revision of this standard and replaces the 1972 edition which is withdrawn.

Other standards in this series of specifications for wrought aluminium and aluminium alloys for general engineering purposes are as follows.

BS 1470, *Plate sheet and strip.*

BS 1471, *Drawn tube.*

BS 1472, *Forging stock and forgings.*

BS 1473, *Rivet, bolt and screw stock.*

BS 1475, *Wire.*

New designation systems for both composition and tempers have been introduced in this revision.

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 Aluminium Association (AA) of the USA, which issues the "Registration record of international alloy designations and chemical composition limits for wrought aluminium and wrought aluminium alloys"[1)].

It has been decided to use this system in British Standards to designate the nominal chemical composition of the alloys specified. This has necessitated, in some cases, minor compositional changes from the previous alloys used. The details of the AA system are given in Appendix B, and a cross-reference table for the new and old British Standard alloy designations and the nearest equivalent ISO (International Organization for Standardization) alloy designations is included in Appendix C.

The temper designation system used is that given in BS EN 515.

The opportunity was taken in this revision to consider the alloys and tempers currently used commercially in significant quantities. As a consequence, one alloy previously in BS 4300/4 (alloy 6463) and a new alloy 6060 have been included.

The appendices contained in the 1972 edition concerning forms of material available, the annealing and heat treatment of wrought aluminium and its alloys, and standard sizes of material, have been omitted. Detailed information concerning the annealing and heat treatment of aluminium alloys can be obtained from the Aluminium Federation publication "Properties of aluminium and its alloys'[2)].

In previous editions of this standard, clauses were included entitled "Inspection" and "Facilities for testing". As these clauses were contractual in nature and are not relevant to a product standard, they have been omitted from this revision.

[1)] Available from the Aluminum Association Inc., 900 19th Street, NW, Suite 300, Washington DC, 20006, USA.

[2)] Available from the Aluminium Federation, Broadway House, Calthorpe Road, Five Ways, Birmingham, B15 1TN.

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 22, 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 chemical composition, mechanical properties, dimensional tolerances, the selection of test samples and test methods for solid bars and sections and for extruded round tube and hollow sections made from two grades of aluminium (unalloyed) and ten aluminium alloys in various tempers.

NOTE 1 Information which purchasers are recommended to provide in any enquiry or order is given in Appendix A. Details of the international alloy designations and chemical composition limits for wrought aluminium alloys are given in Appendix B. Appendix C contains a cross-reference table for British Standard and ISO alloy and temper designations. A rule for the rounding on numbers is set out in Appendix E.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

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

2.1
bar

a round, rectangular or polygonal solid section supplied in straight lengths, applicable to materials not less than 6 mm diameter or minor dimension

2.2
extruded round tube

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

NOTE Extruded round tube may be seamless (see **2.3**) or porthole/bridge (see **2.4**) tube.

2.3
seamless tube

tube in which there is no split or deliberate longitudinal bonding of two or more edges by pressure, fusion or mechanical interlocking

2.4
porthole/bridge tube

tube produced by extrusion of a solid billet through a porthole/bridge die (see **2.5**)

2.5
porthole die

an extrusion die that incorporates a mandrel as an integral part of the die assembly

NOTE Bridge, spider, duo and self-stripping dies are special forms of porthole die.

2.6
heat treatment batch

a quantity of material of one alloy, of the same dimensions and produced in the same way, solution heat-treated and, if required, subsequently artificially aged in one furnace load

NOTE More than one heat treatment batch may comprise a furnace load.

2.7
hollow section

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

2.8
purchaser

the party, whether user, retailer, wholesaler or corporate body or his/its agent(s) as appropriate, responsible for ordering the material standardized

2.9
regular section

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

3 General requirements

Bars, extruded round tubes and sections shall comply with clauses **4** to **8**.

When tests are carried out to verify that a batch of bars, extruded round tubes or sections complies with the requirements for mechanical properties (see clause **6**), the selection of test samples and the test methods used shall be in accordance with clauses **9** and **10**.

4 Chemical composition

The chemical composition of bars, extruded round tubes and sections shall be as given in Table 1 and Table 2 for the appropriate material.

NOTE Alloy 6060 is new to this British Standard. Alloy 6463 was previously included in BS 4300/4.

5 Tempers

The material shall be supplied to a temper in accordance with BS EN 515 as specified by the purchaser and selected from Table 1 or Table 2.

F As fabricated.

O Annealed.

T4 Solution heat-treated and naturally aged.
NOTE Properties of some alloys in this temper are unstable.

T5 Cooled from an elevated temperature shaping process and then artificially aged.

T6 Solution heat-treated and artificially aged.

6 Mechanical properties

The mechanical properties (i.e. 0.2 % proof stress, tensile strength and elongation, as appropriate) of bars, extruded round tubes and sections shall be as given in Table 1 and Table 2, except that for tubes and hollow sections having a wall thickness greater than 75 mm, no mechanical properties are specified.

Where a tensile strength range is specified in Table 1, the requirements of the standard shall be regarded as being met if the upper limit of the range is exceeded by a maximum of 10 N/mm^2, provided that the minimum value specified for the elongation after fracture is achieved.

NOTE 1 The tensile strength requirements given in Table 1 and Table 2 are either single minimum or maximum values, or ranges, depending upon the technical requirements and application of the individual materials.
NOTE 2 There are no mandatory mechanical properties specified for materials in the "F" temper. Table 1 and Table 2 give properties for the "F" temper for information only.

7 Tolerances on dimensions

7.1 General

The dimensional and shape tolerances of bars, extruded round tubes and sections for the various materials, shapes, sizes and end-uses covered by this standard shall be as given in **7.2** to **7.7**.

NOTE The dimensional and shape tolerances of materials outside the size ranges covered in Table 3 to Table 17 should be agreed between the purchaser and the supplier at the time of the enquiry and order.

7.2 Tolerances on round bar

7.2.1 The tolerances on the diameter, straightness and length of round bars (other than those covered by **7.2.2** and **7.2.3**) shall be as given for the appropriate size in Table 6, Table 14 and Table 15, except that for bars in alloy 5083 the tolerances in Table 6 shall be increased by one-third.

7.2.2 The tolerances on the diameter, straightness and length of round bars intended for use on automatic lathes shall be as given for the appropriate size in Table 3, Table 14 and Table 15.

NOTE When round bar is required for use on automatic lathes, this should be clearly stated in the enquiry and order (see item f) in Appendix A).

7.2.3 The tolerances on the diameter, straightness and length of controlled stretched round bar shall be as given for the appropriate size in Table 5, Table 14 and Table 15.

7.3 Tolerances on hexagonal and regular polygonal bar

7.3.1 The tolerances on the width across flats, the straightness and the length of hexagonal bars intended for use in the manufacture of nuts and bolts shall be as given for the appropriate size in Table 4, Table 14 and Table 15.

NOTE When hexagonal bar for the manufacture of nuts and bolts is required, this should be clearly stated in the enquiry and order (see item h) in Appendix A).

7.3.2 The tolerances on the width across flats, the straightness and the length of hexagonal bars, other than those covered by **7.3.1**, and of regular polygonal bar shall be as given for the appropriate size in Table 6, Table 14 and Table 15, except that for bars in alloy 5083 the tolerances in Table 6 shall be increased by one-third.

7.4 Tolerances on rectangular bar and solid regular sections

The tolerances on the width, thickness, angular dimensions, corner radii, straightness, length, and the concavity, convexity and twist (when measured on a flatness inspection table) of rectangular bar and solid regular sections shall be as given for the appropriate size in Table 6, Table 7, Table 9, Table 10, Table 14, Table 15, Table 16 and Table 17, except that for bars and sections in alloy 5083 the tolerances in Table 6 and Table 7 shall be increased by one-third.

NOTE The tolerances on the shape and dimensions of non-regular sections should be agreed between the supplier and the purchaser at the time of the enquiry and order.

7.5 Tolerances on channels and I-beams

In addition to the tolerances given in **7.4**, the tolerances on the open end dimension(s) of channels and I-beams shall be as given for the appropriate size in Table 8 (see also Figure 1).

7.6 Tolerances on extruded round tube

7.6.1 The tolerances on the outside diameter, straightness and length of tube in all materials shall be as given in Table 12, Table 14 and Table 15.

7.6.2 In addition to the tolerances given in **7.6.1**, and if no tolerances for the inside diameter are required (see item k) in Appendix A), the tolerances on the wall thickness of tube shall be as given for the appropriate size and class in Table 11 as follows:

a) tube in materials 1050A, 1200, 6060, 6061, 6063, 6063A, 6082 and 6463 shall comply with class A, class B or class C tolerances, as specified by the purchaser (see item i) in Appendix A);

b) tube in materials 5251, 5083, 5154A and 2104A shall comply with class B or class C tolerances, as specified by the purchaser (see item j) in Appendix A).

NOTE Class A tolerances are normally applied to porthole/bridge tube. Class B tolerances may be applied to both seamless and porthole/bridge tube. Class C tolerances apply to seamless tube produced by extrusion over a tapered mandrel. This method of production results in a tube whose wall thickness tapers along the length of the extrusion.

7.6.3 If a wall thickness tolerance is not specified and the outside and inside diameters are specified, then the tolerances on these dimensions shall be as given for the appropriate size in Table 12.

NOTE The tolerances on eccentricity for class A and class B tube when a wall thickness tolerance is not specified should be agreed between the purchaser and the supplier at the time of the enquiry and order.

7.7 Tolerances on hollow sections

7.7.1 The tolerances on the width and length, and on concavity, convexity, straightness and twist (when measured on a flatness inspection table), of hollow regular sections shall be as given in Table 6, Table 14, Table 15, Table 16 and Table 17, except that for hollow sections in alloy 5083 the tolerances in Table 6 shall be increased by one-third.

7.7.2 In addition to the tolerances given in **7.7.1**, the tolerances on the thickness of hollow regular sections shall be as given for the appropriate size and class in Table 13 as follows:

a) hollow regular section in materials 1050A, 1200, 6060, 6061, 6063, 6063A, 6082 and 6463 shall comply with class A or class B tolerances, as specified by the purchaser (see item l) in Appendix A);

b) hollow regular section in materials 5154A, 5251 and 2014A shall comply with class B tolerances;

c) hollow regular section in material 5083 shall comply with class B tolerances in Table 13, increased by one-third.

7.7.3 The tolerances on the straightness, length and permitted twist of hollow non-regular sections shall be as given in Table 14, Table 15 and Table 17.

NOTE The tolerances on all other dimensions of hollow non-regular sections should be agreed between the supplier and the purchaser at the time of the enquiry and order.

8 Freedom from defects

The material shall be free from defects prejudicial to its suitable and proper use.

9 Selection and preparation of test samples

9.1 Bars, extruded round tube and sections of aluminium and non-heat-treatable aluminium alloys

Material of the same cross-sectional dimensions, produced in the same way and of the same nominal composition shall be grouped into batches as follows:

a) for round bar of diameter up to and including 10 mm, and for other shapes having a cross-sectional area less than 80 mm^2, a batch shall consist of 1 000 kg or fraction thereof;

b) for round bar of diameter over 10 mm, and for other shapes having a cross-sectional area equal to or greater than 80 mm^2, a batch shall consist of 2 000 kg or fraction thereof.

One test sample shall be cut from a bar, tube or section selected from each batch. Before the test samples are cut off, they shall be suitably marked to identify them with the batch represented. The test samples shall be taken from the material or its offcuts in the "as supplied" temper and shall not be annealed or mechanically worked (except for straightening and machining the test piece) before being tested.

9.2 Bars, extruded round tube and sections of heat-treatable aluminium alloys

Material of the same cross-sectional dimensions, produced in the same way and of the same nominal composition shall be grouped into batches as in **9.1** to form a heat treatment load, unless the heat treatment load is smaller, in which event that shall constitute the batch.

One test sample shall be cut from a bar, tube or section selected from each batch. Before the test samples are cut off, they shall be suitably marked to identify them with the batch represented. The test samples shall be taken from the material or its offcuts in the "as supplied" temper (but see note) and shall not be further heat treated or mechanically worked (except for straightening and machining the test piece) before being tested.

NOTE If a purchaser intends to convert the material to a final temper which is different from the "as supplied" temper, then additional testing may be requested by the purchaser in order to satisfy himself that the material is capable of meeting the specified properties of the final temper. For instance, additional testing could be requested on a batch of material supplied in the T4 temper to demonstrate that it would meet the T6 temper properties when artificially aged by the purchaser. It is only necessary for the supplier to confirm that selected samples, heat treated using supplier laboratory conditions, meet the properties specified for the final temper required by the purchaser (see item n) in Appendix A).

10 Test methods

10.1 General

The tensile test and the test for 0.2 % proof stress described in **10.2** and **10.3** shall be carried out on test pieces prepared from the test samples selected in accordance with clause **9**.

For test samples representing bars up to and including 50 mm diameter or minor cross-sectional dimension, the tensile test piece shall be machined coaxially from the test sample. For bars over 50 mm diameter or minor cross-sectional dimension, the longitudinal axis of the test piece shall be located at half the distance between the surface and the centre of the test sample, and shall be parallel to the extrusion direction.

10.2 Tensile test

The tensile test shall be carried out as described in BS EN 10 002-1.

The test samples shall normally be machined to the dimensions of one of the proportional round test pieces given in BS EN 10 002-1. However, for suitably shaped sections one of the non-proportional rectangular test pieces given in BS EN 10 002-1 shall be permitted to be used, in which case the gauge length to be used shall be 50 mm.

10.3 Test for 0.2 % proof stress

The 0.2 % proof stress shall be determined as described in BS EN 10 002-1 on the test piece used in **10.2**.

11 Retests

Should any one of the test pieces, tested as described in clause **10**, fail to pass the mechanical tests, then two further samples from the same batch shall be selected for testing, one of which shall be from the bar, extruded round tube or section from which the original failed test sample was taken, unless that bar, extruded round tube or section has been withdrawn by the supplier.

NOTE For heat-treatable alloys, the supplier is permitted to heat treat the material again before the two further samples are selected.

Should the test pieces from both these additional samples pass, the batch represented by the test samples shall be deemed to comply with the requirements of this standard. Should the test pieces from either of these additional samples fail, the batch represented by the test samples shall be deemed not to comply with the requirements of this standard.

12 Certificate of conformity

The supplier shall certify, if requested, that the material complies with this British Standard.

Table 1 — Chemical composition limits[1] and mechanical properties of unalloyed aluminium and non-heat-treatable aluminium alloy bars, extruded round tube and sections (Figures in parentheses refer to the notes at the end of this table)

Material designation	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Nickel	Zinc	Other restrictions	Titanium	Others[2]		Aluminium	Temper[3]	Diameter (bar) or thickness (tube/section)		0.2 % proof stress (min.)	Tensile strength		Elongation	
											Each	Total			>	≤		Min.	Max.	On 5.65 $\sqrt{So}$ (min.)	On 50 mm (min.)
	%	%	%	%	%	%	%	%	%	%	%	%	%		mm	mm	N/mm^2	N/mm^2	N/mm^2	%	%
1050A	0.25	0.40	0.05	0.05	0.05	—	—	0.07	—	0.05	0.03	—	99.50[4] min.	F	—	—	—	(60)	—	(25)	(23)
1200	1.0 Si + Fe		0.05	0.05	—	—	—	0.10	—	0.05	0.05	0.15	99.00[4] min.	F	—	—	—	(65)	—	(20)	(18)
5083	0.40	0.40	0.10	0.40 – 1.0	4.0 – 4.9	0.05 – 0.25	—	0.25	—	0.15	0.05	0.15	Rem.[a]	O F	—	150[5] 150	125 (130)	275 (280)	— —	14 (12)	13 (11)
5154A	0.50	0.50	0.10	0.50	3.1 – 3.9	0.25	—	0.20	0.10 – 0.50 Mn + Cr	0.20	0.05	0.15	Rem.	O F	—	150[5] 150	85 (100)	215 (215)	275 —	18 (16)	16 (14)
5251	0.40	0.50	0.15	0.10 – 0.50	1.7 – 2.4	0.15	—	0.15	—	0.15	0.05	0.15	Rem.	F	—	150	(60)	(170)	—	(16)	(14)

NOTES FOR TABLE 1

NOTE 1 Composition in percent (m/m) maximum unless shown as a range or a minimum.

NOTE 2 Analysis is regularly made only for the elements for which specific limits are shown. If, however, the presence of other elements is suspected to be, or in the course of routine analysis is indicated to be, in excess of the specified limits, further analysis should be made to determine that these other elements are not in excess of the amount specified.

NOTE 3 No mechanical properties are specified for material in the "F" condition. The bracketed values shown for proof stress, tensile strength and elongation are typical properties and are given for information only.

NOTE 4 The aluminium content for unalloyed aluminium not made by a refining process is the difference between 100 % and the sum of all other metallic elements present in amounts of 0.010 % or more each, expressed to the second decimal before determining the sum.

NOTE 5 No mechanical properties are specified for tube and hollow sections having a wall thickness greater than 75 mm (see clause **6**).

[a] Remainder.

Table 2 — Chemical composition limits[1] and mechanical properties of heat-treatable aluminium alloy bars, extruded round tube and sections (Figures in parentheses refer to the notes at the end of this table)

Material designation	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Nickel	Zinc	Other restrictions	Titanium	Others[2]		Aluminium	Temper[3]	Diameter (bar) or thickness (tube/section)[4]		0.2 % proof stress (min.)	Tensile strength		Elongation	
											Each	Total			>	≤		Min.	Max.	On 5.65√So (min.)	On 50 mm (min.)
	%	%	%	%	%	%	%	%	%	%	%	%	%		mm	mm	N/mm²	N/mm²	N/mm²	%	%
2014A	0.50 – 0.9	0.50	3.9 – 5.0	0.40 – 1.2	0.20 – 0.8	0.10	0.10	0.25	0.20 Zr + Ti	0.15	0.05	0.15	Rem.[a]	T4	— 20 75 150	20 75 150 200	230 250 250 230	370 390 390 370	— — — —	11 11 8 8	10 — — —
														T6 T6510	— 20 75 150	20 75 150 200	370 435 420 390	435 480 465 435	— — — —	7 7 7 7	6 — — —
6060	0.30 – 0.6	0.10 – 0.30	0.10	0.10	0.35 – 0.6	0.05	—	0.15	—	0.10	0.05	0.15	Rem.	T4 T5 T6	— — —	150 150 150	60 100 150	120 145 190	— — —	16 8 8	— — —
6061	0.40 – 0.8	0.7	0.15 – 0.40	0.15	0.8 – 1.2	0.04 – 0.35	—	0.25	—	0.15	0.05	0.15	Rem.	T4 T6 T6510	— —	150 150	115 240	190 280	— —	16 8	14 7
6063	0.20 – 0.6	0.35	0.10	0.10	0.45 – 0.9	0.10	—	0.10	—	0.10	0.05	0.15	Rem.	O F	—	200 200	— —	— (100)	140 —	15 (13)	13 (12)
														T4	— 150	150 200	70 70	130 120	— —	16 13	14 —
														T5	— —	25 150	110 160	150 195	— —	8 8	7 7
														T6	— 150	200 200	130 150	150 —	—	6	—
6063A	0.30 – 0.6	0.15 – 0.35	0.10	0.15	0.6 – 0.9	0.05	—	0.15	—	0.10	0.05	0.15	Rem.	T4 T5 T6	— — —	25 25 25	90 160 190	150 200 230	— — —	14 8 8	12 7 7

Table 2 — Chemical composition limits[1] and mechanical properties of heat-treatable aluminium alloy bars, extruded round tube and sections (Figures in parentheses refer to the notes at the end of this table)

Material designation	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Nickel	Zinc	Other restrictions	Titanium	Others[2]		Aluminium	Temper[3]	Diameter (bar) or thickness (tube/section)[4]		0.2 % proof stress (min.)	Tensile strength		Elongation	
											Each	Total			>	≤		Min.	Max.	On $5.65\sqrt{So}$ (min.)	On 50 mm (min.)
	%	%	%	%	%	%	%	%	%	%	%	%	%		mm	mm	N/mm^2	N/mm^2	N/mm^2	%	%
6082	0.7 – 1.3	0.50	0.10	0.40 – 1.0	0.6 – 1.2	0.25	—	0.20	—	0.10	0.05	0.15	Rem.	O	—	200	—	—	170	16	14
														F	—	200	—	(110)	—	(13)	(12)
														T4	—	150	120	190	—	16	14
															150	200	100	170	—	13	—
														T5	—	6	230	270	—		8
														T6	—	20	255	295	—	8	7
															20	150	270	310	—	8	—
														T6510	150	200	240	280	—	5	—
6463	0.20 – 0.6	0.15	0.20	0.05	0.45 – 0.9	—	—	0.05	—	—	0.05	0.15	Rem.	T4	—	50	75	125	—	16	14
														T6	—	50	160	185	—	10	9

NOTES TO TABLE 2

NOTE 1 Composition in percent (m/m) maximum unless shown as a range or a minimum.

NOTE 2 Analysis is regularly made only for the elements for which specific limits are shown. If, however, the presence of other elements is suspected to be, or in the course of routine analysis is indicated to be, in excess of the specified limits, further analysis should be made to determine that these other elements are not in excess of the amount specified.

NOTE 3 No mechanical properties are specified for material in the "F" condition. The bracketed values shown for tensile strength and elongation are typical properties and are given for information only.

NOTE 4 No mechanical properties are specified for tube and hollow sections having a wall thickness greater than 75 mm (see clause **6**).

NOTE 5 The temper T6510 is applicable only to bars.

[a] Remainder.

Table 3 — Tolerances on diameter of round bar intended for use on automatic lathes (see note 1)

Diameter		Plus and minus tolerances on diameter (see note 2)	
Over	Up to and including		
mm	mm	+ mm	– mm
10	18	0.05	0.10
18	30	0.08	0.13
30	40	0.14	0.14
40	60	0.20	0.20
60	80	0.30	0.30
80	100	0.40	0.40
100	160	± ½ % of specified diameter	

NOTE 1 For tolerances on diameter for round bar not intended for use on automatic lathes, see Table 6.
NOTE 2 Total tolerances (i.e. the sum of the plus and minus limits) may be applied unilaterally by agreement between the supplier and the purchaser.

Table 4 — Tolerances on width across flats of hexagonal bar for the manufacture of nuts and bolts (see note)

Width across flats		Tolerance on width across flats (all minus)
Over	Up to and including	
mm	mm	mm
–	4.0	0.08
4.0	19.0	0.10
19.0	36.0	0.13
36.0	46.0	0.15
46.0	60.0	0.20

NOTE For tolerances on width across flats of hexagonal bar not intended for the manufacture of nuts and bolts see Table 6.

Table 5 — Tolerances on diameter of round bar in the controlled stretched condition

Diameter		Tolerance on diameter (plus and minus)	
Over	Up to and including		
mm	mm	+ mm	– mm
10	18	0.05	0.20
18	30	0.08	0.26
30	40	0.14	0.28
40	60	0.20	0.40
60	80	0.30	0.60
80	100	0.40	0.80
100	160	½ % of specified diameter	1 % of specified diameter

Table 6 — Tolerances on diameter, or width across flats of bars for general purposes and on width of solid or hollow regular sections

Diameter, width or width across flats		Tolerances (see notes 1 and 2)
Over	Up to and including	
mm	mm	± mm
—	3	0.16
3	10	0.20
10	18	0.26
18	30	0.32
30	40	0.40
40	60	0.45
60	80	0.50
80	100	0.65
100	120	0.80
120	140	0.90
140	160	1.0
160	180	1.1
180	200	1.2
200	240	1.3
240	280	1.5
260	320	1.7

NOTE 1 In the case of 5083 bars, regular sections and hollow sections see **7.2.1**, **7.3.2**, **7.4** and **7.7.1**.

NOTE 2 Tolerances in this table apply to solid materials other than:
a) round bar for use on automatic lathes (see Table 3);
b) controlled stretched bar (see Table 5);
c) hexagonal bars for the manufacture of nuts and bolts (see Table 4).

NOTE 3 Tolerances in this table also apply to hollow regular sections having a wall thickness not less than 16 mm or 3 % of the overall width, whichever is the greater, in the case of non-heat-treated material or 1.6 mm or 4 % of the overall width, whichever is the greater, in the case of heat-treated material. The tolerance should be applied to the width measured at the corners.

Table 7 — Tolerances on thickness of bars and regular sections

Width across flats of bar or width of section		Tolerance on specified thickness (plus and minus) (see notes 1 and 2)												
Over	Up to and including	Up to and including 1.6 mm thick	Over 1.6 mm up to and including 3 mm thick	Over 3 mm up to and including 6 mm thick	Over 6 mm up to and including 10 mm thick	Over 10 mm up to and including 18 mm thick	Over 18 mm up to and including 30 mm thick	Over 30 mm up to and including 40 mm thick	Over 40 mm up to and including 60 mm thick	Over 60 mm up to and including 80 mm thick	Over 80 mm up to and including 100 mm thick	Over 100 mm up to and including 120 mm thick	Over 120 mm up to and including 140 mm thick	Over 140 mm up to and including 160 mm thick
mm	mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm
—	10	0.16	0.18	0.20	0.22	—	—	—	—	—	—	—	—	—
10	18	0.18	0.20	0.22	0.24	0.26	—	—	—	—	—	—	—	—
18	30	0.22	0.24	0.26	0.28	0.30	0.32	—	—	—	—	—	—	—
30	60	0.24	0.26	0.28	0.30	0.33	0.36	0.40	—	—	—	—	—	—
60	80	0.28	0.30	0.32	0.34	0.37	0.40	0.43	0.45	0.50	—	—	—	—
80	120	0.32	0.34	0.36	0.39	0.42	0.45	0.48	0.52	0.57	0.65	0.80	—	—
120	180	—	0.36	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.82	0.90	1.00
180	240	—	—	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.05
240	320	—	—	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10

NOTE 1 In the case of 5083 bars and regular sections see **7.4**.

NOTE 2 For sections over 160 mm thick, the tolerances on thickness are those shown for comparable widths (see Table 6).

Table 8 — Tolerances on open end of channels and I-beams (see Figure 1)

Over width *W* of channel or I-beam		Minimum thickness of web or flange		Internal or external tolerance on open and dimension for various depths of opening *D* (plus and minus)										
Over	Up to and including	Over	Up to and including	For *D* up to and including 10 mm deep	For *D* over 10 mm up to and including 18 mm deep	For *D* over 18 mm up to and including 30 mm deep	For *D* over 30 mm up to and including 40 mm deep	For *D* over 40 mm up to and including 60 mm deep	For *D* over 60 mm up to and including 80 mm deep	For *D* over 80 mm up to and including 100 mm deep	For *D* over 100 mm up to and including 120 mm deep	For *D* over 120 mm up to and including 140 mm deep	For *D* over 140 mm up to and including 160 mm deep	For *D* over 160 mm up to and including 180 mm deep
mm	mm	mm	mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm
–	10	—	1.5	0.25	0.32	0.41	—	—	—	—	—	—	—	—
		1.5	3.0	0.23	0.28	0.34	—	—	—	—	—	—	—	—
		3.0	—	0.22	0.26	0.30	—	—	—	—	—	—	—	—
10	18	—	1.5	0.31	0.38	0.47	0.56	0.70	—	—	—	—	—	—
		1.5	3.0	0.29	0.34	0.40	0.46	0.55	—	—	—	—	—	—
		3.0	—	0.28	0.32	0.36	0.41	0.47	—	—	—	—	—	—
18	30	—	3.0	0.37	0.47	0.57	0.68	0.84	1.05	1.26	—	—	—	—
		3.0	6.0	0.37	0.44	0.53	0.62	0.76	0.93	1.11	—	—	—	—
		6.0	—	0.35	0.41	0.48	0.55	0.64	0.78	0.91	—	—	—	—
30	40	—	3.0	0.45	0.55	0.65	0.76	0.92	1.13	1.34	1.55	1.76	—	—
		3.0	6.0	0.45	0.52	0.61	0.70	0.84	1.01	1.19	1.36	1.54	—	—
		6.0	—	0.43	0.49	0.56	0.63	0.72	0.86	0.99	1.12	1.25	—	—
40	60	—	3.0	—	0.60	0.70	0.81	0.97	1.18	1.39	1.60	1.81	2.02	—
		3.0	6.0	—	0.57	0.66	0.75	0.89	1.06	1.24	1.41	1.59	1.76	—
		6.0	—	—	0.54	0.61	0.68	0.77	0.91	1.04	1.17	1.30	1.43	—
60	80	—	3.0	—	0.65	0.75	0.86	1.02	1.23	1.44	1.65	1.86	2.07	2.28
		3.0	6.0	—	0.62	0.71	0.80	0.94	1.11	1.29	1.46	1.64	1.81	1.99
		6.0	—	—	0.59	0.66	0.73	0.82	0.96	1.09	1.22	1.35	1.48	1.61
80	100	—	6	—	—	0.90	1.01	1.17	1.38	1.59	1.80	2.01	2.22	2.43
		6	—	—	—	0.86	0.95	1.09	1.26	1.44	1.61	1.79	1.96	2.14
100	120	—	6	—	—	1.05	1.16	1.32	1.53	1.74	1.95	2.16	2.37	2.58
		6	—	—	—	1.01	1.10	1.24	1.41	1.59	1.76	1.94	2.11	2.29
120	140	—	6	—	—	1.15	1.26	1.42	1.63	1.84	2.05	2.26	2.47	2.68
		6	—	—	—	1.11	1.20	1.34	1.51	1.69	1.86	2.04	2.21	2.39
140	160	—	6	—	—	1.25	1.36	1.52	1.73	1.94	2.15	2.36	2.57	2.78
		6	—	—	—	1.21	1.30	1.44	1.61	1.79	1.96	2.14	2.31	2.49

Table 8 — Tolerances on open end of channels and I-beams (see Figure 1)

Over width *W* of channel or I-beam		Minimum thickness of web or flange		Internal or external tolerance on open and dimension for various depths of opening *D* (plus and minus)										
Over	Up to and including	Over	Up to and including	For *D* up to and including 10 mm deep	For *D* over 10 mm up to and including 18 mm deep	For *D* over 18 mm up to and including 30 mm deep	For *D* over 30 mm up to and including 40 mm deep	For *D* over 40 mm up to and including 60 mm deep	For *D* over 60 mm up to and including 80 mm deep	For *D* over 80 mm up to and including 100 mm deep	For *D* over 100 mm up to and including 120 mm deep	For *D* over 120 mm up to and including 140 mm deep	For *D* over 140 mm up to and including 160 mm deep	For *D* over 160 mm up to and including 180 mm deep
mm	mm	mm	mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm
160	180	—	6	—	—	1.35	1.46	1.62	1.83	2.04	2.25	2.46	2.67	2.88
		6	—	—	—	1.31	1.40	1.54	1.71	1.89	2.06	2.24	2.41	2.59
180	200	—	6	—	—	1.45	1.56	1.72	1.93	2.14	2.35	2.56	2.77	2.98
		6	—	—	—	1.41	1.50	1.64	1.81	1.99	2.16	2.34	2.51	2.69
200	240	—	6	—	—	1.55	1.66	1.82	2.03	2.24	2.45	2.66	2.87	3.08
		6	—	—	—	1.51	1.60	1.74	1.91	2.09	2.26	2.44	2.61	2.79
240	280	6	—	—	—	1.71	1.80	1.94	2.11	2.29	2.46	2.64	2.81	2.99
280	320	6	—	—	—	1.91	2.00	2.14	2.32	2.49	2.66	2.84	3.01	3.19

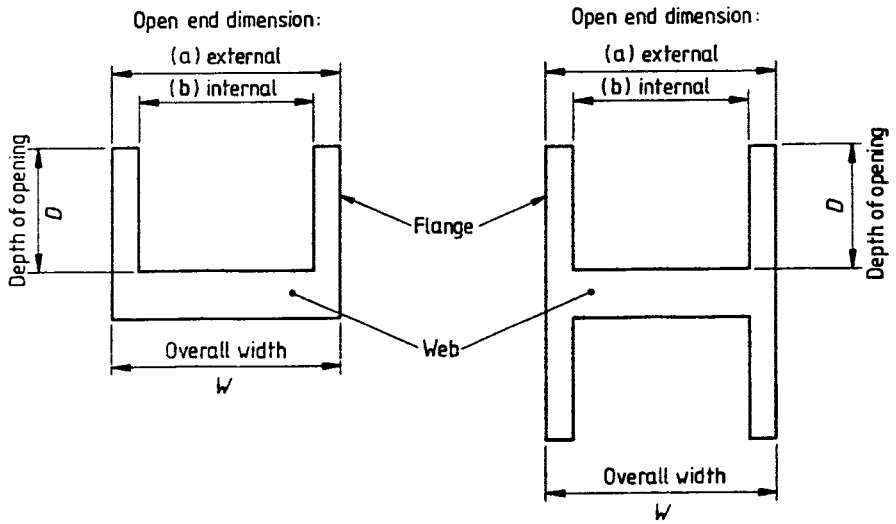

Figure 1 — Channel and I-beam dimensions for tolerance purposes
(see Table 8)

Table 9 — Angular tolerances for extruded regular sections

Nominal thickness of thinnest leg		Allowable deviation from angle specified (measured at the extremities of the section)
Over	Up to and including	
mm	mm	±
—	1.6	2°
1.6	5.0	1½°
5.0	—	1°

Table 10 — Permitted corner radii

For square and rectangular sections		
Minor dimension		Radius on corner (max.)
Over	Up to and including	
mm	mm	mm
—	5	0.4
5	10	0.8
10	25	1.6
25	50	2.5
50	120	3.0
120	–	5.0
For regular sections (e.g. angle, channel, I- and T-sections)		
Thickness of section		**Radius on corner (max.)**
mm		mm
Up to and including 5		0.8
Over 5		1.5

Table 11 — Tolerances on wall thickness of extruded round tube (classes A, B and C) (see note 1)

Nominal wall thickness of tube	Class A			Class B			Class C		
	Tolerance on mean wall thickness	Wall thickness at any point		Tolerance on mean wall thickness	Wall thickness at any point		Tolerance on mean wall thickness	Wall thickness at any point	
		(Max.)	(Min.)		(Max.)	(Min.)		(Max.)	(Min.)
mm	± mm	mm	mm	± mm	mm	mm	± mm	mm	mm
1.0	0.15	1.20	0.80	—	—	—	—	—	—
1.5	0.16	1.71	1.29	0.18	1.74	1.26	—	—	—
2.0	0.17	2.23	1.77	0.20	2.27	1.73	—	—	—
2.5	0.18	2.74	2.26	0.22	2.80	2.20	—	—	—
3.0	0.20	3.27	2.73	0.27	3.36	2.64	0.65	3.87	2.13
4.0	0.23	4.30	3.70	0.31	4.42	3.58	0.70	4.93	3.09
5.0	0.26	5.34	4.66	0.37	5.49	4.51	0.75	6.00	4.00
6.0	0.28	6.38	5.62	0.43	6.58	5.42	0.82	7.09	4.91
7.0	0.31	7.43	6.57	0.51	7.67	6.33	0.89	8.18	5.82
8.0	0.34	8.47	7.53	0.56	8.76	7.24	0.94	9.27	6.73
10.0	0.40	10.52	9.48	0.65	10.85	9.15	1.03	11.36	8.64
12.0	0.46	12.61	11.39	0.77	13.03	10.97	1.15	13.54	10.46
14.0	0.53	14.71	13.29	0.88	15.24	12.76	1.30	15.75	12.25
16.0	0.58	16.76	15.24	1.00	17.34	14.66	1.40	17.88	14.12
18.0	0.63	18.82	17.18	1.13	19.44	16.56	1.50	20.00	16.00
20.0	0.68	20.90	19.10	1.22	21.63	18.38	1.60	22.13	17.88
22.0	0.74	23.00	21.00	1.35	23.81	20.19	1.73	24.32	19.68
25.0	0.81	26.10	23.90	1.49	27.00	23.00	1.88	27.50	22.50

NOTE 1 For details concerning the applicability of tolerance class (A, B or C) to alloy see **7.6.2**.

NOTE 2 The tolerances given in this table apply to non-heat-treated tube of wall thickness not less than 1.6 mm or 3 % of the outside diameter, whichever is the greater and to heat treated tube of wall thickness not less than 1.6 mm or 4 % of the outside diameter, whichever is the greater.

NOTE 3 These tolerances on wall thickness do not apply where tolerances on both outside and inside diameter are required in which case the eccentricity tolerance on the resultant wall should be agreed between the purchaser and the supplier at the timeof the enquiry and order.

NOTE 4 Mean thickness is defined as the sum of the wall thicknesses measured at the ends of any two diameters at right angles, divided by four.

NOTE 5 The tolerance on the wall thickness of intermediate nominal wall thickness should be taken as those of the next lower size

Table 12 — Tolerances (a) on the outside diameter of all extruded round tube and (b) on the inside diameter of class A and class B extruded round tube (see note 1)

(a) Outside diameter, or (b) Inside diameter		Tolerance on the actual diameter (see notes 5 and 6)	Tolerance on the mean diameter (see notes 5 and 6)
Over	Up to and including		
mm	mm	± mm	± mm
12	18	0.25	0.19
18	30	0.30	0.23
30	40	0.36	0.27
40	50	0.45	0.34
50	60	0.54	0.40
60	80	0.60	0.45
80	300	1 % of diameter	¾ % of diameter

NOTE 1 For details concerning the applicability of tolerance class (A or B) to alloy, see **7.6.2** and **7.6.3**.

NOTE 2 The tolerances are applicable to non-heat-treated tubing of wall thickness not less than 1.6 mm or 3 % of the outside diameter, whichever is the greater, and to heat-treated tubing of wall thickness not less than 1.6 mm or 4 % of the outside diameter, whichever is the greater.

NOTE 3 In the case of tubing in straight lengths, the above tolerance limits are inclusive of ovality.

NOTE 4 Where a tolerance on wall thickness is required, the tolerances on diameter are to be applied either to the outside diameter or to the inside diameter, but not to both.

NOTE 5 Tolerances on the actual diameter indicate the amount by which the diameter (inside or outside, as appropriate) measured in any direction may depart from the specified diameter. Tolerances on the mean diameter (inside or outside, as appropriate) indicate the amount by which the mean of two diameters measured in two directions at right angles in the same plane may depart from the specified diameter.

NOTE 6 The given tolerances on the actual diameter do not apply to annealed tube, coiled tube, or tube having a wall thickness less than $2\,^1/_2$ % of outside diameter. The tolerances of these products and of controlled stretched tube are subject to agreement between purchaser and supplier.

Table 13 — Tolerances on thickness of hollow sections (classes A and B)

Width or width across flats		Tolerance on specified thickness											
		Class A						Class B					
Over	Up to and including	Up to and including 1.6 mm thick	Over 1.6 mm up to and including 3.0 mm thick	Over 3.0 mm up to and including 6.0 mm thick	Over 6.0 mm up to and including 10 mm thick	Over 10 mm up to and including 18 mm thick	Over 18 mm up to and including 30 mm thick	Up to and including 1.6 mm thick	Over 1.6 mm up to and including 3.0 mm thick	Over 3.0 mm up to and including 6.0 mm thick	Over 6 mm up to and including 10 mm thick	Over 10 mm up to and including 18 mm thick	Over 18 mm up to and including 30 mm thick
mm	mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm	± mm
—	10	—	—	—	—	—	—	—	—	—	—	—	—
10	18	0.20	0.22	—	—	—	—	0.22	0.28	—	—	—	—
18	30	0.26	0.28	0.32	—	—	—	0.28	0.36	0.54	—	—	—
30	60	0.32	0.36	0.41	0.48	—	—	0.36	0.45	0.65	0.90	1.40	—
60	80	0.36	0.41	0.48	0.58	0.68	—	0.45	0.55	0.75	0.95	1.45	—
80	120	—	0.48	0.58	0.68	0.82	1.00	—	0.65	0.80	1.00	1.50	2.00
120	180	—	0.65	0.75	0.85	0.95	1.10	—	0.75	0.85	1.10	1.60	2.20
180	240	—	—	0.95	1.05	1.20	1.40	—	—	1.00	1.20	1.80	2.40
240	320	—	—	—	1.25	1.45	1.80	—	—	—	1.40	2.00	2.60

NOTE 1 For details concerning the applicability of tolerance class (A or B) to alloy, see **7.7.2**.

NOTE 2 The tolerances apply to non-heat-treated sections of wall thickness not less than 16 mm or 3 % of the overall width, whichever is the greater, and to heat-treated sections of wall thickness not less than 1.6 mm or 4 % of the overall width, whichever is the greater.

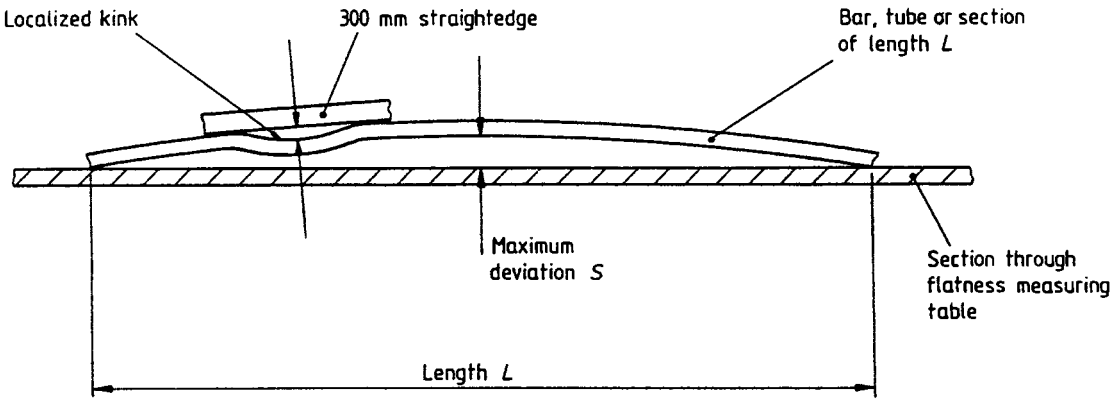

Figure 2 — Measurement of straightness (see Table 14)

Table 14 — Tolerances on straightness for extruded bar, regular sections and extruded round tubes (see Figure 2)

For bars, tubes or sections within a circumscribing circle	Temper	Nominal length of bar, tube or section L	Maximum deviation S from straightness of length L (metres) (see Figure 2)	Maximum localized kink in any 300 mm portion
mm		m	mm	mm
Up to and including 100	All tempers	over 0.4	1.5 L	0.6
Over 100	F	over 0.4	2.0 L	0.8
	All other tempers	over 0.4	2.5 L	1.0

NOTE 1 The straightness is measured by determining the maximum deviation from straightness S over length L, when the bar, section or tube is supported on a flat table such that the deviation is minimized by its own mass.
NOTE 2 Kink is measured using a straightedge 300 mm in length (see Figure 2).
NOTE 3 Tolerances on straightness for annealed and controlled stretched materials should be subject to agreement between the purchaser and the supplier at the time of the enquiry and order.

Table 15 — Tolerances on length for all materials supplied in fixed cut lengths

Diameter, width across flats or overall width		Tolerance on length for given length (plus and minus) (see notes 1 and 2)					
Over	Up to and including	Over 300 mm up to and including 1 000 mm long	Over 1 000 mm up to and including 1 500 mm long	Over 1 500 mm up to and including 5 000 mm long	Over 5 000 mm up to and including 7 000 mm long	Over 7 000 mm up to and including 10 000 mm long	Over 10 000 mm long
mm	mm	± mm	± mm	± mm	± mm	± mm	± mm
—	60	2.0	2.5	2.5	3.5	4.0	6.5
60	100	2.0	2.5	3.5	4.0	5.5	7.5
100	140	3.0	3.5	4.0	5.0	6.5	8.0
140	180	3.5	4.0	5.0	6.5	8.0	9.5
180	240	4.5	5.0	6.5	8.0	9.5	11.0

NOTE 1 Tolerances on length are measured at a temperature of 16 ± 5°C. They provide for out-of-squareness of cut to the extent of 1°.
NOTE 2 Total tolerances (i.e. the sum of the plus and minus limits) may be applied unilaterally by agreement between the supplier and the purchaser.

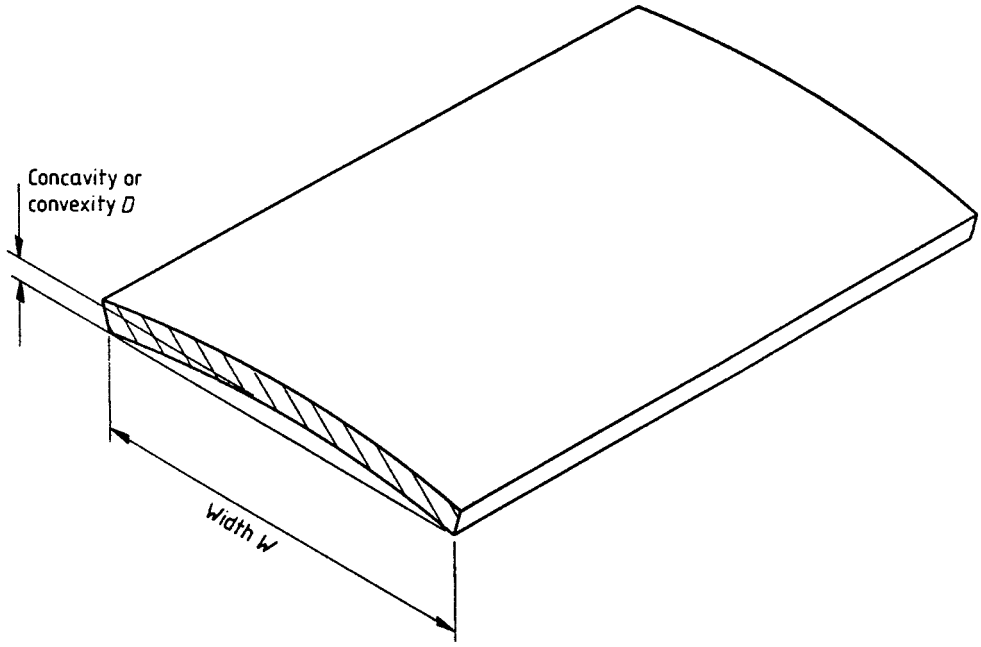

Figure 3 — Measurement of concavity and convexity of extruded sections

Table 16 — Tolerances on concavity and convexity for extruded solid and hollow sections

Width of section *W*	**Maximum allowable deviation *D*** (see Figure 3)
mm	mm
Up to and including 25	0.125
Over 25	0.125 per 25 mm increment in width (e.g. for 150 mm width maximum deviation *D* permitted is 0.75 mm)

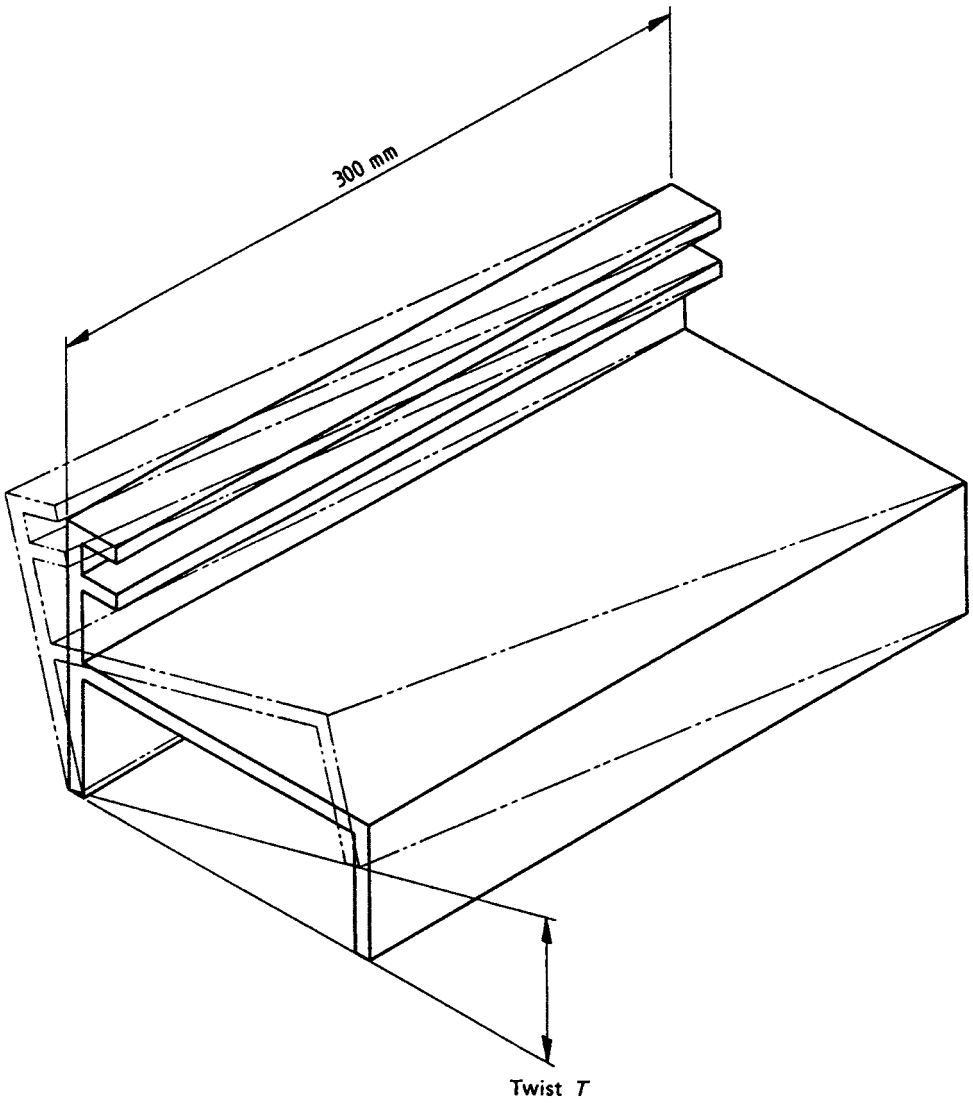

Figure 4 — Measurement of twist of section

Table 17 — Tolerances on twist for extruded solid and hollow sections
(see Figure 4)

Diameter of circumscribing circle for the section	Maximum angle of twist *T* per 300 mm run	Maximum total angle of twist per length
mm	degrees	degrees
Under 20	3	7
20 up to and including 40	1	5
Over 40 up to and including 80	½	3
Over 80		
Lengths up to and including 8 000 mm	¼	2
Lengths over 8 000 m	¼	3

Appendix A Information to be supplied by the purchaser

It is essential that the following information be given by the purchaser in the enquiry and/or order to assist the manufacturer in supplying the correct material:

a) a description of the material required, i.e. aluminium or aluminium alloy, bar, extruded round tube or section, and for tube, whether seamless or porthole/bridge tube is required (see **2.3**, **2.4** and **7.6**);

b) reference to this standard, i.e. BS 1474;

c) the material designation (see Table 1 and Table 2);

d) the temper designation (see clause **5**);

e) the dimensions required;

f) whether round bar is required for use on automatic lathes (see **7.2.2**);

g) whether controlled stretched bar is required;

h) whether hexagonal bar is intended for the manufacture of nuts and bolts (see **7.3.1**);

i) for tube in materials 1050A, 1200, 6060, 6061, 6063, 6063A, 6082 and 6463, whether class A, class B or class C tolerances are required (see **7.6.2**);

j) for tube in materials 5251, 5083, 5154 and 2104A, whether class B or class C tolerances are required (see **7.6.2**);

k) for tube, except for class C with a tapered wall thickness, whether a wall thickness tolerance (see Table 11) or an inside diameter tolerance (see Table 12) is required (see **7.6.3**);

l) for hollow regular section in materials other than 5083, 5154A, 5251 and 2014A, whether class A or class B thickness tolerances are required (see Table 13);

m) whether a certificate of conformity is required (see clause **12**);

n) whether additional mechanical testing is required on samples heat treated to a different temper from the "as supplied" temper (see **9.2**);

o) whether drift testing is required to be carried out by the supplier on extruded round tube and hollow sections produced by the porthole/bridge die method, and if so details of the method of selection of test samples, the test procedure and the criteria for acceptance should be given and agreed between the purchaser and the supplier (guidance on drift testing may be obtained from appendix C of BS 1139-1).

Appendix B Details of the international alloy designations and chemical composition limits for wrought aluminium alloys

B.1 Alloys groups: general

The first of the four digits in the designation indicates the alloy group as follows.

a) Aluminium, 99.00 % (*m*/*m*) minimum and greater	1*XXX*
b) Aluminium alloys groups by major alloying elements	
1) Copper	2*XXX*
2) Manganese	3*XXX*
3) Silicon	4*XXX*
4) Magnesium	5*XXX*
5) Magnesium and silicon	6*XXX*
6) Zinc	7*XXX*
7) Other element	8*XXX*
8) Unused series	9*XXX*

B.2 1*XXX* group

In the 1*XXX* group for aluminium purity of 99.00 % (*m*/*m*) and greater, the last two of the four digits in the designation indicate the minimum aluminium percentage. These digits are the same as the two digits to the right of the decimal point in the minimum aluminium percentage when it is expressed to the nearest 0.01 %.

The second digit in the designation indicates modifications in impurity limits or alloying elements. If the second digit in the designation is zero, it indicates unalloyed aluminium having natural impurity limits; integers 1 to 9, which are assigned consecutively as needed, indicate special control of one or more individual impurities or alloying elements.

B.3 2*XXX* to 8*XXX* groups

In the 2*XXX* to 8*XXX* groups, the last two of the four digits in the designation have no special significance but serve only to identify the different aluminium alloys in the group. The second digit in the alloy designation indicates alloy modifications. If the second digit in the designation is zero, it indicates the original alloy; integers 1 to 9, which are assigned consecutively, indicate alloy modifications.

B.4 National variations

National variations of wrought aluminium and wrought aluminium alloys registered by another country are identified by a serial letter after the numerical designation. The serial letters are assigned in alphabetical sequence starting with A for the first national variation registered, but omitting I, O and Q.

Appendix C Alloy and temper designation cross-references

As explained in the foreword, the 4-digit designations of the AA alloy designation system and the system of temper designations given in BS EN 515 have been adopted in this revision. Table 18 cross-refers these designations with those used in earlier editions of this standard and also gives the related ISO alloy coding designations.

Table 18 — Alloy and temper designation cross-references

BS alloy designation	Old BS alloy designation (see note)	ISO alloy designation	BS temper designation	Old BS temper designation
Unalloyed				
1050A	E1B	Al 99.5	F	M
1200	E1C	Al 99.0	F	M
Non-heat-treatable				
5083	NE8	AlMg4.5Mn	O F	O M
5154A	NE5	AlMg3.5	O F	O M
5251	NE4	AlMg2	F	M
Heat-treatable				
2014A	HE15	AlCu4SiMg	T4 T6	TB TF
6060	Not previously in BS 1474	AlMgSi	T4 T5 T6	TB TE TF
6061	HE20	AlMg1SiCu	T4 T6	TB TF
6063	HE9	AlMg0.7Si	O F T4 T5 T6	O M TB TE TF
6063A	HE9	AlMg.7SiA	T4 T5 T6	TB TE TF
6082	HE30	AlSi1MgMn	O F T4 T5 T6	O M TB TE TF
6463	Previously BTR E6 in BS 4300/4	AlMg.07SiB	T4 T6	TB TF

NOTE The "old" BS alloy designations were those used prior to the issue in June 1980 of amendment No. 1, which introduced the 4-digit alloy designation system.

Appendix D *Text deleted.*

Appendix E The rounding of numbers rule

For the purposes of determining compliance with composition limits and mechanical properties (NOT dimensional tolerances), an observed value or a calculated value obtained from the analysis or test is rounded to the same number of decimal places as used in the relevant standard in expressing the specified limit. The following rules should be used for rounding.

a) When the figure immediately after the last figure to be retained is less than 5, then the last figure to be retained should be kept unchanged.

b) When the figure immediately after the last figure to be retained is either:

1) greater than 5, or

2) equal to 5 and followed by at least one figure other than zero,

then the last figure to be retained should be increased by 1.

c) When the figure immediately after the last figure to be retained is equal to 5, and followed by zeros only, then the last figure to be retained should be left unchanged if even and increased by 1 if odd.

blank

Publications referred to

BS 1139, *Metal scaffolding.*

BS 1139-1, *Tubes.*

BS 1470, *Specification for wrought aluminium and aluminium alloys for general engineering purposes: plate, sheet and strip*[3)].

BS 1471, *Specification for wrought aluminium and aluminium alloys for general engineering purposes: drawn tube*[3)].

BS 1472, *Specification for wrought aluminium and aluminium alloys for general engineering purposes: forging stock and forgings*[3)].

BS 1473, *Specification for wrought aluminium and aluminium alloys for general engineering purposes: rivet, bolt and screw stock*[3)].

BS 1475, *Specification for wrought aluminium and aluminium alloys for general engineering purposes: wire*[3)].

BS 4300/4, *Specification (supplementary series) for wrought aluminium and aluminium alloys for general engineering purposes 6463 Solid extruded bars and sections suitable for bright trim/reflector applications*

BS EN 515, *Aluminium and aluminium alloys — Wrought products — Temper designations.*

BS EN 10 002-1, *Tensile testing of metallic materials.*

BS EN 10 002-1-1, *Method of test at ambient temperature.*

ISO 2107, *Aluminium, magnesium and their alloys — Temper designations.*

"Properties of aluminium and its alloys", Aluminium Federation[4)]

"Registration record of international alloy designations and chemical composition limits for wrought aluminum and wrought aluminum alloys", Aluminum Association of the USA[5)]

[3)] Referred to in the foreword only.

[4)] Available from the Aluminium Federation, Broadway House, Calthorpe Road, Five Ways, Birmingham, B15 1TN.

[5)] Available from the Aluminum Association Inc., 900 19th Street, NW, Suite 300, Washington DC, 20006, USA.

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