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**Hladno oblikovani varjeni votli konstrukcijski profili iz jekla - 3. del: Mere, mejni odstopki in značilnosti profilov**

Cold formed welded structural steel hollow sections - Part 3: Tolerances, dimensions and sectional properties

Kaltgefertigte geschweißte Hohlprofile für den Stahlbau aus unlegierten Baustählen und aus Feinkornbaustählen - Teil 2: Grenzabmaße, Maße und statische Werte

Profils creux de construction soudés, formés à froid en aciers non alliés et à grains fins - Partie 2 : Tolérances, dimensions et caractéristiques de profil

**Ta slovenski standard je istoveten z: prEN 10219-3**

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aciers non alliés et à grains fins - Partie 2 : Tolérances,  
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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee ECIS/TC 103.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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## European foreword

This document (prEN 10219-3:2016) has been prepared by Technical Committee ECISS/TC 103 “Structural steels other than reinforcement”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 10219-2:2006.

This standard consists of the following parts under the general title 'Cold formed welded structural steel hollow sections':

- *Part 1: General*
- *Part 2: Technical delivery conditions*
- *Part 3: Tolerances, dimensions and sectional properties*

It forms part of a series of standards on hollow sections together with prEN 10210-1 to prEN 10210-3.

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## prEN 10219-3:2016 (E)

## 1 Scope

This part of prEN 10219 specifies tolerances for cold formed welded circular, square, rectangular and elliptical structural hollow sections, manufactured in wall thicknesses up to 40 mm, in the following size ranges:

Circular: Outside diameters up to 2 500 mm

Square: Outside dimensions up to 500 mm x 500 mm

Rectangular: Outside dimensions up to 500 mm x 300 mm

Elliptical: Outside dimensions up to 480 mm x 240 mm

The formulae for calculating sectional properties of sections manufactured to the dimensional tolerances of this standard, to be used for the purposes of structural design, are given in Annex B.

Dimensions and sectional properties for a limited range of more common sizes are given in Annex C.

The general conditions are specified in prEN 10219-1 (product characteristics, test methods and performance criteria that apply under the Construction Products Regulations) and the technical delivery conditions in prEN 10219-2.

**NOTE** The designation of the sections' major axis (yy) and its minor axis (zz) align with the axis designation used for structural design in the structural Eurocodes.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

prEN 10219-1:2016, *Cold formed welded structural steel hollow sections - Part 1: General*

prEN 10219-2, *Cold formed welded structural steel hollow sections - Part 2: Technical delivery conditions*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 10219-1:2016 apply.

## 4 Symbols

For the purposes of this document, the symbols defined in Table 1 apply.

**Table 1 — Symbols and definitions**

Symbol	Unit	Definition
$A$	cm <sup>2</sup>	Cross-sectional area
$A_m$	mm <sup>2</sup>	Area of the surface delimited by the perimeter at mid-thickness
$A_s$	m <sup>2</sup> /m	Superficial area per metre length
$B$	mm	Specified side dimension of a square hollow section. Specified dimension of the shorter side of a rectangular hollow section. Specified outside dimension of an elliptical section on its minor axis
$C_1/C_2$	mm	Length of corner region of a square or rectangular hollow section
$C_t$	cm <sup>3</sup>	Torsional modulus constant
$D$	mm	Specified outside diameter of a circular hollow section

Symbol	Unit	Definition
$D_{\max}/D_{\min}$	mm	The maximum and minimum outside diameter of a circular hollow section measured in the same plane
$e$	mm	Deviation from straightness
$H$	mm	Specified dimension of the longer side of a rectangular hollow section. Specified outside dimension of an elliptical section on its major axis
$I$	cm <sup>4</sup>	Second moment of area
$I_t$	cm <sup>4</sup>	Torsional inertia constant (polar moment of inertia in the case of circular hollow sections only)
$i$	cm	Radius of gyration
$L$	mm	Length
$M$	kg/m	Mass per unit length
$O$	%	Out-of-roundness
$P$	mm	External perimeter of an elliptical hollow section
$R$	mm	External corner radius of a square or rectangular hollow section
$T$	mm	Specified thickness
$U$	mm	Perimeter of an elliptical hollow section at mid-thickness
$V$	mm	Total measured twist
$V_1$	mm	Twist measured at one end of a section
$W_{el}$	cm <sup>3</sup>	Elastic section modulus
$W_{pl}$	cm <sup>3</sup>	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
$yy$	—	Axis of cross-section, major axis of a rectangular hollow section
$zz$	—	Axis of cross-section, minor axis of a rectangular hollow section
$\theta$	°	Angle between adjacent sides of a square or rectangular hollow section

## 5 Information to be obtained by the manufacturer

The following mandatory information from this part of prEN 10219 shall be obtained by the manufacturer at the time of enquiry and order:

- the type of length, length range or length (see Table 4);
- the dimensions (see Clause 8);
- for products where the diameter to thickness ratio exceeds 100, the agreed tolerance on out-of-roundness.

NOTE This information is included in the list of information to be obtained by the manufacturer contained in prEN 10219-2:2016, Clause 5.

## 6 Tolerances

**6.1** Tolerances shall not exceed the values given in Table 2 for shape and mass, Table 3 for external corner profiles, Table 4 for manufacturer's delivered length and Table 5 for the height of the internal and external weld bead of submerged arc welded hollow sections.

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

NOTE The internal corner profile is not specified.

**6.3** Additional tolerances for out-of-roundness, accidental eccentricity and dimples may be applied to tubes of diameter  $\geq 900$  mm and  $D/T \geq 50$  when they are to be used as bearing piles or primary elements in combined walls in accordance with EN 1993-5. In order for these additional tolerances to be applied the fabrication tolerance quality class, A, B, or C should be agreed. See Annex A.

**Table 2 — Tolerances on shape, straightness and mass**

Characteristic	Circular hollow sections	Square and rectangular hollow sections		Elliptical hollow section
		Side length mm	Tolerance	
Outside dimensions ( $D$ , $B$ and $H$ )	$\pm 1\%$ with a minimum of $\pm 0,5$ mm and a maximum of $\pm 10$ mm	$H, B < 100$ $100 \leq H, B \leq 200$ $H, B > 200$	$\pm 1\%$ with a minimum of $\pm 0,5$ mm $\pm 0,8\%$ $\pm 0,6\%$	$\pm 1\%$ with a minimum of $\pm 0,5$ mm
Thickness ( $T$ )	For $D \leq 406,4$ mm: $T \leq 5$ mm $\pm 10\%$ $T > 5$ mm $\pm 0,5$ mm For $D > 406,4$ mm: $\pm 10\%$ with a maximum of $\pm 2$ mm	$T \leq 5$ mm $\pm 10\%$ $T > 5$ mm $\pm 0,5$ mm		$T \leq 5$ mm $\pm 10\%$ $T > 5$ mm $\pm 0,5$ mm
Out-of-roundness ( $O$ )	2 % for hollow sections having a diameter to thickness ratio not exceeding 100 <sup>a</sup>	—	—	—
Concavity/convexity ( $x_1, x_2$ ) <sup>b</sup>	—	Max. 0,8 % with a minimum of 0,5 mm	—	—
Squareness of side ( $\theta$ )	—	$90^\circ \pm 1^\circ$	—	—
External corner profile ( $C_1, C_2$ or $R$ )	—	See Table 3	—	—
Twist ( $V$ )	—	2 mm plus 0,5 mm/m length	—	—
Straightness ( $e$ )	0,20 % of total length and 3 mm over any 1 m length	0,15 % of total length and 3 mm over any 1 m length	—	0,20 % of total length and 3 mm over any 1 m length
Mass per unit length ( $M$ )	$\pm 6\%$ on individual delivered lengths			

<sup>a</sup> Where the diameter to thickness ratio exceeds 100 the tolerance on out-of-roundness shall be agreed.

<sup>b</sup> The tolerance on convexity and concavity is independent of the tolerance on outside dimensions.



**Table 3 — Tolerances on external corner profiles**

Dimensions in millimetres

Thickness $T$	External corner profile $C_1, C_2$ or $R^a$
$T \leq 6$	$1,6T$ to $2,4T$
$6 < T \leq 10$	$2,0T$ to $3,0T$
$10 < T$	$2,4T$ to $3,6T$
<sup>a</sup> The sides need not be tangential to the corner arcs.	

**Table 4 — Tolerances on manufacturer's delivered length**

Dimensions in millimetres

Type of length <sup>a</sup>	Range of length or length $L$	Tolerance
Random length	$4\,000 < L \leq 16\,000$ with a range of 2 000 per order item	10 % of sections supplied may be below the minimum for the ordered range but not shorter than 75 % of the minimum range length
Standard length	$\geq 4\,000$	$+50_0$ mm
Exact length <sup>b</sup>	$< 6\,000$	$+10_0$ mm
	$6\,000 \leq L \leq 10\,000$	$+15_0$ mm
	$> 10\,000$	$+5_0$ mm + 1 mm/m
<sup>a</sup> The manufacturer shall establish at the time of enquiry and order the type of length required and the length range or length.		
<sup>b</sup> Common lengths available are 6 m and 12 m.		

**Table 5 — Tolerance on height of internal and external weld seam for submerged arc welded hollow sections**

Dimensions in millimetres

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

## 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 and elliptical sections, with a minimum of 100 mm.

All dimensional and shape tolerances indicated in Tables 2, 3 and 5 shall be verified according to a procedure fixed by the manufacturer.

## 7.2 Outside dimensions

For circular hollow sections the diameter ( $D$ ) and for elliptical hollow sections the outside dimensions ( $B$  and  $H$ ) shall be measured either directly, e.g. using a calliper gauge, or for circular tubes by circumference tape at the discretion of the manufacturer.

The limiting cross-sectional positions for measuring  $B$  and  $H$  for square and rectangular hollow sections are shown in Figure 1.

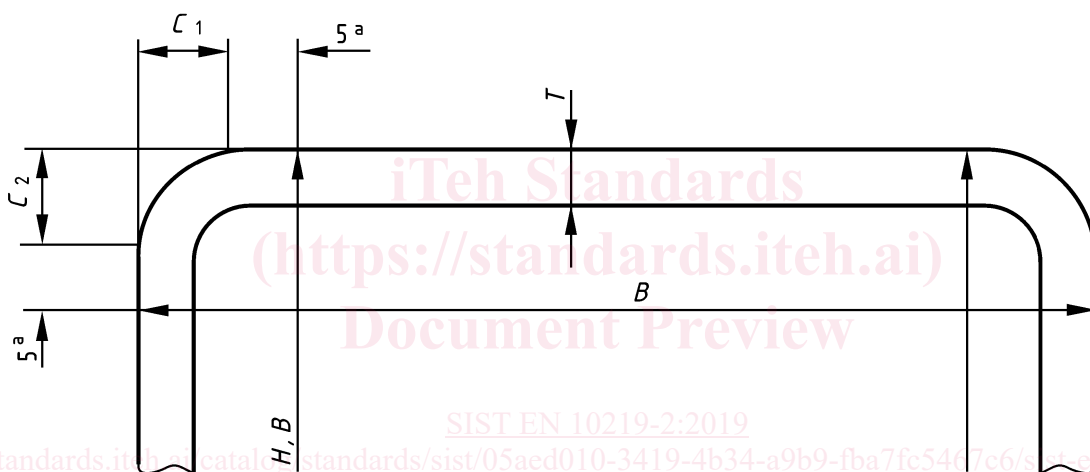
## 7.3 Thickness

The thickness ( $T$ ) 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 dimension of the longer side from the end of the section.

Dimensions in millimetres



<sup>a</sup> 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**

## 7.4 Out-of-roundness

The out-of-roundness ( $O$ ) of a circular hollow section shall be calculated from the following formula, but see Annex A for piling tube.

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

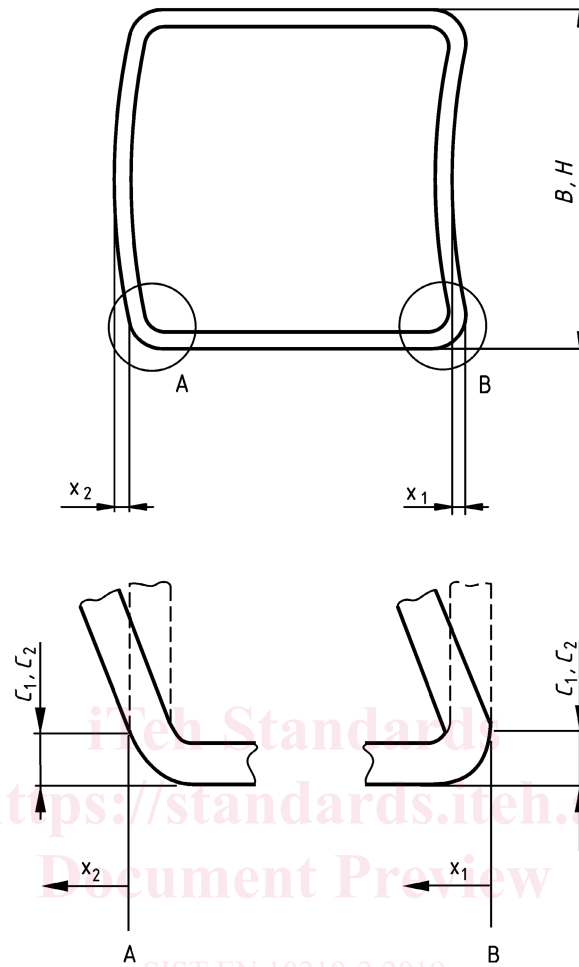
## 7.5 Concavity and convexity

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:

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

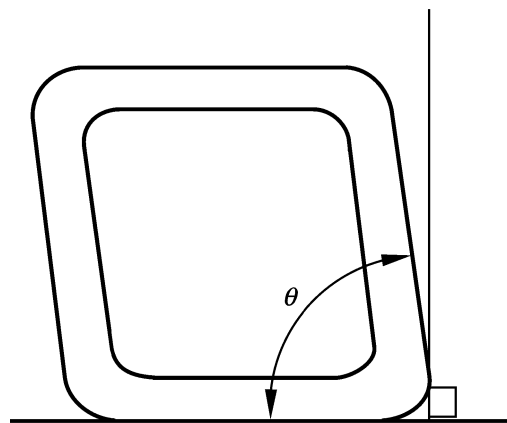
where  $B$  and  $H$  are the dimensions of the sides containing the concavity  $x_1$  or the convexity  $x_2$ .



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

## 7.6 Squareness of sides

The deviation from squareness of the sides of a square or rectangular hollow section shall be measured as the difference between  $90^\circ$  and  $\theta$  as shown in Figure 3.



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

## 7.7 External corner profile

**7.7.1** The external corner profile of a square or rectangular hollow section shall be measured according to 7.7.2 or 7.7.3 at the discretion of the manufacturer.

**7.7.2** The corner arc shall be measured with a radius gauge.

**7.7.3** The distance between the intersection of the flat side and the corner arc and the intersection of the projections of the flat sides to the corner ( $C_1$  and  $C_2$  in Figure 4) shall be measured.

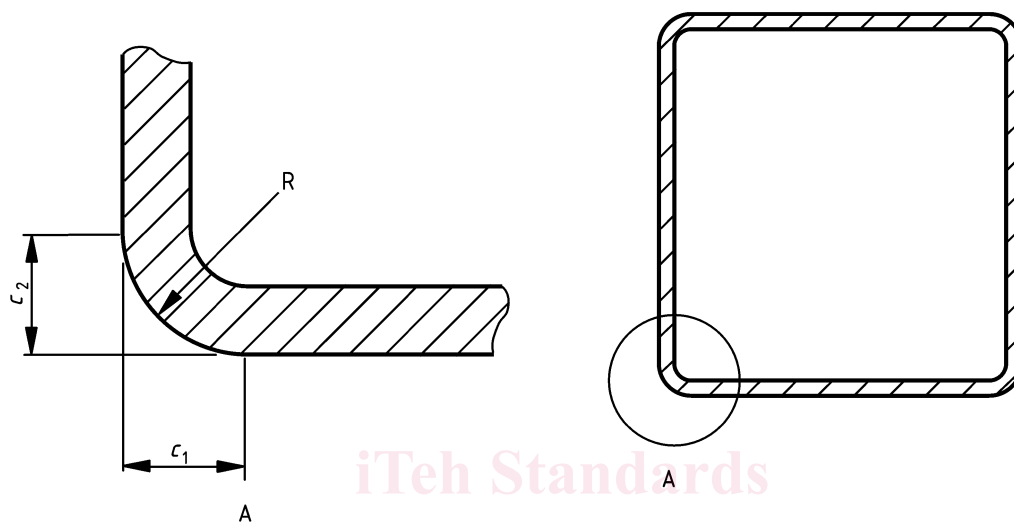


Figure 4 — Outside corner profile of square or rectangular hollow sections

## 7.8 Twist

**7.8.1** The 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. The twist ( $V$ ) in an elliptical hollow section shall be determined in accordance with 7.8.4.

**7.8.2** The hollow section shall be placed on a horizontal surface with one side at one end pressed flat against the surface. At the opposite end of the hollow section the difference in height of the two lower corners from the horizontal surface (see Figure 5) shall be determined.

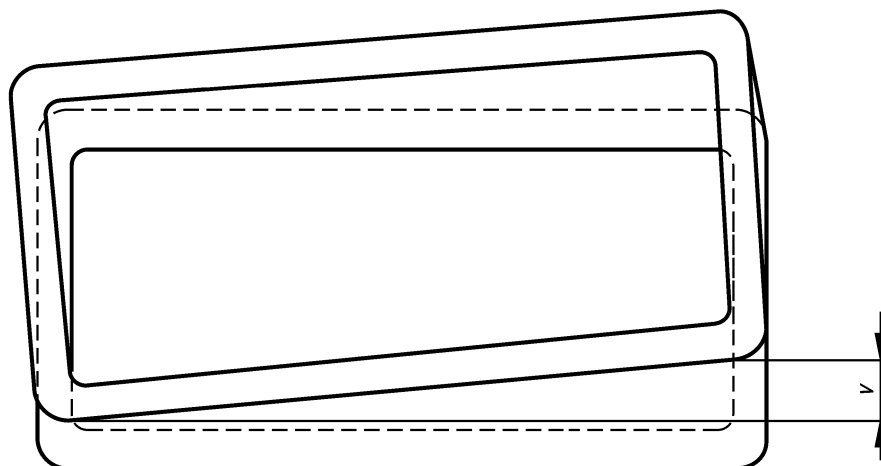
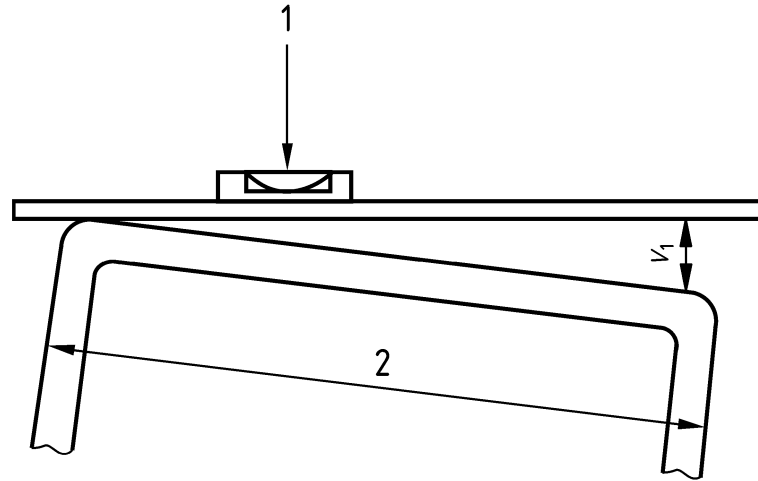


Figure 5 — Twist of square or rectangular hollow sections

**7.8.3** The twist of square and rectangular hollow sections shall be measured with a spirit level and micrometer gauge (screw). The reference length of the spirit level shall be the distance between the intersection of the flat sides and the corner arcs (see Figure 6). The twist  $V$  is the difference between the values  $V_1$  (see Figure 6) measured at each end of the hollow section.

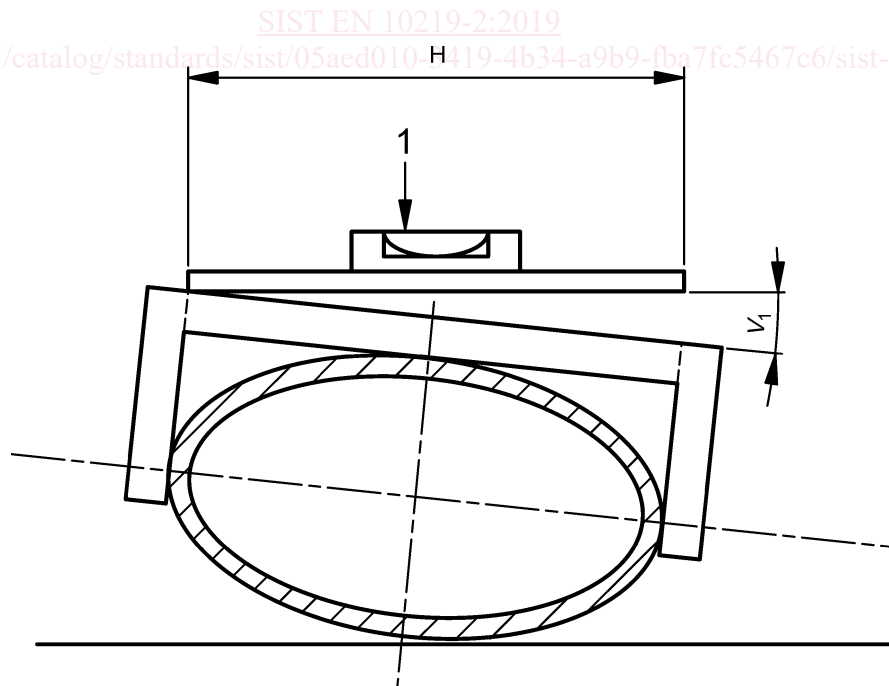


**Key**

- 1 Spirit level
- 2  $H$  for rectangular sections,  $B$  for square sections

**Figure 6 — Measurement of twist**

**7.8.4** The twist of elliptical hollow sections shall be measured with a spirit level and micrometer gauge (screw). The reference length of the spirit level shall be the dimension of the sections major axis ( $H$ ). The twist  $V$  is the difference between the values  $V_1$  (see Figure 7) measured at each end of the hollow section.



**Key**

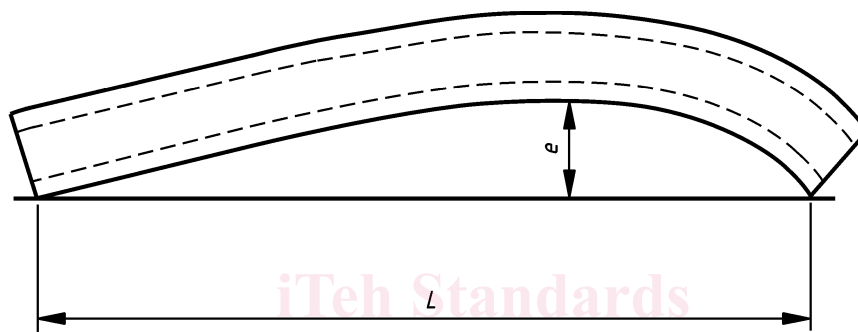
- 1 Spirit level

**Figure 7 – Measurement of twist of elliptical hollow sections****7.9 Straightness**

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 8 where  $L$  is the manufacturer's delivered length. The percentage deviation from straightness shall be calculated as follows:

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

In addition the local deviation ( $e$ ) from straightness of a hollow section, measured at any point along its length from a straight line length  $L$  of 1 m, shall be not more than 3 mm.

**Figure 8 — Measurement of deviation from straightness****8 Dimensions and sectional properties**

The nominal sectional properties of hollow sections within the scope of this part of prEN 10219 and manufactured to the dimensional tolerances of this standard, required for the purposes of structural design, shall be calculated in accordance with Annex B.

The sectional properties for a limited range of standard sizes of cold formed hollow sections are given in Table C.1 for circular sections, Table C.2 for square sections, Table C.3 for rectangular sections and Table C.4 for elliptical hollow sections. These sectional properties were calculated from the formulae given in Annex B.

Not all sizes and thicknesses shown in Tables C.1, C.2, C.3 and C.4 are available from all manufacturers and the user is recommended to check availability. Other sizes and thicknesses within the scope of this standard may be available.