
Hot-rolled steel sections —

Part 14:

**Hot-finished structural hollow sections —
Dimensions and sectional properties**

*Profilés en acier laminés à chaud —
Partie 14: Profils creux pour la construction finis à chaud — Dimensions et
caractéristiques du profil*

ISO 657-14:2000

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 657 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 657-14 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Subcommittee SC 1, *Steel tubes*, and ISO/TC 17, *Steel*.

This third edition cancels and replaces the second edition (ISO 657-14:1982), which has been technically revised.

ISO 657 consists of the following parts, under the general title *Hot-rolled steel sections*:

- Part 1: *Equal-leg angles — Dimensions* [ISO 657-14:2000](https://standards.iteh.ai/catalog/standards/sist/81bac8b-86ac-47b7-bb87-ca128f5a57ee/iso-657-14-2000)
- Part 2: *Unequal-leg angles — Dimensions* <https://standards.iteh.ai/catalog/standards/sist/81bac8b-86ac-47b7-bb87-ca128f5a57ee/iso-657-14-2000>
- Part 5: *Equal-leg angles and unequal-leg angles — Tolerances for metric and inch series*
- Part 11: *Sloping flange channel sections (Metric series) — Dimensions and sectional properties*
- Part 13: *Tolerances on sloping flange beam, column and channel sections*
- Part 14: *Hot-finished structural hollow sections — Dimensions and sectional properties*
- Part 15: *Sloping flange beam sections (Metric series) — Dimensions and sectional properties*
- Part 16: *Sloping flange column sections (metric series) — Dimensions and sectional properties*
- Part 18: *L sections for shipbuilding (metric series) — Dimensions, sectional properties and tolerances*
- Part 19: *Bulb flats (metric series) — Dimensions, sectional properties and tolerances*
- Part 21: *T-sections with equal depth and flange width — Dimensions*

Hot-rolled steel sections —

Part 14:

Hot-finished structural hollow sections — Dimensions and sectional properties

1 Scope

This part of ISO 657 specifies the tolerances for hot-finished circular, square and rectangular structural hollow sections and gives the dimensions and sectional properties for a range of standard sizes.

NOTE For the technical delivery requirements, see ISO 630-2.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of ISO 657. For dated references, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this part of ISO 657 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 630-2, *Structural steels — Part 2: Technical delivery requirements for hot-formed hollow sections.*

3 Terms and definitions

For the purposes of this part of ISO 657, the terms and definitions given in ISO 630-2 apply.

4 Symbols

Symbols used in this part of ISO 657 are given in Table 1.

5 Information to be supplied by the purchaser

5.1 Mandatory information

The following information from this part of ISO 657 shall be supplied by the purchaser at the time of enquiry and order.

- a) the type of length, and the length or the length range (see Table 3);
- b) the dimensions (see clause 8).

NOTE This information is included in the list of information to be supplied by the purchaser contained in subclause 5.1 of ISO 630-2:1999.

Table 1 — Symbols

Symbol	Unit	Definition
A	cm ²	Cross-sectional area
A_s	m ² /m	Surface area per unit length
B	mm	Nominal length of side of a square hollow section Nominal length of the shorter side of a rectangular hollow section
$C_1; C_2$	mm	Length of external corner profile of a square or rectangular hollow section
C_t	cm ³	Torsional-modulus constant
D	mm	Nominal outside diameter of a circular hollow section
$D_{max}; D_{min}$	mm	Maximum and minimum outside diameter of a circular hollow section, measured in the same plane
e	mm	Deviation from straightness
H	mm	Nominal length of the longer side of a rectangular hollow section
I	cm ⁴	Second moment of area
I_t	cm ⁴	Torsional-inertia constant (polar moment of inertia for circular hollow sections only)
i	cm	Radius of gyration
L	mm	Length
M	kg/m	Mass per unit length
O	%	Out-of-roundness
R	mm	External corner radius of a square or rectangular hollow section
T	mm	Nominal thickness
V	mm	Total twist
V_1	mm	Twist measured at one end of a section
W_{el}	cm ³	Elastic section modulus
W_{pl}	cm ³	Plastic section modulus
x_1	mm	Concavity of a side of a square or rectangular hollow section
x_2	mm	Convexity of a side of a square or rectangular hollow section
XX	—	Axis of cross-section: major axis of a rectangular hollow section
YY	—	Axis of cross-section: minor axis of a rectangular hollow section
θ	Degrees	Angle between adjacent sides of a square or rectangular hollow section

5.2 Options

One option is specified in this part of ISO 657. In the event that the purchaser does not indicate his wish to implement this option at the time of enquiry or order, the products shall be supplied in accordance with the basic specification (see 5.1).

Option 1 The tolerance on approximate length shall be $^{+150}_0$ mm (see Table 3).

6 Tolerances

6.1 Tolerances on the dimensions and mass of hot-finished hollow sections shall not exceed the values given in Table 2 for shape and mass, Table 3 for length and, in the case of submerged-arc-welded hollow sections, Table 4 for the height of the internal and external weld bead.

6.2 The internal corners of square and rectangular hollow sections shall be rounded.

NOTE The internal corner profile is not specified.

7 Measurement of size and shape

7.1 General

All external dimensions, including out-of-roundness, shall be measured at a distance from the end of the hollow section of not less than D for circular sections, B for square sections or H for rectangular sections, with a minimum of 100 mm.

7.2 Outside dimensions

For circular hollow sections, the diameter D shall be measured. A calliper gauge, circumference tape or other suitable device may be used at the discretion of the manufacturer.

Dimensions B and H shall be measured at a position within 5 mm from the start of the external corner profile as shown in Figure 1.

7.3 Thickness

The thickness T of welded hollow sections shall be measured at a position not less than $2T$ from the weld.

The limiting cross-sectional positions for measuring the thickness of square and rectangular hollow sections are shown in Figure 1.

NOTE Thickness is normally measured within a distance of half the outside diameter or half the longer side length from the end of the section.

7.4 Out-of-roundness

The percentage out-of-roundness O of a circular hollow section shall be calculated from the following equation:

$$O = \frac{D_{\max} - D_{\min}}{D} \times 100$$

7.5 Concavity and convexity

The concavity x_1 or the convexity x_2 of the sides of a square or rectangular hollow section shall be measured as shown in Figure 2.

The percentage concavity or convexity shall be calculated as follows:

$$\frac{x_1}{B} \times 100; \quad \frac{x_2}{B} \times 100; \quad \frac{x_1}{H} \times 100; \quad \frac{x_2}{H} \times 100$$

where B and H are the lengths of the sides containing the concavity x_1 or the convexity x_2 .

7.6 Squareness of sides

The deviation from squareness of the sides of a square or rectangular hollow section is defined as the difference between 90° and θ as shown in Figure 3.

7.7 External corner profile

7.7.1 The external corner profile of a square or rectangular hollow section shall be measured in accordance with 7.7.2 or 7.7.3 at the discretion of the manufacturer.

7.7.2 Measure the external corner radius R . Use a radius gauge or other suitable device.

7.7.3 Measure the length of the external corner profile (C_1 and C_2 in Figure 4).

7.8 Twist

7.8.1 The total twist V in a square or rectangular hollow section shall be determined in accordance with 7.8.2 or 7.8.3 at the discretion of the manufacturer.

7.8.2 Place the hollow section on a horizontal surface with one side at one end pressed flat against the surface. At the opposite end of the hollow section, determine the difference V in the height of the two lower corners from a horizontal surface (see Figure 5).

7.8.3 Measure the total twist V with a spirit level and micrometer (screw) gauge or other suitable device. The reference length of the spirit level shall be the distance between the intersection of the flat sides and the external corner profile (see Figure 6). The total twist V is the difference between the values V_1 (see Figure 6) measured at each end of the hollow section.

7.9 Straightness

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The deviation from straightness e of the total length of a hollow section shall be measured at the point of maximum departure of the hollow section from a straight line connecting its two ends as shown in Figure 7. The percentage deviation from straightness shall be calculated as follows:

$$\frac{e}{L} \times 100 \%$$

8 Dimensions and sectional properties

The nominal section dimensions and sectional properties for a range of sizes of hot-finished structural hollow sections are given in Table 5 for circular sections, Table 6 for square sections and Table 7 for rectangular sections. The sectional properties were calculated from the formulae given in annex A. Other sizes and thicknesses may be available.

Table 2 — Tolerances

Characteristic	Circular hollow sections	Square and rectangular hollow sections
Outside dimensions (D, B, H)	$\pm 1\%$, with a minimum of $\pm 0,5$ mm and a maximum of ± 10 mm	$\pm 1\%$, with a minimum of $\pm 0,5$ mm
Thickness T	- 10 % ^{a,b}	
Out-of-roundness O	2 % for hollow sections having a diameter to thickness ratio not exceeding 100 ^c	—
Concavity/convexity ^d	—	1 %
Squareness of sides	—	$90^\circ \pm 1^\circ$
External corner profile (C_1, C_2 or R) ^e	—	$3T$ maximum at each corner
Twist V	—	2 mm plus 0,5 mm/m length
Straightness	0,2 % of total length	
Mass per unit length M	$\pm 6\%$ on individual lengths ^f	

^a The positive deviation is limited by the tolerance on mass.

^b For seamless sections, thicknesses 10 % less than, but not more than 12,5 % less than, the nominal thickness may occur in smooth transition areas, but not over more than 25 % of the circumference.

^c Where the diameter to thickness ratio exceeds 100, the tolerance on out-of-roundness shall be agreed.

^d The tolerance on convexity and concavity is independent of the tolerance on outside dimensions.

^e The sides need not be tangential to the corner arcs.

^f The positive tolerance on the mass per unit length of seamless hollow sections shall be 8 %.

Table 3 — Tolerances on length ^a

Type of length	Range mm	Tolerance
Random length	4 000 to 16 000 with a range of 2 000 per order item	10 % of sections supplied may be below the minimum for the ordered range but not less than 75 % of the minimum of the range
Approximate length	4 000 to 16 000	± 500 mm ^b
Exact length	$\geq 2\,000$ to 6 000	$\begin{matrix} +10 \\ 0 \end{matrix}$ mm
	$\geq 6\,000$	$\begin{matrix} +15 \\ 0 \end{matrix}$ mm

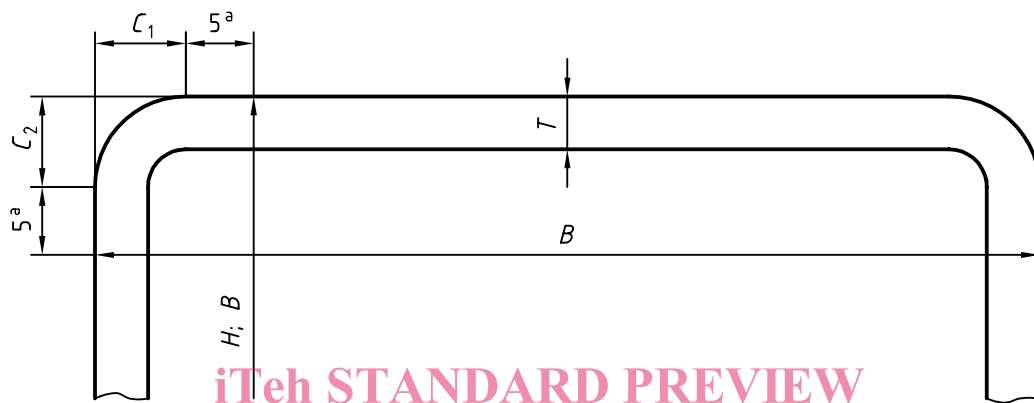
^a The purchaser shall indicate in the enquiry and order the type of length required and the length range or length as appropriate.

^b Option 1 (see 5.2): The tolerance on the approximate length shall be $\begin{matrix} +150 \\ 0 \end{matrix}$ mm.

Table 4 — Tolerance on height of internal and external weld bead for submerged-arc-welded hollow sections

Thickness T mm	Maximum weld bead height mm
$\leq 14,2$	3,5
$> 14,2$	4,8

Dimensions in millimetres



a This dimension is a maximum when measuring B or H and a minimum when measuring T .

Figure 1 — Limiting cross-sectional positions for measuring the dimensions B , H and T for square or rectangular hollow sections

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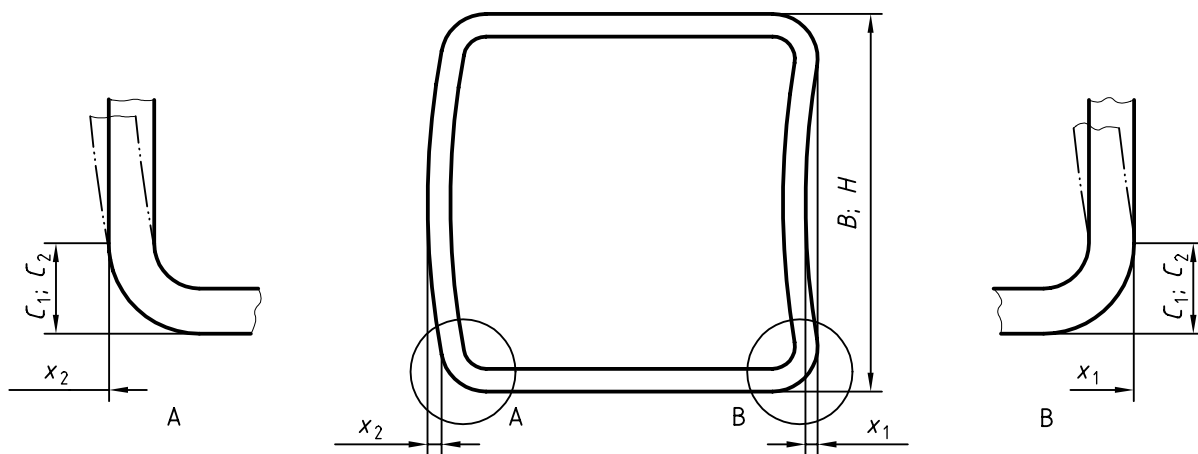
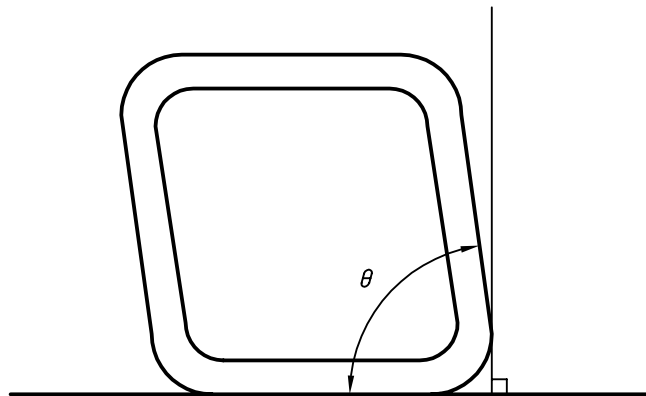


Figure 2 — Measurement of concavity/convexity of square or rectangular hollow sections



Deviation from squareness = $90^\circ - \theta$

Figure 3 — Squareness of sides of square or rectangular hollow sections

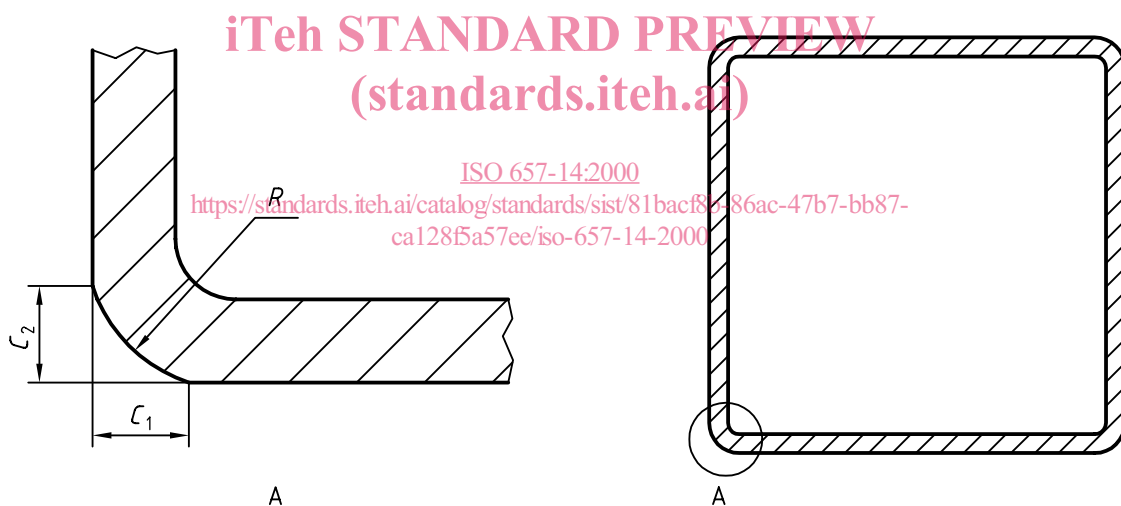


Figure 4 — External corner profile of square or rectangular hollow sections

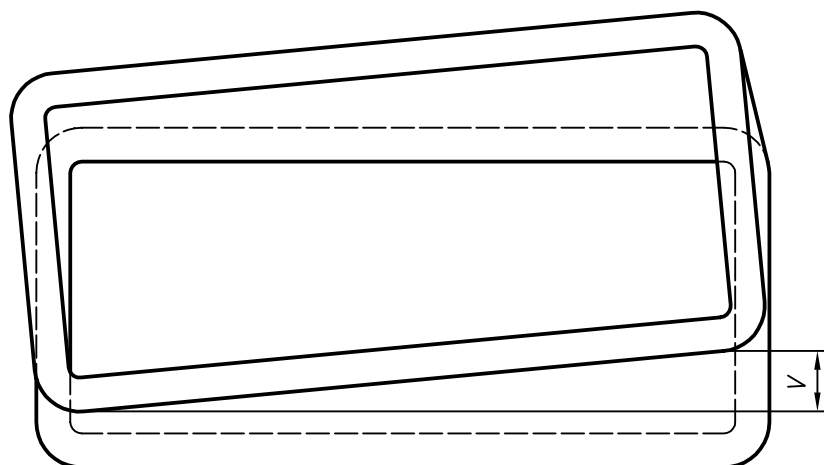
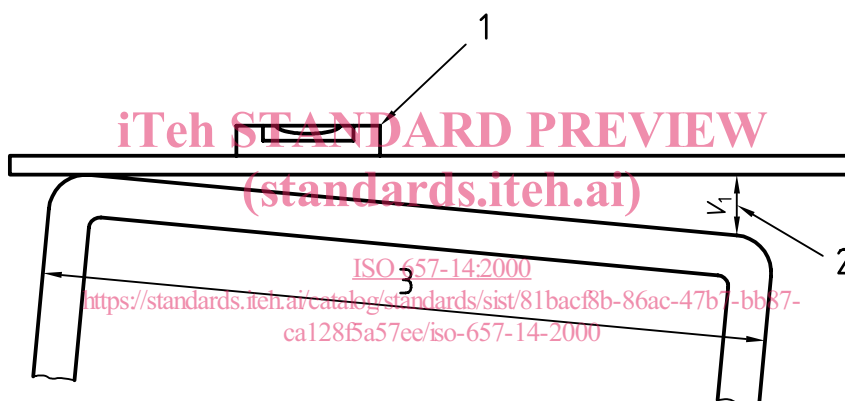


Figure 5 — Total twist of square or rectangular hollow sections



Key

- 1 Spirit level
- 2 Micrometer gauge
- 3 H for rectangular sections, B for square sections

Figure 6 — Measurement of twist

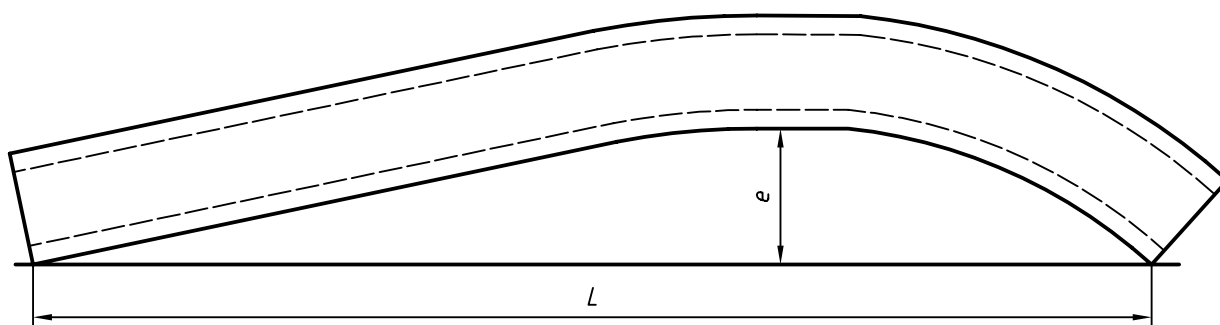


Figure 7 — Measurement of deviation from straightness