

Australian Standard[®]

**Carbon steels and carbon-manganese
steels—Hot rolled bars and semi-
finished products**



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- Australasian Railways Association
 - Australian Building Codes Board
 - Australian Foundry Institute
 - Australian Industry Group
 - Bureau of Steel Manufacturers of Australia
 - Materials Australia
-

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Australian Standard[®]

**Carbon steels and carbon-manganese
steels—Hot rolled bars and semi-
finished products**

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PREFACE

This Standard was prepared by the Australian members of the Joint Standards/Standards New Zealand Committee MT-001, Iron and Steel to supersede AS 1442—1992, *Carbon steels and carbon-manganese steels—Hot rolled bars and semi-finished products*.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian, rather than an Australian/New Zealand Standard.

The objective of the Standard is to specify the general technical delivery requirements for carbon steels and carbon-manganese steels in the hot rolled or semi-finished condition, including the requirements for sampling and testing.

The objective of this revision is to update the referenced documents and to apply current style.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

Statements expressed in mandatory terms in footnotes to tables are deemed to be requirements of this Standard.

CONTENTS

	<i>Page</i>
1 SCOPE.....	4
2 REFERENCED DOCUMENTS.....	4
3 DEFINITIONS.....	5
4 DESIGNATION.....	6
5 MATERIALS.....	7
6 FREEDOM FROM DEFECTS.....	8
7 SURFACE DRESSING	8
8 TENSILE TEST	9
9 DIMENSIONAL TOLERANCES FOR RODS AND BARS	10
10 ROUNDING OF TEST RESULT VALUES	10
11 MARKING	10
 APPENDICES	
A PURCHASING GUIDELINES.....	18
B MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD	20
C REQUIREMENTS FOR MAXIMUM SURFACE IMPERFECTION DEPTH AND RECOMMENDED MACHINING ALLOWANCES	21

STANDARDS AUSTRALIA

Australian Standard

Carbon steels and carbon-manganese steels—Hot rolled bars and semi-finished products**1 SCOPE**

This Standard specifies requirements for carbon steels and carbon-manganese steel rods, bars, blooms, billets and slabs, delivered in the as-rolled or normalized condition, for forging and for general engineering purposes. It specifies chemical composition requirements for all grades, and tensile strength requirements for grades required to meet mechanical properties. The Standard permits the addition of boron and micro-alloying elements for the achievement of special properties.

The Standard also specifies requirements for the maximum depth of surface imperfections and gives recommended machining allowances for bars of various sizes.

NOTES:

- 1 Advice and recommendations on information to be supplied by the purchaser at the time of enquiry or order are contained in Appendix A.
- 2 For guidance on a means for demonstrating compliance to the Standard refer to Appendix B.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|--------|---|
| 1199 | Sampling procedures for inspection by attributes |
| 1199.0 | Part 0: Introduction to the ISO 2859 attribute sampling system |
| 1199.1 | Part 1: Sampling schemes indexed by acceptance of quality limit (AQL) for lot-by-lot inspection |

- | | |
|------|---|
| 1391 | Metallic materials—Tensile testing at ambient temperatures |
| 1733 | Methods for determination of grain size in metals |
| 2338 | Preferred dimensions of wrought metal products |
| 2706 | Numerical values—Rounding and interpretation of limiting values |

AS/NZS

- | | |
|--------|---|
| 1050 | Methods for the analysis of iron and steel |
| 1050.1 | Part 1: Sampling iron and steel for chemical analysis |

AS/NZS ISO

- | | |
|----------|---|
| 9001 | Quality management system—Requirements |
| 9004 | Quality management system—Guidelines for performance improvements |
| HB 18.28 | Conformity assessment—Guidance on a third-party certification system for products |

ISO

- | | |
|--------|---------------------------------------|
| 2566 | Steel—Conversion of elongation values |
| 2566-1 | Part 1: Carbon and low alloy steels |

3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

3.1 Bar

A finished product of solid section which may have rectangular, square, round or hexagonal cross-section, defined as follows:

(a) *Flat bars (flats)*

Bars of rectangular cross-section, 3 mm or greater in thickness and less than 600 mm in width, supplied in straight lengths or coils and having edges of controlled contour.

(b) *Hexagonal bars (hexagons)*

Bars of regular hexagonal cross-section supplied in straight lengths or coils.

(c) *Square bars (squares)*

Bars of square cross-section supplied in straight lengths or coils.

(d) *Round bars (round)*

Bars of circular cross-section supplied in straight lengths or coils.

3.2 Billet

A semi-finished forged, rolled or continuously-cast product intended for processing into finished products by further forging or rolling. The cross-section is usually square or rectangular, with dimensions not greater than 165 mm × 165 mm (or equivalent cross-sectional area), and the width-to-thickness ratio is less than 4:1.

3.3 Bloom

A semi-finished forged, rolled or continuously-cast product intended for further rolling or forging. The cross-section is square or rectangular, with dimensions greater than 165 mm × 165 mm (or equivalent cross-sectional area), and the width-to-thickness ratio is less than 4:1.

3.4 Fully killed steel

Steel deoxidized with a strong deoxidizing agent such as silicon or aluminium in order to reduce the oxygen content to prevent a reaction between carbon and oxygen during solidification.

3.5 Merchant quality steel

Product having wider carbon and manganese ranges than those of specified carbon steels (see Table 1). It is not subject to product analysis tolerances, grain size requirements or modification with special additions.

3.6 Out-of-hexagon

The greatest difference between the three dimensions measured at the same cross-section across opposite flats of the hexagon.

3.7 Out-of-round

The difference between the maximum and minimum diameters of the bar, measured at the same cross-section.

3.8 Out-of-square

The difference between the two dimensions at the same cross-section across opposite flats of the square.

3.9 Primary rolled product

Steel product produced in a primary mill by the direct hot-rolling of an ingot or from a continuously cast bloom.

3.10 Rod

A semi-finished or finished product of approximately circular cross-section produced in coils.

3.11 Slab

A semi-finished forged, rolled or continuously-cast product intended for rolling or forging. The cross-section is rectangular, with the thickness greater than 50 mm and the width-to-thickness ratio equal to or greater than 4:1.

3.12 Test batch

Finished steel of the same size, produced from the same cast and from the same heat treatment batch.

3.13 Test sample

A portion of material or product, or a group of items selected from a test batch by a sampling procedure.

3.14 Test specimen

A portion or a single item taken from the test sample for the purpose of applying a particular test.

4 DESIGNATION

4.1 General

The steel designation shall comprise the number of this Australian Standard, i.e. AS 1442, followed by a slash and additional characters in accordance with Clauses 4.2 and 4.3. Additional designations for surface condition and austenitic grain size are given in Clauses 4.4 and 4.5.

4.2 For steels supplied to chemical composition only

The designation of steel supplied to a specified chemical composition shall be in accordance with the following:

- (a) A prefix letter, if applicable, as follows:

M: Merchant quality steel

U: Unspecified deoxidation

X: Major deviation in chemical composition of any grade from the corresponding AISI-SAE grade

NOTE: Information on AISI-SAE grades is given in the relevant steel products manual of the American Iron and Steel Institute.

- (b) A four-digit series designation, as follows, wherein the first two digits of the number indicate the type of steel and the last two digits indicate the approximate mean of the specified carbon range:

10XX: Plain carbon steels

11XX: Sulfurized free-cutting carbon steels

12XX: Phosphorized and sulfurized free-cutting carbon steels

12XX: Carbon-manganese steels

NOTE: The double 'X' has no significance other than to indicate the position for digits to be added.

- (c) Modification symbols may be added to the series designation as follows:

- (i) For lead-bearing steels, the letter 'L' is used to indicate that the steel contains lead and is placed between the second and third characters of the four-digit series designation.
- (ii) For aluminium-killed steels, the letter 'A' is placed between the second and third characters of the four-digit series designation.
- (iii) For boron-treated steels, the letter 'B' is placed between the second and third characters of the four-digit series designation.
- (iv) For micro-alloyed steels, the letter 'M' is placed between the second and third characters of the four-digit series designation.

Examples of designation: AS 1442/12L14, AS 1442/10A08, AS 1442/10B22, AS 1442/10M40, AS 1442/X1038.

4.3 For steels supplied to chemical composition and mechanical properties

The designation of steel supplied to chemical composition and mechanical properties shall consist of the following:

- (a) The prefix letter 'U', if applicable (see Clause 4.2(a)).
- (b) A number 1, 3, 4, 5, 6, 8, 9 or 10 to indicate the steel grade.

Examples of designation: AS 1442/U5, AS 1442/5.

4.4 Surface condition

The surface condition resulting from the mill is normally of commercial quality. Where a special condition is required, it is indicated by either of the following suffix letters:

- B: Intermediate surface condition suitable for cold drawn products, heat-treated products and forgings other than upset or drop-forged products.
- F: Surface condition suitable for upsetting, drop-forging and other severe forming applications.

Example of designation: AS 1442/1040B.

4.5 Austenitic grain size

The following designations consisting of suffix letters 'CG' or 'FG' indicate the austenitic grain size of the steel as defined in AS 1733:

CG: Coarse

FG: Fine

Example of designation: AS 1442/1030FG.

NOTE: The absence of these suffix letters indicates that the steel may be coarse-grained or fine-grained at the supplier's option.

5 MATERIALS

5.1 Chemical composition

5.1.1 General

Chemical composition shall be determined by any procedures which are at least as accurate as those given in AS/NZS 1050.1.

5.1.2 Cast analysis

Wherever possible, a chemical analysis of the steel from each cast shall be made to determine the proportions of the specified elements. In cases where it is impracticable to obtain samples from liquid steel, analysis on test samples taken in accordance with the requirements of AS 1199.1 may be reported as cast analysis.

The reported cast analysis of the steel shall conform to the limits given in Tables 1 to 5 for the appropriate grade.

5.1.3 *Residual elements*

For steels complying with this Standard, residual elements are acceptable to the following limits:

- (a) Chromium: 0.30% maximum
- (b) Copper: 0.35% maximum
- (c) Molybdenum: 0.10% maximum
- (d) Nickel: 0.35% maximum

NOTE: The amount of residual elements may affect subsequent processes, especially those involving cold working, welding and heat treatment.

5.1.4 *Product analysis*

For grades of steel specified in Tables 1, 4 and 5, excluding those with unspecified deoxidation (U), with cross-sectional areas up to and including 0.06 m², the results of individual determinations carried out on the product shall be within the product analysis tolerance limits specified in Table 6. Where several determinations of a single element, excluding lead, are carried out on products from any one cast, the spread of individual results shall not extend both above and below the range specified in Tables 1, 4 and 5.

5.1.5 *Tensile test requirements*

When tested in accordance with Clause 8, steels requiring tensile testing shall meet the relevant requirements of Table 5.

6 FREEDOM FROM DEFECTS

6.1 *General*

The steel shall be free from internal and surface defects which render it unsuitable for its particular application. If, after acceptance of the steel and provided that it has been properly treated after delivery, subsequent processing reveals that it contains defects found to be detrimental, the steel shall be deemed not to comply with this Standard.

6.2 *Freedom from surface imperfections*

The maximum permissible depth of surface imperfections from commercial, B and F surface conditions is specified in Appendix C. This Appendix also gives recommendations for machining allowances.

7 SURFACE DRESSING

7.1 *Bars*

Surface defects may be removed from bars by grinding, chipping or by other means, provided that the final dimensions meet the tolerance requirements of Clause 9.

7.2 *Blooms, billets and slabs*

7.2.1 *General*

Surface defects on blooms, billets and slabs may be removed by rough machining, chipping, grinding, scarfing or other similar processes. The method used and the dimensions remaining after removal of the defects shall not adversely affect the end use of the product.

The amount of steel removed from blooms, billets and slabs that are to be forged shall be as specified in Clauses 7.2.2 and 7.2.3.

7.2.2 Depth of gouge

The maximum depth of gouge shall be as follows:

(a) *In blooms, billets and in the edges of slabs*

Not more than 1.5 mm for each 25 mm of dimension up to a maximum depth of 20 mm, provided that the sum of the depths on two parallel sides at opposite locations does not exceed 1.5 times the maximum depth allowed for one side.

(b) *In the faces of slabs*

Not more than 2.5 mm for each 25 mm of thickness dimension up to a maximum depth of 20 mm, provided that the sum of the depths in two parallel faces does not exceed 1.5 times the maximum allowed for one face.

7.2.3 Width of gouge

The width of any gouge present shall be at least four times the depth.

8 TENSILE TEST

8.1 Condition of test sample

For rounds, squares and hexagons up to 40 mm diameter or minor cross-sectional dimension, and flats up to 25 mm thick, the test sample shall be tested in the 'as-supplied' condition.

For larger bars, billets and slabs, test specimens should be prepared from a test sample which is in one of the following conditions:

- (a) As rolled (no additional treatment).
- (b) Normalized.
- (c) Forged and normalized, i.e. forged to 50% of the original cross-sectional area and normalized.

The condition of the material supplied and that of the test sample shall be reported on the test certificate.

8.2 Location and preparation of test specimen

Test specimen shall be located and prepared as follows (see also AS 1391):

- (a) Bars up to 40 mm diameter or major cross-sectional dimension shall be tested axially, either in full section, or by using a proportional test specimen
- (b) Bars with nominal cross-sectional dimensions greater than 40 mm shall have the axis of the test specimen parallel to the axis of the bar and as near as practicable to a point one-sixth of the distance between diagonally (or diametrically) opposite surfaces. A proportional test specimen shall be used.
- (c) Rectangular bars of width greater than 40 mm and thickness not greater than 40 mm shall be tested either in full thickness or by using a proportional test specimen with its axis as near as practicable to a position one quarter of the width and one half of the thickness from adjacent surfaces of the bar.
- (d) Rectangular products of thickness greater than 40 mm shall have the axis of the test specimen parallel to the axis of the product, and as near as practicable to a point one-sixth of the distance from a surface of the bar between opposite surfaces. A proportional test specimen shall be used.

8.3 Method of test

The yield strength, tensile strength and percentage elongation shall be determined in accordance with AS 1391.

The rate of straining when approaching the yield point shall conform to the limits of the standard strain rate given in AS 1391.

The elongation results shall be reported on a gauge length of $L_0 = 5.65 \sqrt{S_0}$ is the cross-sectional area of the test specimen before testing. If necessary, conversion of results from a non-proportional gauge length shall be in accordance with ISO 2566-1.

9 DIMENSIONAL TOLERANCES FOR RODS AND BARS

Steel products shall be manufactured to the tolerances given in the following Tables, as appropriate:

- (a) Cross-sectional dimension tolerances for round and square bars Table 7
- (b) Cross-sectional dimension tolerances for rods Table 8
- (c) Cross-sectional dimension tolerances for hexagonal bars Table 9
- (d) Width tolerances for square edge and round edge flat bars Table 10
- (e) Thickness tolerances for square edge and round edge flat bars Table 11
- (f) Length tolerances for bars Table 12
- (g) Straightness tolerances for bars Table 13

10 ROUNDING OF TEST RESULT VALUES

10.1 General

With the exception of tensile test results, the observed or calculated values shall be rounded to the same number of figures as in the specified values and then compared with the specified values. For example, for specified maximum or minimum values of 2.5, 2.50, 2.500, the observed or calculated value would be rounded, to the nearest 0.1, 0.01, 0.001 respectively, (see AS 2706).

10.2 Tensile test results

The determined value of tensile strength shall be rounded to the nearest 10 MPa and the determined value of yield strength shall be rounded to the nearest 5 MPa.

11 MARKING

Steel as supplied by the manufacturer shall be legibly and durably marked or tagged (for bundles) as follows:

- (a) To identify the manufacturer.
- (b) To enable it to be traced to the ladle of steel from which it was made.
- (c) To indicate the grade of steel.
- (d) To enable it to be identified with this Standard.
- (e) To indicate nominal size and shape.

NOTE: Manufacturers making a statement of compliance with this Australian Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

TABLE 1
CHEMICAL COMPOSITION REQUIREMENTS FOR CARBON STEELS

Grade designation AS 1442/ (Note 1)	Chemical composition (cast analysis), %							
	Carbon		Silicon (Notes 2 and 3)		Manganese		Phosphorus	Sulfur
	Min.	Max.	Min.	Max.	Min.	Max.	Max.	Max.
1006	—	0.08	0.10	0.35	0.25	0.50	0.040	0.040
1008	—	0.10	0.10	0.35	0.25	0.50	0.040	0.040
1010	0.08	0.13	0.10	0.35	0.30	0.60	0.040	0.040
1016	0.13	0.18	0.10	0.35	0.60	0.90	0.040	0.040
1020	0.18	0.23	0.10	0.35	0.30	0.6	0.040	0.040
1021	0.18	0.23	0.10	0.35	0.60	0.9	0.040	0.040
1022	0.18	0.23	0.10	0.35	0.70	1.00	0.040	0.040
1030	0.28	0.34	0.10	0.35	0.60	0.90	0.040	0.040
1035	0.32	0.38	0.10	0.35	0.60	0.90	0.040	0.040
X1038	0.35	0.42	0.10	0.35	0.70	1.00	0.040	0.040
1040	0.37	0.44	0.10	0.35	0.60	0.90	0.040	0.040
1045	0.43	0.50	0.10	0.35	0.60	0.90	0.040	0.040
1050	0.48	0.55	0.10	0.35	0.60	0.90	0.040	0.040
1055	0.5	0.6	0.10	0.35	0.60	0.90	0.040	0.040
1058	0.56	0.63	0.10	0.35	0.30	0.55	0.040	0.040
1060	0.55	0.65	0.10	0.35	0.60	0.90	0.040	0.040
1065	0.60	0.70	0.10	0.35	0.60	0.90	0.040	0.040
1070	0.65	0.75	0.10	0.35	0.60	0.90	0.040	0.040
1080	0.75	0.88	0.10	0.35	0.60	0.90	0.040	0.040
1084	0.80	0.93	0.10	0.35	0.60	0.90	0.040	0.040
1095	0.90	1.03	0.10	0.35	0.40	0.70	0.040	0.040

NOTES:

- 1 Steel grades may be treated with micro-alloying elements such as niobium, vanadium and titanium (for the designation requirements see Clause 4.2(c)).
- 2 For aluminium-killed steels, the maximum silicon content is 0.10%.
- 3 For steel grades with a U prefix, e.g. U1040 (see Clause 4.2(a)), the minimum silicon content does not apply and the material is not subject to product analysis or grain size requirements.

TABLE 2
**CHEMICAL COMPOSITION REQUIREMENTS FOR MERCHANT
QUALITY STEELS**

Grade designation AS 1422/	Chemical composition (cast analysis), %						
	Carbon		Silicon	Manganese		Phosphorus	Sulfur
	Min.	Max.	Max.	Min.	Max.	Max.	Max.
M1020	0.15	0.25	0.35	0.30	0.90	0.050	0.050
M1030	0.25	0.35	0.35	0.30	0.90	0.050	0.050
M1040	0.35	0.45	0.35	0.40	0.90	0.050	0.050

NOTE: These grades are not subject to product analysis or grain size requirements.

TABLE 3
CHEMICAL COMPOSITION REQUIREMENTS FOR FREE-CUTTING STEELS

Grade designation AS 1442/	Chemical composition (cast analysis), %									
	Carbon		Silicon		Manganese		Phosphorus		Sulfur	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
X1112	0.08	0.15	—	0.10	1.1	1.40	—	0.040	0.20	0.30
1137	0.32	0.39	0.10	0.35	1.35	1.65	—	0.040	0.08	0.13
1144	0.40	0.48	—	0.35	1.35	1.65	—	0.040	0.24	0.33
1146	0.42	0.49	0.10	0.35	0.70	1.00	—	0.040	0.08	0.13
X1147	0.40	0.47	0.10	0.35	1.60	1.90	—	0.040	0.07	0.12
1214	—	0.15	—	0.10	0.80	1.20	0.04	0.09	0.25	0.35
12L14*	—	0.15	—	0.10	0.80	1.20	0.04	0.09	0.25	0.35

* For lead-bearing steels, the lead content shall be 0.15% to 0.35%.

TABLE 4
**CHEMICAL COMPOSITION REQUIREMENTS FOR CARBON-
MANGANESE STEELS**

Grade designation AS 1442/	Chemical composition (cast analysis), % (Note 1)							
	Carbon		Silicon (Note 2)		Manganese		Phosphorus	Sulfur
	Min.	Max.	Min.	Max.	Min.	Max.	Max.	Max.
X1315	0.12	0.18	0.10	0.35	1.40	1.70	0.040	0.040
X1320	0.18	0.23	0.10	0.35	1.40	1.70	0.040	0.040
X1325	0.23	0.28	0.10	0.35	1.40	1.70	0.040	0.040
X1340	0.38	0.43	0.10	0.35	1.40	1.70	0.040	0.040
X1345	0.43	0.48	0.10	0.35	1.40	1.70	0.040	0.040

NOTES:

- 1 The steels may be treated with micro-alloying elements such as niobium, vanadium and titanium (see Clause 4.2(c)).
- 2 For aluminium-killed steels, the maximum silicon content is 0.10%.

TABLE 5
 REQUIREMENTS FOR STEELS WITH SPECIFIED CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES IN THE
 AS-ROLLED OR NORMALIZED CONDITION (EXCLUDING COILED MATERIAL)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Grade designation AS 1442/	Chemical composition (cast analysis), %								Form	Mechanical properties				
	Carbon		Silicon		Manganese		Phosphorus	Sulfur		Specified size (diameter or minor cross- sectional dimension) mm	Yield strength MPa	Tensile strength MPa	Elongation on $L_0=5.65 \sqrt{S_0}$ %	
	Min.	Max.	Min.	Max.	Min.	Max.	Max.	Max.						
	—	0.20	—	0.40	0.40	1.20	0.040	0.040						—
U1	—	0.20	—	0.40	0.40	—	1.40	0.040	Rounds, squares, hexagons	—	50	250	410	22
U3	—	0.25	—	0.40	—	—	—	—	Flat bar	50	170	230	410	22
	—	—	—	—	—	—	—	—		12	40	250	410	22
	—	—	—	—	—	—	—	—		40	60	230	410	22
	—	—	—	—	—	—	—	—		120	230	410	22	
3	—	0.25	0.10	0.40	—	1.40	0.040	0.040	Rounds, squares hexagons	—	50	250	410	22
	—	—	—	—	—	—	—	—	Flat bar	50	215	230	410	22
	—	—	—	—	—	—	—	—		12	260	410	22	
	—	—	—	—	—	—	—	—		12	40	250	410	22
—	—	—	—	—	—	—	—	Blooms, billets, slabs	40	60	230	410	22	
—	—	—	—	—	—	—	—		250	230	410	22		

(continued)

(continued)

TABLE 5 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Grade designation AS 1442/	Chemical composition (cast analysis), %								Form	Mechanical properties				
	Carbon		Silicon		Manganese		Phosphorus	Sulfur		Specified size (diameter or minor cross- sectional dimension) mm	Yield strength MPa	Tensile strength MPa	Elongation on $L_0=5.65 \sqrt{S_0}$, %	
	Min.	Max.	Min.	Max.	Min.	Max.	Max.	Max.						
U4	0.25	0.38	—	0.40	0.40	1.00	0.040	0.040	Bars	—	100	250	500	20
4*	0.25	0.38	0.10	0.40	0.40	1.00	0.040	0.040	Bars Blooms, billets, slabs	—	215	250	500	20
U5	0.35	0.45	—	0.40	0.50	1.00	0.040	0.040	Bars	—	100	270	540	16
5*	0.35	0.45	0.10	0.40	0.50	1.00	0.040	0.040	Bars Blooms, billets, slabs	—	215	270	540	16
U6	0.40	0.50	—	0.40	0.50	1.00	0.040	0.040	Bars	—	100	300	600	14
6*	0.40	0.50	0.10	0.40	0.50	1.00	0.040	0.040	Bars Blooms, billets, slabs	—	215	300	600	14
8	0.10	0.18	0.10	0.40	1.30	1.70	0.040	0.040	Bars Blooms, billets, slabs	—	215	270	480	22
9*	0.15	0.25	0.10	0.40	1.30	1.70	0.040	0.040	Bars Blooms, billets, slabs	—	215	300	540	18
10*	0.2	0.30	0.10	0.40	1.30	1.70	0.040	0.040	Bars Blooms, billets, slabs	—	215	330	580	16

* For bars which have cross-sectional areas in excess of 0.02 m² (equivalent to the cross-sectional area of a 160 mm diameter round), a normalizing heat treatment may be required to ensure that the mechanical properties are achieved. For blooms, billets and slabs which have cross-sectional areas in excess of 0.02 m² it may be necessary to forge and normalize to achieve the properties (see Clause 8.1).

TABLE 6
PRODUCT ANALYSIS TOLERANCES FOR STEELS OF
CROSS-SECTIONAL AREA UP TO AND INCLUDING 0.06 m²
EXCEPT FOR SULFURIN SULFURIZED GRADES
(applicable to steels supplied on composition basis only)

Element	Limit or maximum of specified range	Tolerances over maximum limit or under minimum limit
	%	%
Carbon	≤0.25	0.02
	>0.25 ≤0.55	0.03
	>0.55	0.04
Manganese	≤0.90	0.03
	>0.90 ≤1.90	0.06
Phosphorus	≤0.040	0.008*
Sulfur	≤0.040	0.008*
Silicon	≤0.35	0.02
Lead	≥0.15 ≤0.35	0.03

* Over maximum only.

TABLE 7
CROSS-SECTIONAL DIMENSION TOLERANCES FOR
ROUND AND SQUARE BARS

millimetres		
Specified size (diameter or thickness)	Permissible variation from specified size	Permissible out-of-round or out-of-square
≤25	+0.25, -0.25	0.40
>25 ≤30	+0.30, -0.30	0.45
>30 ≤40	+0.40, -0.40	0.60
>40 ≤50	+0.50, -0.50	0.75
>50 ≤60	+0.60, -0.60	0.90
>60 ≤70	+0.70, -0.70	1.05
>70 ≤80	+0.80, -0.80	1.20
>80 ≤100*	+0.90, -0.90	1.35
>100 ≤125	+3.20, —	3.20
>125 ≤170	+4.80, —	4.80
>170 ≤215	+6.40, —	6.40

* For material produced as primary-rolled product (see Clause 3.9), optional dimensional tolerances in the size range >80 ≤100 are +2.45, -0, and the permissible out-of-round or out-of-square is 1.85.

TABLE 8
CROSS-SECTIONAL DIMENSION TOLERANCES FOR RODS

millimetres		
Specified size (diameter)	Diameter tolerance	Permissible out-of-round
All diameters	+0.40, -0.40	0.60

TABLE 9
CROSS-SECTIONAL DIMENSION TOLERANCES FOR HEXAGON BARS

millimetres		
Specified thickness	Permissible variation from specified thickness	Permissible out-of-hexagon
≤21	+0.20, -0.20	0.30
>12 ≤25	+0.25, -0.25	0.40
>25 ≤40	+0.55, -0.35	0.65
>40 ≤50	+0.80, -0.40	0.90
>50 ≤65	+1.20, -0.40	1.10

TABLE 10
WIDTH TOLERANCES FOR SQUARE-EDGE AND ROUND-EDGE FLAT BARS

millimetres	
Specified width	Width tolerance
≤25	+0.40, -0.40
>25 ≤50	+0.80, -0.80
>50 ≤100	+1.60, -0.80
>100 ≤150	+2.40, -1.60
>150 ≤200	+3.20, -3.20
>200 ≤300	+3.20, -3.20

TABLE 11
THICKNESS TOLERANCES FOR SQUARE-EDGE AND ROUND-EDGE FLAT BARS

millimetres					
Specified width	Thickness tolerance (plus or minus)				
	Specified thickness				
	<6	≥6 ≤12	>12 ≤25	>25 ≤50	>50
≤25	0.20	0.20	0.25	—	—
>25 ≤50	0.20	0.30	0.40	0.80	—
>50 ≤100	0.20	0.40	0.50	0.80	1.20
>100 ≤150	0.25	0.40	0.50	0.80	1.60
>150 ≤200	0.25	0.40	0.50	0.80	—
>200 ≤300	—	0.40	0.50	0.80	—

TABLE 12
LENGTH TOLERANCES FOR BARS

millimetres	
Specified length, m	Length tolerance
≤70	+50, -0
>7 ≤12	+75, -0
>12	+100, -0

NOTE: These tolerances do not apply to primary rolled product.

TABLE 13
STRAIGHTNESS TOLERANCES FOR BARS

millimetres		
Specified size	Maximum deviation from straight line	
	In any 1.5 m of length	Per metre run
All size	6	4

NOTE: These tolerances do not apply to primary rolled product.

APPENDIX A
PURCHASING GUIDELINES
(Informative)

A1 GENERAL

Australian Standards are intended to include the technical requirements for relevant products, but do not purport to comprise all the necessary provisions of a contract. This Appendix contains advice and recommendations on the information to be supplied by the purchaser at the time of enquiry or order.

A2 INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser should supply the following information at the time of enquiry and order, after making due reference to the explanation, advice and recommendations contained in this Appendix:

- (a) Quantity and delivery instructions (dates, schedules, delivery point).
- (b) Dimensions of steel, e.g. section, length (if applicable), mass per unit length, bundle mass.

NOTE: Attention is drawn to the desirability of specifying cross-sectional dimensions in terms of AS 2338. It should be noted that sizes not listed in AS 2338 are not necessarily precluded for ordering purposes.

- (c) Designation of grade (see Clause 4).
- (d) The surface condition designation (see Clause 4.4).
- (e) Defects allowable.

NOTE: Defects such as pipe, segregation or surface flaws cannot be completely quantified. Where the presence, size or frequency of any defects is considered to be of concern, arrangements should be made between the purchaser and the manufacturer. This may be achieved by the provision of acceptance samples.

Where defects are present and the product is submitted for acceptance, the manufacturer should be able to demonstrate fitness for purpose.

- (f) Whether fine or coarse austenite grain size is required (see Clause 4.5).
NOTE: Specified grain size does not apply to grades designated 'U' and 'M'.
- (g) The condition of tensile test specimens (see Clause 8.1).
- (h) Whether a test certificate or certificate of compliance is required.
- (i) Whether non-destructive testing examination is required and, if so, the test method to be used and the acceptance criteria.
- (j) Whether it is the intention of the purchaser to inspect the steel at the manufacturer's works.
- (k) Any information concerning processing or end use that the purchaser considers would assist the manufacturer. Specific customer requirements may include upper and lower limits on residual elements.
- (l) Any special or supplementary requirements.
- (m) Reference to this Australian Standard, i.e. AS 1442.

APPENDIX B
MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD
(Informative)

B1 SCOPE

This Appendix sets out the following different means by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

- (a) Evaluation by means of statistical sampling.
- (b) The use of a product certification scheme.
- (c) Assurance using the acceptability of the supplier's quality system.
- (d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

B2 STATISTICAL SAMPLING

Statistical sampling is a procedure which enables decisions to be made about the quality of batches of items after inspecting or testing only a portion of those items. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

- (a) The sample needs to be drawn randomly from a population of product of known history. The history needs to enable verification that the product was made from known materials at essentially the same time, by essentially the same processes and under essentially the same system of control.
- (b) For each different situation, a suitable sampling plan needs to be defined. A sampling plan for one manufacturer of given capability and product throughput may not be relevant to another manufacturer producing the same items.

In order for statistical sampling to be meaningful to the customer, the manufacturer or supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199.1, guidance to which is given in AS 1199.0.

B3 PRODUCT CERTIFICATION

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Standard.

The certification scheme should meet the criteria described in HB 18.28 in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective quality planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard.

B4 SUPPLIER'S QUALITY MANAGEMENT SYSTEM

Where the manufacturer or supplier can demonstrate an audited and registered quality management system complying with the requirements of the appropriate or stipulated Australian or international Standard for a supplier's quality management system or systems, this may provide the necessary confidence that the specified requirements will be met. The quality assurance requirements need to be agreed between the customer and supplier and should include a quality or inspection and test plan to ensure product conformity.

Information on establishing a quality management system is set out in AS/NZS ISO 9001 and AS/NZS ISO 9004.

B5 OTHER MEANS OF ASSESSMENT

If the above methods are considered inappropriate, determination of compliance with the requirements of this Standard may be assessed from the results of testing coupled with the manufacturer's guarantee of product conformance.

Irrespective of acceptable quality levels (AQLs) or test frequencies, the responsibility remains with the manufacturer or supplier to supply products that conform to the full requirements of the Standard.

APPENDIX C

REQUIREMENTS FOR MAXIMUM SURFACE IMPERFECTION DEPTH AND
RECOMMENDED MACHINING ALLOWANCES

(Normative)

Table C1 specifies the maximum permitted depth of surface imperfections for a commercial quality surface condition and for surface condition designations, B and F (see Clause 4.4). Table C2 gives recommendations for machining allowances for bars for commercial, B and F conditions.

TABLE C1
MAXIMUM SURFACE IMPERFECTION DEPTH FOR COMMERCIAL AND FOR B
AND F SURFACE CONDITION DESIGNATIONS

Diameter		Thickness of flats	Maximum depth		
Rods	Rounds		Commercial	B	F
—	—	3	0.40	0.20	0.10
—	—	5	0.40	0.20	0.10
5.5	—	—	0.40	0.20	0.10
—	—	6	0.40	0.20	0.10
6.5	—	—	0.40	0.21	0.11
7.0	—	—	0.40	0.21	0.11
7.5	—	—	0.40	0.22	0.12
8.0	—	8	0.40	0.22	0.12
9	—	—	0.40	0.23	0.13
10.0	10	10	0.40	0.23	0.13
11.2	—	—	0.45	0.24	0.14
—	12	12	0.48	0.25	0.15
12.5	—	—	0.50	0.25	0.15
—	14	—	0.56	0.26	0.16
—	16	16	0.64	0.27	0.17
—	18	—	0.72	0.29	0.19
—	20	20	0.80	0.30	0.20
—	22	—	0.88	0.33	0.21
—	24	—	0.96	0.36	0.22
—	—	25	1.00	0.37	0.22
—	27	—	1.08	0.42	0.23
—	30	—	1.20	0.45	0.24
—	—	32	1.28	0.48	0.24
—	33	—	1.32	0.49	0.25
—	36	—	1.44	0.54	0.26

(continued)

TABLE C1 (continued)

Diameter		Thickness of flats	Maximum depth		
Rods	Rounds		Commercial	B	F
—	39	—	1.56	0.59	0.27
—	—	40	1.60	0.60	0.27
—	42	—	1.60	0.63	0.28
—	45	—	1.60	0.68	0.29
—	48	—	1.60	0.72	0.29
—	50	50	1.60	0.75	0.30
—	56	—	1.60	0.84	0.32
—	60	—	1.60	0.90	0.34
—	65	—	1.60	0.98	0.35
—	70	—	1.60	1.05	0.37
—	75	—	1.60	1.13	0.38
—	80	—	1.60	1.20	0.40
—	90	—	1.60	1.20	0.40
—	100	—	1.60	1.20	0.40
—	110	—	3.00	1.35	0.45
—	120	—	3.0	1.45	0.45
—	130	—	3.0	1.60	0.50
—	140	—	3.0	1.70	0.55
—	150	—	4.0	1.80	0.55
—	160	—	4.0	1.90	0.60
—	170	—	4.0	2.00	0.65
—	180	—	4.0	2.10	0.70
—	190	—	4.0	2.20	0.70
—	200	—	5.0	2.30	0.75
—	215	—	5.0	2.40	0.80

NOTE: The requirement for maximum imperfection depth in squares and hexagons of a nominal size is the same as for rounds of the same nominal diameter (e.g. a square section with faces 24 mm × 24 mm corresponds to a 24 mm diameter round section).

TABLE C2
RECOMMENDED MINIMUM MACHINING
ALLOWANCES FOR BARS

Rolled size	millimetres	
	Minimum allowance for machining (on nominal diameter)	
	Commercial condition	B or F condition
≤16	3.0	0.80
>16 ≤22	3.0	1.10
>22 ≤24	3.0	1.15
>24 ≤27	4.0	1.25
>27 ≤30	4.0	1.40
>30 ≤36	5.0	1.50
>36 ≤39	5.0	1.70
>39 ≤50	5.0	2.10
>50 ≤65	5.0	2.60
>65 ≤75	10.0	3.60
>75 ≤130	13.0	6.40
>130 ≤215	—	9.50

NOTES

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