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Withdrawn incorporated
in BS 1474:1969
3 Amendments

BRITISH STANDARD 1476:1963

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Prod

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PD 6299

SPECIFICATION FOR
**WROUGHT
ALUMINIUM
AND ALUMINIUM ALLOYS
BARS AND SECTIONS**

BRITISH STANDARDS INSTITUTION

THIS BRITISH STANDARD, having been approved by the Non-ferrous Metals Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 3rd September, 1963.

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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 4000, 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. 18. Tensile testing of metals.

B.S. 1499. Sampling non-ferrous metals.

B.S. 1728. Methods for the analysis of aluminium and aluminium alloys.

B.S. 1957. Presentation of numerical values (fineness of expression ; rounding of numbers).

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 NFE/19. Draft for comment AC(NFE)263

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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:

- *Admiralty
- *Aluminium Federation
 - Association of Bronze and Brass Founders
 - Association of Consulting Engineers, Incorporated
 - British Bronze and Brass Ingot Manufacturers' Association
- *British Electrical and Allied Manufacturers' Association
 - British Lead Manufacturers' Association
 - British Non-ferrous Metals Federation
- *British Non-ferrous Metals Research Association
 - Cable Makers' Association
 - Copper Development Association
 - Crown Agents for Oversea Governments and Administrations
 - High Commission of India
 - High Conductivity Copper Association
 - Institute of British Foundrymen
- *Institute of Metals
- *Institution of Mechanical Engineers (Automobile Division)
 - Institution of Mining and Metallurgy
- *Institution of Structural Engineers
 - Lead Development Association
 - Light Metal Founders' Association
 - London Metal Exchange
 - Magnesium Industry Council
- *Ministry of Aviation
 - Ministry of Transport
 - National Brassfoundry Association
- *Non-ferrous metal stockists
 - Post Office
- *Royal Institute of British Architects
 - Society of British Aircraft Constructors
- *Society of Motor Manufacturers and Traders Ltd.
 - Tin Research Institute
 - War Office
 - Zinc Development Association
 - Individual manufacturers

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 this British Standard:

- ALARS (Association of Light Alloy Refiners and Smelters)
- British Aluminium Holloware Manufacturers' Association
- Institute of Sheet Metal Engineering
- Institute of Welding
- Lloyd's Register of Shipping
- London Transport Board
- National Association of Drop Forgers and Stampers
- National Federation of Vehicle Trades
- National Physical Laboratory (D.S.I.R.)
- Rolled Thread Screw Association
- Small Rivet Association

BRITISH STANDARD SPECIFICATION FOR
WROUGHT ALUMINIUM AND
ALUMINIUM ALLOYS
FOR GENERAL ENGINEERING PURPOSES

Bars and Sections

FOREWORD

This British Standard for bars and sections was first issued in 1949 and forms part of a comprehensive series of British Standards for aluminium and aluminium alloys in various wrought forms for general engineering purposes. The whole series was reviewed in 1955 and the requirements for wire previously covered by B.S. 1474 and 1475 were incorporated in the one standard B.S. 1475. The number 1474 was then allocated to a new standard for extruded round tube and hollow sections. This numbering system has been retained in this second revision of the series of which the other British Standards are:

- B.S. 1470. Sheet and strip.
- B.S. 1471. Drawn tube.
- B.S. 1472. Forging stock and forgings.
- B.S. 1473. Rivet, bolt and screw stock for forging.
- B.S. 1474. Extruded round tube and hollow sections.
- B.S. 1475. Wire.
- B.S. 1477. Plate.

The same system of nomenclature has been adopted for all standards in the series and particular care should be taken to ensure that the symbol is quoted.

In this revision of the series the term 'rod' has been omitted as applying to extrusions, the ranges for magnesium in alloys N4 and N5 have been amended, N5/6 has been omitted and a new alloy N8 has been introduced. For all these alloys the iron limits have been reduced so that these and the new ranges for magnesium are more in line with those agreed for inclusion in ISO Recommendation R 209. For certain other alloys amendments have been made to the limits for essential elements and impurities. As in the earlier editions major alloying elements are printed in heavy type throughout Section Two and limits in all cases have been set bearing in mind the rounding rule of B.S. 1957, 'Presentation of numerical values (finesness of expression; rounding of numbers)'.

In this revised standard for bars and sections material N7 has been omitted and material N8 introduced. The mechanical properties for certain of the other alloys have been restricted to material up to 8 in, and proof stress values for

alloys N5 and N6 in the 'M' condition which are 'for information only' now appear only in a footnote. For material H14 the 'T' condition has been replaced by the 'W' condition. H19 which was introduced into this standard in 1960 is intended for applications requiring a good surface finish and medium strength, but where stressed structures are not involved.

SYSTEM OF NOMENCLATURE

In this series of British Standards the following symbols have been adopted throughout:

a. Form of material.

- S Sheet and strip (B.S. 1470).
- C Clad sheet and strip (B.S. 1470).
- T Drawn tube (B.S. 1471).
- F Forging stock and forgings (B.S. 1472).
- R Rivet stock (B.S. 1473).
- B Bolt and screw stock (B.S. 1473).
- V Extruded round tube and hollow sections (B.S. 1474).
- G Wire (B.S. 1475).
- E Bars and sections (B.S. 1476).
- P Plate (B.S. 1477).
- PC Clad plate (B.S. 1477).

b. Heat treatment. In the case of the aluminium alloys, the following prefix symbols have been adopted throughout:

- N Non-heat-treatable alloys, i.e. those which are not strengthened by heat treatment.
- H Heat-treatable alloys, i.e. those which are strengthened by heat treatment.

Thus the letters NE indicate non-heat-treatable alloys in the form of bars and sections. The letters HP refer to heat-treatable alloys in the form of plate.

c. Condition. Suffix letters have been used to indicate the temper or condition of heat treatment in which the materials are available. These symbols are as follows for aluminium and the non-heat-treatable alloys:

- O Material in the annealed condition.
- M Material in the 'as manufactured' conditions i.e. as rolled, as extruded, straightened and/or drawn to size, or as forged.
- OD Material in the annealed and controlled drawn condition (at present applicable only to rivet stock).
- $\frac{1}{4}H$ Material subjected to the application of cold work after annealing
- $\frac{1}{2}H$ or to a combination of cold work and partial annealing/stabilizing
- $\frac{3}{4}H$ in order to secure the specified mechanical properties. The designations are in ascending order of tensile strength.
- H

For the heat-treatable alloys, the suffix letters have the following significance:

- O Material in the annealed condition.
- M Material in the 'as manufactured' condition, i.e. as rolled, as extruded, straightened and/or drawn to size, or as forged, without subsequent heat treatment of any kind.
- OD Material in the annealed and controlled drawn condition (at present applicable only to rivet, bolt and screw stock).
- W Material in the solution-treated and naturally aged condition.
- WP Material in the fully heat-treated condition, i.e. solution-treated and subsequently precipitation-treated.
- WD Material in the solution-treated and drawn condition (at present applicable only to wire).
- WDP Material drawn after solution treatment and subsequently precipitation-treated (at present applicable only to wire).
- P Material in the air-quenched and precipitation-treated condition.

d. Numerical classification. The different grades of pure aluminium and the aluminium alloys are listed under numbers, and the same number has been used to indicate any given grade of pure aluminium or aluminium alloy in whatever form it may be obtainable.

99-99 grade aluminium has been given the classification 1, whilst the three other grades of aluminium have been identified by the suffix letters A, B and C.

c. Examples. The following are examples of the nomenclature specified above:

- E1C-M Aluminium of grade 1C in the form of bars or sections, in the 'as manufactured' condition.
- NE5-M Non-heat-treatable aluminium alloy No. 5 in the form of bars or sections in the 'as manufactured' condition.
- HE30-WP Heat-treatable aluminium alloy No. 30 in the form of bars or sections which have been solution-treated and precipitation-treated.

WROUGHT ALUMINIUM ALLOYS FOR GENERAL ENGINEERING PURPOSES

SUMMARY OF CHEMICAL COMPOSITIONS

Material	Aluminium	Copper		Magnesium		Silicon		Iron		Manganese		Nickel		Zinc	†Lead	†Tin	Titanium and/or other grain refining elements max.	Chromium		‡Anti-mony
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	max.	max.	max.	max.	min.	max.	max.
		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
1	99.99	§see below		—	—	§see below		§see below		—	—	—	—	—	—	—	—	—	—	—
*1A	†99.8	—	0.02	—	—	—	0.15	—	0.15	—	0.03	—	—	0.06	—	—	—	—	—	—
*1B	†99.5	—	0.05	—	—	—	0.3	—	0.4	—	0.05	—	—	0.10	—	—	—	—	—	—
*1C	†99.0	—	0.10	—	—	—	0.5	—	0.7	—	0.1	—	—	†0.10	—	—	—	—	—	—
N2	remainder	—	0.10	—	†0.25	10.0	13.0	—	0.6	—	0.5	—	†0.2	†0.2	0.05	0.05	—	—	—	—
N21	remainder	—	0.10	—	†0.25	4.5	6.0	—	0.6	—	0.5	—	†0.2	†0.2	0.05	0.05	—	—	—	—
N3	remainder	—	0.1	—	—	—	0.6	—	0.7	1.0	1.5	—	—	†0.2	—	—	0.20	—	—	—
*N4	remainder	—	0.10	1.7	2.8	—	0.6	—	0.5	—	0.5	—	—	†0.2	—	—	0.15	—	0.25	—
*N5	remainder	—	0.10	2.8	4.0	—	0.6	—	0.5	—	0.6	—	—	†0.2	—	—	0.15	—	0.25	—
*N6	remainder	—	0.10	4.5	5.5	—	0.6	—	0.5	—	1.0	—	—	†0.2	—	—	0.15	—	0.25	—
*N7	remainder	—	0.10	6.5	7.5	—	0.6	—	0.5	—	0.5	—	—	†0.2	—	—	0.15	—	0.25	—
*N8	remainder	—	0.10	4.0	4.9	—	0.40	—	0.40	0.5	1.0	—	—	†0.2	—	—	0.15	—	0.25	—
*H9	remainder	—	0.10	0.4	0.9	0.3	0.7	—	0.5	—	0.30	—	—	†0.1	—	—	0.2	—	0.10	—
*H19	remainder	—	0.10	0.4	1.5	0.60	1.3	—	0.6	—	0.2	—	—	†0.1	—	—	0.2	—	0.10	—
*H20	remainder	0.15	0.40	0.8	1.2	0.4	0.8	—	0.7	‡0.2	0.8	—	—	†0.2	—	—	0.2	‡0.15	0.35	—
*H30	remainder	—	0.10	0.4	1.4	0.60	1.3	—	0.5	0.40	1.0	—	—	†0.1	—	—	0.2	—	0.3	—
*H11	remainder	1.0	2.0	0.5	1.2	0.8	1.3	—	0.7	—	1.0	—	†0.2	†0.2	0.05	0.05	0.3	—	—	0.05
H12	remainder	1.8	2.8	0.6	1.2	0.5	1.3	0.6	1.2	—	0.5	0.6	1.4	†0.2	0.05	0.05	0.3	—	—	0.05
*H14	remainder	3.5	4.7	0.4	1.2	0.2	0.7	—	0.7	0.4	1.0	—	†0.2	†0.2	0.05	0.05	‡0.3	—	‡0.3	0.05
*H15	remainder	3.8	4.8	0.2	0.8	0.5	0.90	—	0.7	0.3	1.2	—	†0.2	†0.2	0.05	0.05	‡0.3	—	‡0.3	0.05
H18	remainder	1.8	2.7	1.2	1.6	—	1.3	0.6	1.2	—	†0.2	0.6	1.4	†0.2	0.05	0.05	0.3	—	—	0.05

* These materials are covered by this standard for bars and sections.

† The supplier shall undertake that the material does not contain the named impurities in excess of the amounts shown.

‡ The sum of the named elements shall not exceed 0.20 for 1A, 0.5 for 1B and 1.0 for 1C.

§ The combined copper, silicon and iron content shall not exceed 0.01 per cent.

|| Either manganese within the limits stated or chromium within the limits stated shall be included.

¶ Titanium and/or other grain refining elements and/or chromium may be present at the option of the supplier provided the total content does not exceed 0.3 per cent.

B.S. 1476 : 1963



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

SPECIFICATION

SCOPE

1. This British Standard specifies requirements for solid bars and sections made from three grades of aluminium, and from eleven aluminium alloys in various conditions.

SECTION ONE : GENERAL CLAUSES

DEFINITIONS

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

Purchaser. The party, whether user, retailer, wholesaler or corporate body, or their agent(s) as appropriate, responsible for ordering the material standardized.

*Heat-treatment batch.** A quantity of material of one alloy, of the same dimensions and produced in the same way, solution-treated in one furnace load, or such material so solution-treated and subsequently precipitation-treated in one furnace load. More than one heat-treatment batch may comprise a furnace load.

*Bar.** A round, rectangular or polygonal solid section supplied in straight lengths. The term is applied to materials of not less than $\frac{3}{4}$ inch diameter or minor dimension.

FREEDOM FROM DEFECTS

3. The material shall be sound and free from harmful defects.

TOLERANCES

4. *a. Regular sections.* The dimensional tolerances for regular sections shall comply with the following tables. Unless otherwise specified by the purchaser the wider tolerances shall apply:

Table 1. Tolerances (Classes A and B) for round bar.

Table 2. Tolerances for hexagon bar for nuts and bolts.

Table 3. Tolerances on overall widths and widths across flats (for regular sections and solid bar up to 12.999 in wide (other than bar covered by Tables 1 and 2)).

Table 4. Tolerances on thickness for regular sections and solid bar up to and including 8 in thick (other than bar covered by Tables 1 and 2). For material ordered in metric sizes Tables 1M, 2M, 3M and 4M apply.

* Extracted from B.S. 3660, 'Glossary of terms used in the wrought aluminium industry'.

Tolerances for bars and sections of dimensions larger than those covered by Tables 3 and 4 shall be subject to agreement between the supplier and the purchaser.

Regular sections shall include square and rectangular bars, angles, T sections, I beams, H sections, Z sections, and any other normal types of sections which can conveniently be divided into approximate rectangles with measurable dimensions.

For purposes of tolerances, any such section 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.

b. Sections of complicated shape. Complicated sections shall be regarded as those sections which are not covered by Tables 1 to 4. 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.

c. Sections for which specially close tolerances are required. Additional manufacturing operations are necessary where specially close tolerances are required, and such tolerances shall be agreed between the supplier and the purchaser.

d. Tolerances for concavity and convexity, twist and straightness. All bars and sections shall be supplied straightened and reasonably free from twist. Special tolerances for straightness, twist, or surface flatness shall be the subject of agreement between the supplier and the purchaser.

e. Tolerance on angle. The tolerances on angles of regular sections measured at the extremities of the section shall be as follows:

Thickness of thinnest leg				Allowable deviation from angle specified (plus and minus)
Over		Up to and including		
in	mm	in	mm	
—	—	0.060	1.5	2°
0.060	1.5	0.200	5.0	1½°
0.200	5.0	—	—	1°

Tolerances on angles of other sections shall be as agreed between supplier and purchaser.

SELECTION OF TEST SAMPLES

5. a. Bars and sections of pure aluminium or non-heat-treatable aluminium alloys. Bars and sections of the same dimensions, produced in the same way, and of the same composition, shall be grouped into batches as follows:

Material up to and including $\frac{3}{8}$ in (9.5 mm) diameter or equivalent cross-section— $\frac{1}{2}$ ton (508 kg) of material.

Material over $\frac{3}{8}$ in (9.5 mm) and up to and including $\frac{3}{4}$ in (19 mm) diameter or equivalent cross-section—1 ton (1016 kg) of material.

Material over $\frac{3}{4}$ in (19 mm) and up to and including 2 in diameter or equivalent cross-section—1 $\frac{1}{2}$ tons (1524 kg) of material.

Material over 2 in (50.8 mm) diameter or equivalent cross-section—2 tons (2032 kg) of material.

One test sample shall be cut from a bar or section selected from each batch.

Before the test samples are cut off, they shall be marked to identify them with the batch they represent.

The test samples shall be taken from the material as supplied, and shall not be annealed or mechanically worked (except for straightening and machining the test piece) before being tested.

b. Bars and sections of heat-treatable aluminium alloys. Bars and sections of the same dimensions, produced in the same way and of the same composition, shall be grouped into batches as follows:

Material up to and including $\frac{3}{8}$ in (9.5 mm) diameter or equivalent cross-section—1 ton (1016 kg) of material, or a heat-treatment batch, whichever is the less.

Material over $\frac{3}{8}$ in (9.5 mm) diameter or equivalent cross-section—2 tons (2032 kg) of material or a heat-treatment batch, whichever is the less.

One test sample shall be cut from a bar or section selected from each batch.

Before the test samples are cut off, they shall be marked to identify them with the batch they represent.

For materials supplied in the M or O condition, the test samples shall either be tested as supplied or be heat treated and tested in the W or WP condition, as specified by the purchaser. The test samples, after heat treatment, shall not be mechanically worked (except for straightening and machining the test piece) before being tested.

Material in the M or O condition can be expected to have the mechanical properties of the W and WP conditions on appropriate heat treatment.

For material supplied in the W condition, the test samples shall be tested in the condition as supplied in the straightened and stretched condition, unless

the purchaser has specified that he requires the test sample to be tested in the WP condition. The test samples shall not be mechanically worked (except for straightening and machining the test piece) before being tested.

For materials in the P or WP condition, the test samples shall be tested in the condition as supplied. The test samples shall not be further heat-treated or mechanically worked (except for straightening and machining the test piece) before being tested.

MECHANICAL TESTS (including preparation of test pieces)

6. The following tests shall be made on test pieces prepared from test samples selected as specified in Sub-clauses 5a and b:

a. Tensile test. The tensile test shall be made in accordance with B.S. 18, 'Tensile testing of metals'. Where possible the tensile test piece shall be of the dimensions of either the British Standard proportional round test piece, or British Standard rectangular section test piece specified in B.S. 18, 'Tensile testing of metals' (see Appendix A).

If the bars or sections are too small for either of the above test pieces to be obtained, the test pieces shall be machined to the largest possible dimensions having the same geometrical proportions as the proportional round test piece, or, if the supplier desires, the bars or sections may be tested in full section with a gauge length of 2 in (50.8 mm) or $4\sqrt{S_0}$.

b. 0.1 per cent proof stress. The 0.1 per cent proof stress is defined as the stress (load divided by the original area of cross-section of a test piece) which is just sufficient to produce, under load, a non-proportional elongation equal to 0.1 per cent of the original gauge length.

The proof stress shall be determined as specified in B.S. 18 (see Appendix B).

RETESTS

7. Should any one of the test pieces first selected fail to pass the mechanical tests, two further samples from the same batch shall be selected for testing, one of which shall be from the bar or section from which the original test sample was taken, unless that bar or section has been withdrawn by the supplier.

For heat-treatable alloys the supplier shall have the right if he so desires, to re-heat-treat the material 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 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 this standard.

CERTIFICATE OF COMPLIANCE

8. The supplier shall certify that the material complies with the requirements of this standard.

INSPECTION

9. If the purchaser wishes to inspect the material at the supplier's works he shall notify the supplier at the time of placing the order.

INDEPENDENT TEST

10. Should there be a dispute about the compliance of the material with regard to the composition or the test requirements of this standard, the purchaser and the supplier shall have the right to have tests made by a mutually acceptable testing authority.

The results obtained by the independent testing authority shall be accepted as final. If the material does not comply with this standard, the cost of independent testing shall be borne by the supplier; if the material complies with this standard the cost shall be borne by the purchaser.

The method of sampling for analysis shall be in accordance with B.S. 1499, 'Sampling non-ferrous metals' and the methods of analysis shall be in accordance with B.S. 1728, 'Methods for the analysis of aluminium and aluminium alloys', where the appropriate method exists.

FACILITIES FOR TESTING

11. For orders of any one size of bar or section in one material in quantities greater than those shown below, the supplier shall provide and prepare the necessary test pieces and supply labour and appliances for such testing as may be carried out on his premises in accordance with this standard. Failing facilities at his own works for making the prescribed tests, the supplier shall make the necessary arrangements for making the tests elsewhere.

Weight per foot of bar or section				Weight above which the supplier shall make the tests	
Over		Up to and including			
lb	kg	lb	kg	lb	kg
—	—	3	1.4	56	25.4
3	1.4	9	4.1	112	50.8
9	4.1	20	9.1	224	101.6
20	9.1	56	25.4	560	254
56	25.4	—	—	1120	508

For orders of the above quantities or less of any one size of bar or section in one material, the mechanical tests shall be made only by special arrangement between supplier and purchaser.

THE ROUNDING OF NUMBERS RULE

12. Values between the limits of composition and mechanical properties shown (NOT dimensional tolerances) are subject to the application of the 'rounding' rule in accordance with B.S. 1957*. Under this rule the determined values are 'rounded' to the last place of figures stated as limits.

The following examples illustrate the application of the rounding rule:

Specification limits		Extreme values which round to specification limitations	
min.	max.	min.	max.
—	0.050	—	0.0505
0.2	0.6	0.15	0.65
6	9	5.5	9.4
6.0	9.0	5.95	9.05
7	10	6.6	10.5
7.5	10.5	7.46	10.54

* B.S. 1957, 'Presentation of numerical values (fineness of expression, rounding of numbers)'.

BARS AND SECTIONS

SUMMARY OF MECHANICAL PROPERTIES

For details reference should be made to the individual specification

Material	Size (diameter or minor cross- sectional dimension)		0.1 per cent proof stress min.	Tensile strength min.	Elongation on 2 in or $4\sqrt{S_0}$ min.
	Over	Up to and including			
	in	in	ton/sq in	ton/sq in	per cent
E1A-M	—	—	—	3.5	30
E1B-M	—	—	—	4.0	25
E1C-M	—	—	—	4.0	20
NE4-M	—	—	—	11.0	18
NE5-M	—	2	—	14.0	18
	2	—	—	13.0	18
NE6-M	—	—	—	17.0	18
NE8-O	—	—	8.0	17.0	16
-M	—	—	8.0	18.0	12
HE9-M or O	—	—	—	7.0	15
-W	—	6	5.0	9.0	18
	6	8	5.0	8.0	15
-P	—	$\frac{1}{8}$	9.0	11.0	10
	$\frac{1}{8}$	$\frac{1}{2}$	7.0	10.0	10
-WP	—	6	10.0	12.0	12
	6	8	8.0	10.0	8
HE19-M or O	—	—	—	7.0	15
-W	—	6	7.0	12.0	18
	6	8	6.0	11.0	15
-WP	—	6	15.0	18.0	10
	6	8	13.0	16.0	7
HE20-M or O	—	—	—	7.0	15
-W	—	6	7.0	12.0	18
	6	8	6.0	11.0	15
-WP	—	6	15.0	18.0	10
	6	8	13.0	16.0	7

BARS AND SECTIONS

SUMMARY OF MECHANICAL PROPERTIES *continued*

For details reference should be made to the individual specification

Material	Size (diameter or minor cross-sectional dimension)		0.1 per cent proof stress	Tensile strength	Elongation on 2 in or $4\sqrt{S_0}$
	Over	Up to and including	min.	min.	min.
	in	in	ton/sq in	ton/sq in	per cent
HE30-M or O	—	—	—	7.0	15
-W	—	6	7.0	12.0	18
	6	8	6.0	11.0	15
-WP	—	$\frac{1}{4}$	16.0	19.0	10
	$\frac{1}{4}$	3	17.0	20.0	10
	3	6	16.0	19.0	10
	6	8	15.0	18.0	7
HE11-W	—	—	12.0	20.0	15
-WP	—	$\frac{3}{8}$	18.0	22.0	8
	$\frac{3}{8}$	3	22.0	26.0	8
	3	6	20.0	25.0	8
	6	8	17.0	23.0	6
HE14-W	—	$\frac{3}{8}$	14.0	24.0	12
	$\frac{3}{8}$	3	15.0	25.0	12
	3	6	15.0	25.0	10
	6	8	14.0	24.0	10
HE15-W	—	$\frac{3}{8}$	14.0	24.0	12
	$\frac{3}{8}$	3	15.0	25.0	12
	3	6	15.0	25.0	10
	6	8	14.0	24.0	10
-WP	—	$\frac{3}{8}$	24.0	28.0	8
	$\frac{3}{8}$	1	26.0	30.0	8
	1	3	27.0	31.0	8
	3	6	26.0	30.0	8
	6	8	24.0	28.0	8