

Australian Standard[®]

Structural steel hollow sections

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PREFACE

This Standard was prepared by the Standards Australia Committee on Structural Steel to supersede AS 1163—1981. This edition incorporates the following changes:

- (a) The deletion of C200 and all H (hot-formed) grades. The inclusion of a new cold-formed grade C450 and grades with guaranteed impact performance at 0°C, namely C250L0, C350L0 and C450L0.
In line with the above change, the tensile strengths of grades C250 and C350 are reduced to reflect the properties obtained on cold-formed sections.
- (b) A revised table on chemical analysis.
- (c) An amended table on minimum inside radius.
- (d) A revised table on tensile test requirements.
- (e) The deletion of the previous Appendix B on rounding of numbers in lieu of reference to AS 2706.

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STANDARDS AUSTRALIA

Australian Standard

Structural steel hollow sections

1 SCOPE This Standard specifies the requirements for cold-formed steel hollow sections for structural purposes, for the six grades of steel that are suitable for welding.

NOTES:

- 1 For guidelines on information to be supplied at the time of enquiry or order, see Appendix A.
- 2 Alternative means for demonstrating compliance with this Standard are given in Appendix B.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS	
1050	Methods for the analysis of iron and steel
1171	Methods for magnetic particle testing of ferromagnetic products and components
1199	Sampling procedures and tables for inspection by attributes
1210	SAA Unfired Pressure Vessels Code
1213	Iron and steel—Methods of sampling
1391	Methods for tensile testing of metals
1399	Guide to AS 1199—Sampling procedures and tables for inspection by attributes
1544	Methods for impact tests on metals
1544.2	Part 2: Charpy V-notch
1553	Covered electrodes for welding
1554	SAA Structural Steel Welding Code
1554.1	Part 1: Welding of steel structures
2084	Non-destructive testing—Eddy current testing of metal tubes
3900	Quality systems—Guide to selection and use
3904	Quality management and quality system elements
K1	Methods for the sampling and analysis of iron and steel
ISO	
2566	Steel—Conversion of elongation values
2566-1	Part 1: Carbon and low alloy steels
Guide 44	General rules of ISO or IEC international third-party certification schemes for products

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

3.1 Batch—hollow sections of the same size, thickness and grade manufactured from the same cast.

3.2 Cast analysis—chemical analysis determined from a test sample taken during casting.

3.3 Cold-formed hollow section—hollow sections formed and shaped at ambient temperature from a single strip of steel, both edges of which are continuously welded by either the electric resistance or submerged arc process.

3.4 Longitudinal direction—direction parallel to the longitudinal weld.

3.5 Product analysis—chemical analysis determined from a test sample of the finished material.

3.6 Testing—mechanical and chemical analysis tests as required by this Standard.

3.7 Test piece—piece prepared for testing, made from a test specimen by a mechanical operation.

3.8 Test sample—portion of material or product or a group of items selected from a batch or group by sampling.

3.9 Test specimen—portion or a single item taken from the test sample for the purpose of applying a particular test.

3.10 Transverse direction—direction at right angles to the longitudinal weld.

3.11 Unit—length of hollow section.

4 DESIGNATION All grades shall be designated as follows:

Example: AS 1163–C250L0

where

AS 1163	= number of this Standard
C	= cold-formed sections
250	= nominal minimum yield strength of steel
L	= guaranteed impact properties of the material
0	= low temperature impact test at 0°C

5 STEELMAKING PROCESS The steel shall be made to fine-grained continuously-cast practice.

6 CHEMICAL COMPOSITION

6.1 General The method of sampling for chemical analysis shall be in accordance with AS 1213. Chemical composition shall be determined in accordance with AS 1050 or AS K1.

6.2 Cast analysis A chemical analysis of the steel from each cast shall be made to determine the proportions of the specified elements.

The reported cast analysis of the steel from which a hollow section is manufactured shall conform to the limits given in Table 1 for the appropriate grade.

6.3 Product analysis The chemical analysis of the finished product is not a requirement of this Standard. When the steel is subject to a product analysis, the analysis shall conform to the limits given in Table 1 for the appropriate grade.

TABLE 1
CHEMICAL COMPOSITION

Grades (see Note 1)	Chemical composition (cast or product analysis) (see Note 2) % max.									
	C	Si	Mn	P	S	Mo	Al (see Note 3)	Ti	Micro-alloying elements	CE (see Note 4)
C250 C250L0	0.12	0.05	0.50	0.040	0.030	0.10	0.10	0.04	0.030 (see Note 6)	0.25
C350 C350L0	0.20 (see Note 5)	0.25	1.60	0.040	0.030	0.10	0.10	—	0.15 (see Note 7)	0.39
C450 C450L0	0.20	0.45	1.60	0.040	0.030	0.35	0.10	—	0.15 (see Note 7)	0.39

NOTES:

- The use of sulfide modification steelmaking techniques for these grades is permitted.
- The following elements may be present to the limits stated, subject to a total content of 0.3 percent:
 - Copper: 0.15 percent
 - Nickel: 0.15 percent
 - Chromium: 0.15 percent
- Limits specified are for soluble or total aluminium.
- Carbon equivalent (CE) is calculated from the following equation:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$
- At the discretion of the manufacturer, the carbon content (C) of grades C350 and C350L0 may be increased to 0.26 percent provided all other requirements are met.
- Applies to niobium and vanadium only. However niobium greater than 0.010 percent is not permitted.
- Applies to niobium, vanadium and titanium only. However vanadium greater than 0.10 percent is not permitted.

7 DIMENSIONS, MASS AND GEOMETRICAL PROPERTIES Appendix C gives dimensions, mass and geometrical properties of common sizes of hollow sections produced in accordance with Table 1.

8 DIMENSIONAL TOLERANCES

8.1 Length The maximum permissible variation in the length of a hollow section product specified as exact or cut shall conform to the limits given in Table 2. When it is not specified as exact or cut, the maximum permissible variation from the length is +100, -0 mm.

TABLE 2
MAXIMUM PERMISSIBLE VARIATION IN LENGTH
SPECIFIED AS EXACT OR CUT

Range of length m	Maximum permissible variation in length mm
≤ 14	+ 6 - 0
> 14 to ≤ 18	+ 10 - 0
> 18	Not specified (see Note)

NOTE: Tolerances should be specified at time of order.

8.2 Cross-section The maximum permissible variation in the cross-sectional dimensions of a hollow section shall conform to the appropriate limits given in Figures 1 and 2.

A thickness tolerance of ± 10 percent shall apply.

The radii of the corners of square hollow sections (SHS) and rectangular hollow sections (RHS) shall be as follows:

- (a) Maximum outside radius: $3t$.
- (b) Minimum outside radius: $1.5t$ (for RHS and SHS with perimeter equal to 50×50 or less).
 $1.8t$ (for RHS and SHS with perimeter greater than 50×50).

where t is the section thickness, in millimetres.

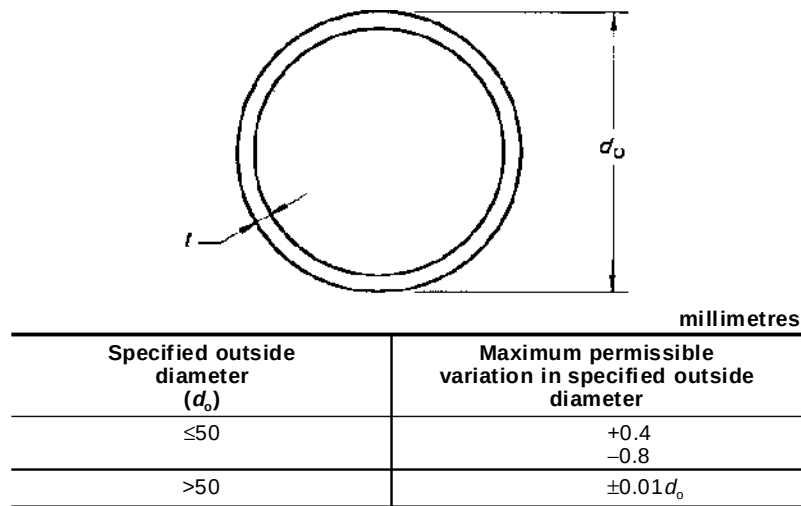
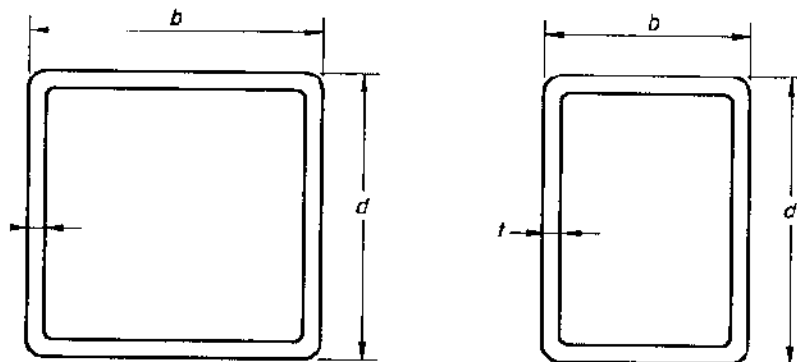


FIGURE 1 MAXIMUM PERMISSIBLE VARIATION IN CROSS-SECTION OF CIRCULAR HOLLOW SECTIONS



Outside dimension of side (b) or (d)	Maximum permissible variation in specified outside dimension of side	Maximum permissible out-of-square at corners
mm	mm	degree
≤ 50	± 0.5	1
> 50	$\pm 0.01b$ or $\pm 0.01d$	

FIGURE 2 MAXIMUM PERMISSIBLE VARIATION IN CROSS-SECTION OF SQUARE AND RECTANGULAR HOLLOW SECTIONS

8.3 Straightness The maximum permissible variation from straightness in a length of hollow section product shall not exceed:

$$\frac{\text{Specified length}}{500}$$

8.4 Twist (rectangular sections) For rectangular hollow sections, the maximum value of V (see Figure 3) shall not exceed 2 mm plus 0.5 mm per metre length.

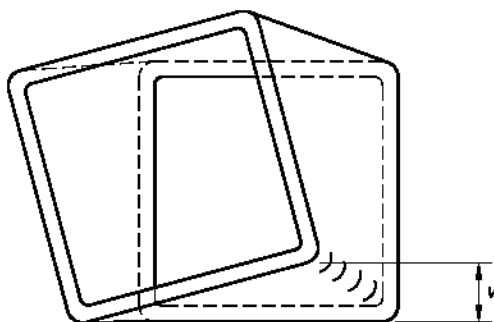


FIGURE 3 MEASUREMENT OF TWIST OF RECTANGULAR HOLLOW SECTIONS

9 MASS TOLERANCE The mass of a length of hollow section shall be not less than 0.96 times the specified mass.

10 FREEDOM FROM DEFECTS The section shall be free from lamination, surface flaws and other defects detrimental to its use for structural purposes.

11 REMOVAL OF SURFACE DEFECTS

11.1 Grinding When removal of surface defects by grinding is adopted, the ground area shall be well flared and the remaining wall thickness in the ground area shall be not less than 90 percent of the nominal thickness.

11.2 Depositing weld metal Welding used in the repair of surface defects shall be performed in accordance with AS 1554.1, using low-hydrogen electrodes complying with AS 1553.

Welds shall be sound, the weld metal being thoroughly fused without undercutting or overlap. The weld metal shall project at least 1.5 mm above the rolled surface and the projecting metal shall be removed by grinding flush with the rolled surface.

12 REMOVAL OF UPSET Hollow sections produced by electric resistance welding shall have the external upset removed.

13 MECHANICAL TESTING

13.1 General Test pieces for tensile tests, impact tests and cold flattening tests shall be taken from a single test specimen.

Test pieces shall be in the same condition as the sections that they represent.

13.2 Orientation of test pieces

13.2.1 Tensile test and impact test The test piece shall be cut such that the major axis is in the longitudinal direction.

13.2.2 Cold flattening test The test piece shall be cut in the transverse direction.

13.3 Position and orientation of test piece

13.3.1 Tensile test and impact test The test piece shall be selected from any position along the length of the test specimen such that the requirements of Clause 13.1 are complied with.

13.3.2 Cold flattening test A test piece shall be cut from one end of a test specimen which contains a longitudinal weld.