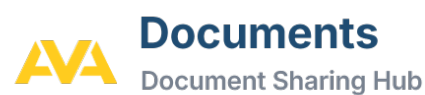


Australian/New Zealand Standard™

Structural steel

Part 1: Hot-rolled bars and sections



AS/NZS 3679.1:2016

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee BD-023, Structural Steel. It was approved on behalf of the Council of Standards Australia on 13 January 2016 and on behalf of the Council of Standards New Zealand on 21 January 2016.

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Australian Industry Group
Australian Steel Association
Australian Steel Institute
Austroads
Bureau of Steel Manufacturers of Australia
Business New Zealand
New Zealand Heavy Engineering Research Association
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Australian/New Zealand Standard™

Structural steel

Part 1: Hot-rolled bars and sections

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee BD-023, Structural Steel, to supersede AS/NZS 3679.1:2010.

The objective of this Standard is to specify requirements for manufacturers and suppliers of hot-rolled structural steel bars and sections for general structural and engineering applications.

This edition includes the following major changes from the previous edition:

- (a) Requirements for type testing, and minimum production testing and inspections, have been included in the normative appendix on product conformity.
- (b) Test certificates are required to be available for all products produced to this Standard.
- (c) Labelling requirements have been added to enable products compliant with this Standard to be traceable back to its corresponding test certificate.
- (d) The prescriptive requirement of a rolled in mark on hot rolled sections greater than 150 mm has been replaced by a performance based requirement that provides the same level of permanency in identification.
- (e) Definitions, clause numbering and layout across the four steel product Standards AS/NZS 1163, AS/NZS 3678, AS/NZS 3679.1 and AS/NZS 3679.2 are consistent wherever practicable.

A statement expressed in mandatory terms in a note to a table is deemed to be a requirement of this Standard.

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.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Structural steel**Part 1: Hot-rolled bars and sections****1 SCOPE**

This Standard specifies the requirements for the production and supply of hot-rolled structural steel bars and sections.

This Standard is intended for general structural and engineering applications. All grades specified in this Standard are suitable for—

- (a) welding in accordance with AS/NZS 1554, Parts 1, 2, 5 and 7; and
- (b) fastening, as specified in AS 3990, AS 4100, AS/NZS 4600, AS 5100.6 and NZS 3404.

This Standard does not cover the following:

- (i) Structural steel—welded I sections.
- (ii) Carbon steels and carbon-manganese steels—Hot-rolled bars and semi-finished products.
- (iii) Steel reinforcing bars for concrete.

Requirements for product conformity to this Standard are given in Appendix B.

NOTES:

- 1 Guidelines for purchasers on requirements that should be specified by the purchaser and those that should or may be agreed on at the time of enquiry and order are given in Appendix A.
- 2 Guidelines on cold-bending of rounds, flats and squares during fabrication are given in Appendix C.

2 NORMATIVE REFERENCES

The following normative documents are referenced in this Standard:

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

AS

1391	Metallic materials—Tensile testing at ambient temperature
1544	Methods for impact tests on metals
1544.2	Part 2: Charpy V-notch
2706	Numerical values—Rounding and interpretation of limiting values
3990	Mechanical equipment—Steelwork
4100	Steel structures
5100	Bridge design
5100.6	Part 6: Steel and composite construction

AS/NZS

1050	Methods for the analysis of iron and steel (series)
1050.1	Part 1: Sampling iron and steel for chemical analysis

AS/NZS

1554	Structural steel welding
1554.1	Part 1: Welding of steel structures
1554.2	Part 2: Stud welding (steel studs to steel)
1554.5	Part 5: Welding of steel structures subject to high levels of fatigue loading
1554.7	Part 7: Welding of sheet steel structures

4600	Cold-formed steel structures
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ISO

2566	Steel—Conversion of elongation values
2566-1	Part 1: Carbon and low alloy steels
7870	Control charts
7870-3	Part 3: Acceptance control charts
14284	Steel and iron—Sampling and preparation of samples for the determination of chemical composition

NZS

3404	Steel Structures Standard
3404.1	Part 1: Materials, fabrication, and construction

3 DEFINITIONS

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

3.1 Analysis**3.1.1 Cast analysis**

Chemical analysis determined from test samples taken from the ladle, tundish or mould during casting.

3.1.2 Product analysis

Chemical analysis determined from a test sample of the finished product.

3.2 Bars

Finished products of solid section, which may be flats, hexagons, rounds or squares.

3.3 Batch

A group of rolled sections or bars consisting of finished steel of the same yield stress gradation (see Tables 14 and 15) and product form, treated in the same manner and from the same heat.

3.4 Can

To denote a capability or possibility that is available or that might occur.

3.5 Crack

Narrow line of fracture on the surface.

3.6 Defects

Surface discontinuities, including cracks, laps and seams, with a depth or area, or both, greater than a specified limiting value.

3.7 Factory production control

Operational techniques and all measures necessary to regulate and maintain the conformity of the product to the requirements of the relevant product standard.

3.8 Heat

A product of a ladle of steel melted in one vessel and processed under the same conditions.

3.9 Imperfections

Surface discontinuities including cracks, laps and seams, with a depth or area, or both, less than or equal to a specified limiting value.

3.10 Inspection

Judgment by competent personnel to determine acceptability against requirements.

3.11 Lap

Overlapping material partially connected with the base material.

3.12 Longitudinal direction

Direction of the greatest extension of the steel during rolling.

3.13 Manufacturer

The business operating the hot rolling process producing the finished steel product.

3.14 May

Indicates the existence of an option.

3.15 Primary rolled product

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

3.16 Purchaser

Organization or person who is a recipient from a supplier of a steel product manufactured to this Standard.

3.17 Seams

Caused when imperfections in the semi-finished product are elongated and extended during rolling.

3.18 Sections

Rolled finished sections of special contour and dimensions (see Appendix D).

3.19 Shall

Indicates that a statement is mandatory.

3.20 Should

Indicates a recommendation.

3.21 Supplier

An organization or person that provides steel products manufactured to this Standard.

3.22 Testing

Chemical analysis tests and mechanical tests undertaken by an accredited laboratory as required by this Standard.

3.23 Test piece

Piece prepared for testing, made from a test specimen by a mechanical operation.

3.24 Test sample

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

3.25 Test specimen

Portion or a single item taken from the test sample for the purpose of eventually applying a particular test.

3.26 Transverse direction

Direction at right angles to the direction of the greatest extension of the steel during rolling.

3.27 Type testing

Testing performed to prove that the material is capable of conforming to the requirements of this Standard.

4 DESIGNATION

All grades shall be designated in the format shown in the following examples:

Examples: AS/NZS 3679.1-350
AS/NZS 3679.1-350L0
AS/NZS 3679.1-300S0

where

AS/NZS 3679.1 = number of this Standard

350 = nominal minimum yield stress of the steel, in MPa, (see Tables 14 and 15)

L = guaranteed impact properties of the material (when applicable)

S = guaranteed seismic impact properties of the material (when applicable)

0 = low temperature impact test at 0°C (when applicable)

5 MANUFACTURING PROCESS—STEEL FEED

The steel shall be made by either the basic oxygen process or an electric arc process.

6 CHEMICAL COMPOSITION

6.1 General

The method of sampling for chemical analysis shall be in accordance with AS/NZS 1050.1 or ISO 14284. Chemical composition shall be determined in accordance with AS/NZS 1050 series Standards, or other procedures that achieve the same or better degree of accuracy.

6.2 Cast analysis

A cast analysis of the steel shall be made from each heat 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 AS/NZS 1050.1 or ISO 14284 may be reported as cast analysis.

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

TABLE 1
CHEMICAL COMPOSITION OF BARS AND SECTIONS

Grade (see Note 1)	Cast analysis (max.) (see Notes 2 and 3) %						
	C	Si	Mn	P	S	Micro-alloying elements (see Note 4)	CE (see Note 5)
300, 300L0, 300L15 and 300S0	0.25	0.50	1.60	0.040	0.040	(See Note 6)	0.44
350, 350L0, 350L15 and 350S0	0.22	0.50	1.60	0.040	0.040	(See Note 7)	0.45

NOTES:

- 1 The use of sulphide modification steel-making techniques for these grades is permitted.
- 2 Grain refining elements, i.e. aluminium and titanium may be added, provided that the total content does not exceed 0.15%. Limits are for total or soluble aluminium.
- 3 The following elements may be present to the limits stated, subject to a maximum total of 1.00%:
 - (a) Copper: 0.50%.
 - (b) Nickel: 0.50%.
 - (c) Chromium: 0.30%.
 - (d) Molybdenum: 0.10%.
- 4 For grades, 300, 300L0 and 300S0, the following are not considered as micro-alloying elements:
 - (a) Titanium: 0.040% maximum.
 - (b) Niobium: 0.020% maximum.
 - (c) Vanadium: 0.030% maximum.
 - (d) Niobium plus vanadium: 0.030% maximum.
- 5 Carbon equivalent (CE) is calculated from the following equation:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$
- 6 Micro-alloying elements are not permitted in grades 300 and 300S0 except in thicknesses greater than or equal to 15 mm, where the following apply:
 - (a) The maximum combined micro-alloying element content is 0.15%.
 - (b) Where micro-alloying elements are used, the percentage of each element shall be shown on the certificates.
- 7 For grades 350, 350L0 and 350S0 micro-alloying elements niobium, vanadium and titanium may be added, provided that their total combined content does not exceed 0.15%.
- 8 Boron shall not be intentionally added to the steel without the agreement of the purchaser.

6.3 Product analysis

Chemical analysis of the finished product is not a requirement of this Standard. If the steel is subjected to a product analysis, the chemical composition shall conform to the limits given in Table 1 with the tolerances given in Table 2.

TABLE 2
PRODUCT ANALYSIS TOLERANCES
FOR GRADES GIVEN IN TABLE 1

Element	Tolerance over maximum limit, %
Carbon	0.04
Silicon	0.05
Manganese	0.10
Phosphorus	0.01
Sulfur	0.01

6.4 Residual elements

Elements not given in Table 1 for the relevant grade shall not be intentionally added to steel without the agreement of the purchaser.

7 MANUFACTURING TOLERANCES

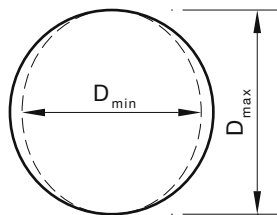
7.1 Bars

Variations from nominal dimensions of a bar shall not exceed the limits given in Tables 3 to 7 and Figures 1 and 2, as appropriate.

Permissible variations in straightness for bars and light angles having a combined leg length of 150 mm or less shall not exceed—

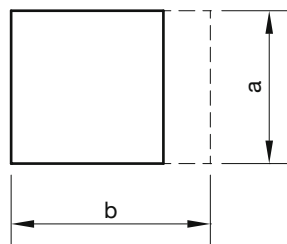
$$\frac{\text{Length}}{250}$$

NOTE: This permissible variation does not apply if any heating operation has been performed subsequent to rolling.



$$\text{Out-of-round} = D_{\max} - D_{\min}$$

(a)



$$\text{Out-of-square} = |a - b|$$

(b)

DIMENSIONS IN MILLIMETRES

FIGURE 1 MEASUREMENTS FOR OUT-OF-ROUND AND OUT-OF-SQUARE

TABLE 3
PERMISSIBLE VARIATIONS IN CROSS-SECTIONAL
DIMENSIONS FOR ROUNDS AND SQUARES

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
(see Note)				
>100	≤125	+3.20	−0	3.20
>125	≤170	+4.80	−0	4.80
>170	≤215	+6.40	−0	6.40

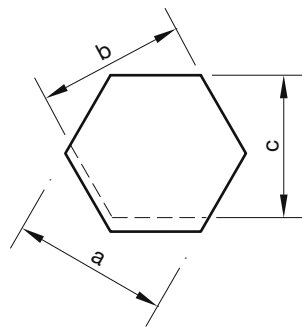
NOTE: For material produced as primary-rolled product (see Clause 3.15), optional dimensional tolerances in the size range >80, ≤100 are +2.45, −0, and the permissible out-of-round or out-of-square is 1.85.

TABLE 4
WIDTH TOLERANCES FOR FLATS

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 5
THICKNESS TOLERANCES FOR FLATS

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	—



$$\text{Out-of-hexagon} = \max (|a-b|, |a-c|, |b-c|)$$

DIMENSIONS IN MILLIMETRES

FIGURE 2 MEASUREMENTS FOR OUT-OF-HEXAGON

TABLE 6
PERMISSIBLE VARIATIONS IN
CROSS-SECTIONAL DIMENSIONS FOR HEXAGONS

millimetres				
Specified thickness		Permissible variation from specified thickness		Permissible out-of-hexagon
≤12		+0.20	−0.20	0.30
>12	≤25	+0.25	−0.25	0.40
>25	≤40	+0.55	−0.35	0.60
>40	≤50	+0.80	−0.40	0.90
>50	≤65	+1.20	−0.40	1.10

TABLE 7
PERMISSIBLE VARIATIONS IN
LENGTH FOR BARS AND SECTIONS

Specified length m		Permissible variation from specified length mm	
≤7		+50	−0
>7	≤12	+75	−0
>12		+100	−0

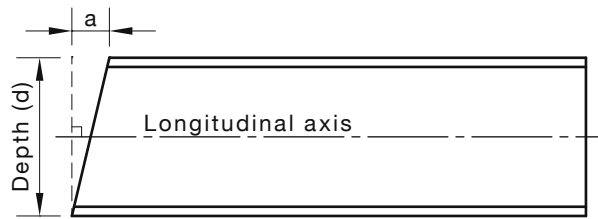
NOTE: Universal sections are normally supplied to a tolerance of +150 mm, −0 mm.

7.2 Sections

Variations from nominal dimensions of a section shall not exceed the appropriate limits given in Tables 7 to 11 and Figures 3 to 7, as appropriate. The mass per unit length as measured on a sample shall be not less than 97.5% of the nominal value. The mass of any group of lengths of section shall be within 2.5% of the nominal value.

For the purpose of this Clause, a group of lengths shall consist of sections of the same nominal dimensions, having—

- (a) minimum mass of 1 tonne; and
- (b) minimum number of 10 lengths.



Off-square = a

Section	Permissible off-square for end cuts of sections 'a' mm
Channels and tapered-flange beams	0.030 per mm of depth (d) (see Note 1)
Angles	0.030 per mm of leg length (see Note 2)

NOTES:

- See Figures D3, D4, D5 or D6, as appropriate.
- For unequal angles, the off-square is determined on the longer leg.

FIGURE 3 PERMISSIBLE OFF-SQUARE FOR END CUTS OF SECTIONS OTHER THAN UNIVERSAL SECTIONS

TABLE 8
PERMISSIBLE VARIATIONS IN STRAIGHTNESS FOR SECTIONS OTHER THAN UNIVERSAL SECTIONS

Characteristic (see Note 1)	Permissible variation mm
Camber (see Note 2)	$\frac{\text{Length}}{500}$
Sweep	Owing to the extreme variations in flexibility of tapered-flange beams and channels about the y axis, straightness tolerances are as specified by the purchaser for the individual sections involved.

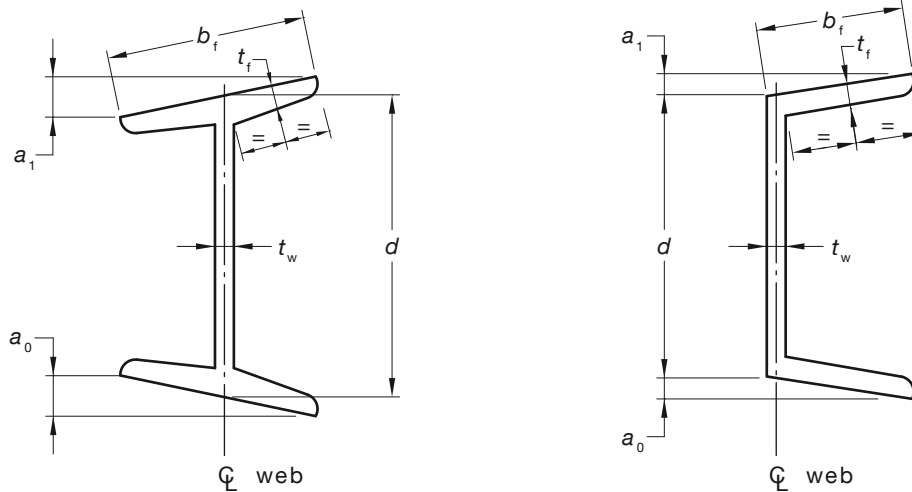
NOTES:

- Measuring of camber and sweep in universal sections shall be in accordance with Appendix E.
- For angles having a combined leg length of greater than 150 mm, this is the straightness tolerance.

TABLE 9
PERMISSIBLE VARIATIONS IN STRAIGHTNESS
FOR UNIVERSAL SECTIONS

millimetres		
Nominal size	Sweep	Camber
Sections with a flange width (b_f) less than 150 mm	$\frac{\text{Length}}{500}$	$\frac{\text{Length}}{1000}$
Sections with a flange width (b_f) equal to the depth (d):	$\frac{\text{Length}}{1000}$ but not more than 10 mm $10 \text{ mm} + \frac{\text{Length} - 14\,000}{1000}$	
(a) Lengths of 14 m and less		
(b) Lengths greater than 14 m		
All other sections	$\frac{\text{Length}}{1000}$	

NOTE: Owing to the extreme variation in the elastic flexibility of universal sections about the y axis, difficulty may be experienced in obtaining reproducible sweep measurements. Measuring of sweep shall be in accordance with Appendix E.

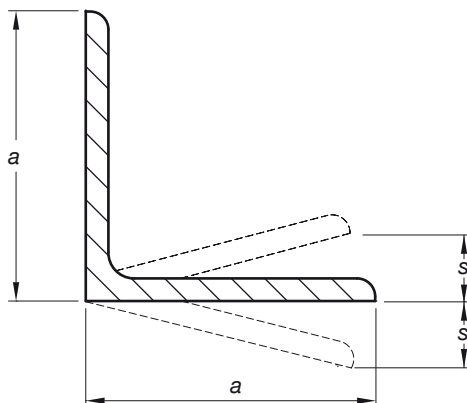


NOTES:

- 1 Dimensions d , a_1 and a_0 are measured parallel with the centre-line of the web. Dimension b_f is measured parallel with the plane of the flange.
- 2 Dimension d is measured at the centre-line of the web for beams and at the back of the web for channels.
- 3 Out-of-square is given by a_1 or a_0 whether the flanges are turned in the same or opposite directions.

1	2	3		4	5		6		7	8
Section	Depth of section (<i>d</i>)			Flange width (<i>b_f</i>)			Permissible variation in flange or web thickness	Permissible out-of- square on each leg or flange	Permissible out-of-square per mm of nominal flange width <i>b_f</i>	
	Nominal dimension	Permissible variation		Nominal dimension	Permissible variation		(t _f or t _w)		(a ₁ or a ₀)	(a ₁ + a ₀)
		Plus	Minus		Plus	Minus	Plus	Minus		
Tapered- flange beams	>75 ≤125	2.5	1.5	>40 ≤80	3.0	3.0	0.7	0.7	1.5	0.03
				>80 ≤90	3.0	3.0	0.7	0.7	2.0	0.03
Parallel flange channels	≥75 ≤ 120	3.0	1.5	>35 ≤55	3.0	3.0	0.7	0.7	1.0	0.03
	>120 ≤ 360	3.0	1.5	>55 ≤80	3.0	3.0	1.0	1.0	1.5	0.03
	>360 ≤ 390	5.0	3.0	>80 ≤105	3.0	4.0	1.0	1.0	2.0	0.03

FIGURE 4 PERMISSIBLE VARIATIONS IN CROSS-SECTIONAL DIMENSIONS FOR TAPERED-FLANGE BEAMS AND PARALLEL FLANGE CHANNELS



NOTES:

- 1 When measuring the out-of-square, the back of the square and the centre-line of the reference leg shall be parallel.
- 2 The nominal size shall be determined as follows:
 - (a) For equal angles—legs length (a).
 - (b) For unequal angles—length of the longer leg.
- 3 For actual thickness, see Tables D5 and D6.

FIGURE 5 PERMISSIBLE OUT-OF-SQUARE FOR ANGLES

TABLE 10
PERMISSIBLE VARIATIONS IN CROSS-SECTIONAL
DIMENSIONS FOR ANGLES—TOLERANCE ON
LEG LENGTH AND OUT-OF-SQUARE

millimetres			
Nominal leg size	Permissible variation		
	Leg length		Out-of-square (s)
	Over	Under	
≤40	2.5	1.5	1
>40 ≤75	2.5	1.5	2
>75 ≤125	3.0	3.0	3
>125 ≤150	3.0	3.0	4
>150	5.0	3.0	5

TABLE 11
PERMISSIBLE VARIATIONS IN
CROSS-SECTIONAL DIMENSIONS
FOR ANGLES—THICKNESS TOLERANCE

millimetres		
Nominal leg size	Permissible variation	
≤10	+0.5	−0.5
>10 ≤15	+0.7	−0.7
>15 ≤25	+1.0	−1.0
>25	+1.5	−1.5