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**Hot-finished structural hollow sections of  
non-alloy and fine grain steels —**

**Part 2:  
Dimensions and sectional properties**

*Profils creux de construction finis à chaud, en acier non allié ou à grains fins —*

*Partie 2: Dimensions et caractéristiques du profil*



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# Contents

Page

|                                                                            |    |
|----------------------------------------------------------------------------|----|
| Foreword .....                                                             | iv |
| 1 Scope .....                                                              | 1  |
| 2 Normative reference .....                                                | 1  |
| 3 Terms and definitions .....                                              | 1  |
| 4 Symbols .....                                                            | 1  |
| 5 Information to be supplied by the purchaser .....                        | 2  |
| 5.1 Mandatory information .....                                            | 2  |
| 5.2 Options .....                                                          | 2  |
| 6 Tolerances .....                                                         | 3  |
| 7 Measurement of size and shape .....                                      | 4  |
| 7.1 General .....                                                          | 4  |
| 7.2 Outside dimensions .....                                               | 4  |
| 7.3 Thickness .....                                                        | 4  |
| 7.4 Out-of-roundness .....                                                 | 5  |
| 7.5 Concavity and convexity .....                                          | 5  |
| 7.6 Squareness of sides .....                                              | 5  |
| 7.7 External corner profile .....                                          | 6  |
| 7.8 Twist .....                                                            | 6  |
| 7.9 Straightness .....                                                     | 7  |
| 8 Dimensions and sectional properties .....                                | 8  |
| Annex A (normative) Formulae for calculation of sectional properties ..... | 24 |

## 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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12633-2 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Subcommittee SC 1, *Steel tubes*.

This first edition of ISO 12633-2 cancels and replaces ISO 657-14:2000, of which it constitutes a minor revision. In particular, better grouping of several documents by subject area and minor editorial improvements have been carried out.

ISO 12633 consists of the following parts, under the general title *Hot-finished structural hollow sections of non-alloy and fine grain steels*:

- *Part 1: Technical delivery conditions*
- *Part 2: Dimensions and sectional properties*

# Hot-finished structural hollow sections of non-alloy and fine grain steels —

## Part 2: Dimensions and sectional properties

### 1 Scope

This part of ISO 12633 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 12633-1.

### 2 Normative reference

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

ISO 12633-1, *Hot-finished structural hollow sections of non-alloy and fine grain steels — Part 1: Technical delivery conditions*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12633-1 apply.

### 4 Symbols

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

Table 1 — Symbols

| Symbol               | Unit              | Definition                                                                                                              |
|----------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------|
| $A$                  | cm <sup>2</sup>   | Cross-sectional area                                                                                                    |
| $A_s$                | m <sup>2</sup> /m | Surface area per unit length                                                                                            |
| $B$                  | mm                | Nominal length of side of a square hollow section<br>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 <sup>3</sup>   | 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                           |

Table 1 (continued)

| Symbol   | Unit            | Definition                                                                             |
|----------|-----------------|----------------------------------------------------------------------------------------|
| $e$      | mm              | Deviation from straightness                                                            |
| $H$      | mm              | Nominal length of the longer side of a rectangular hollow section                      |
| $I$      | cm <sup>4</sup> | Second moment of area                                                                  |
| $I_t$    | cm <sup>4</sup> | 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 <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                          |
| XX       | —               | Axis of cross-section: major axis of a rectangular hollow section                      |
| YY       | —               | Axis of cross-section: minor axis of a rectangular hollow section                      |
| $\theta$ | Degrees         | Angle between adjacent sides of a square or rectangular hollow section                 |

## 5 Information to be supplied by the purchaser

### 5.1 Mandatory information

The following information from this part of ISO 12633 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 5.1 of ISO 12633-1:—.

### 5.2 Options

One option is specified in this part of ISO 12633. 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.

**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 $\pm 10$ mm                      | $\pm 1$ %, with a minimum of $\pm 0,5$ mm |
| Thickness, $T$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | – 10 % <sup>ab</sup>                                                                        |                                           |
| Out-of-roundness, $O$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2 % for hollow sections having a diameter to thickness ratio not exceeding 100 <sup>c</sup> | —                                         |
| Concavity/convexity <sup>d</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | —                                                                                           | 1 %                                       |
| Squareness of sides                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | —                                                                                           | $90^{\circ} \pm 1^{\circ}$                |
| External corner profile ( $C_1$ , $C_2$ or $R$ ) <sup>e</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | —                                                                                           | $3T$ 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 <sup>f</sup>                                                |                                           |
| <p><sup>a</sup> The positive deviation is limited by the tolerance on mass.</p> <p><sup>b</sup> 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.</p> <p><sup>c</sup> Where the diameter to thickness ratio exceeds 100, the tolerance on out-of-roundness shall be agreed.</p> <p><sup>d</sup> The tolerance on convexity and concavity is independent of the tolerance on outside dimensions.</p> <p><sup>e</sup> The sides need not be tangential to the corner arcs.</p> <p><sup>f</sup> The positive tolerance on the mass per unit length of seamless hollow sections shall be 8 %.</p> |                                                                                             |                                           |

**Table 3 — Tolerances on length<sup>a</sup>**

| Type of length                                                                                                                                                                                                                                                           | Range<br>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                                      | $\pm 500$ mm <sup>b</sup>                                                                                                   |
| Exact length                                                                                                                                                                                                                                                             | $\geq 2\ 000$ to 6 000                               | $^{+10}_0$ mm                                                                                                               |
|                                                                                                                                                                                                                                                                          | $\geq 6\ 000$                                        | $^{+15}_0$ mm                                                                                                               |
| <p><sup>a</sup> The purchaser shall indicate in the enquiry and order the type of length required and the length range or length as appropriate.</p> <p><sup>b</sup> Option 1 (see 5.2): the tolerance on the approximate length shall be <math>^{+150}_0</math> mm.</p> |                                                      |                                                                                                                             |

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

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

## 7 Measurement of size and shape

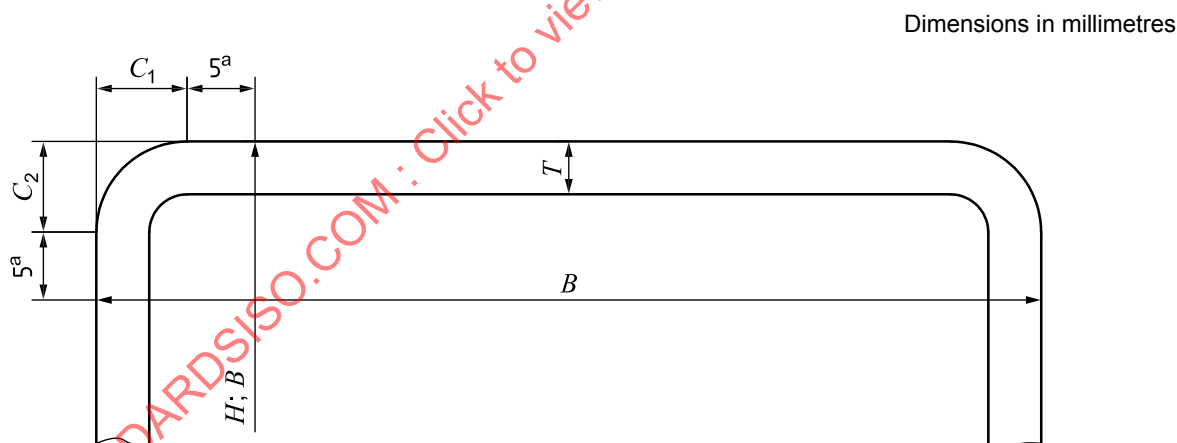
### 7.1 General

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 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.



<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**

### 7.3 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 using the following:

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

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

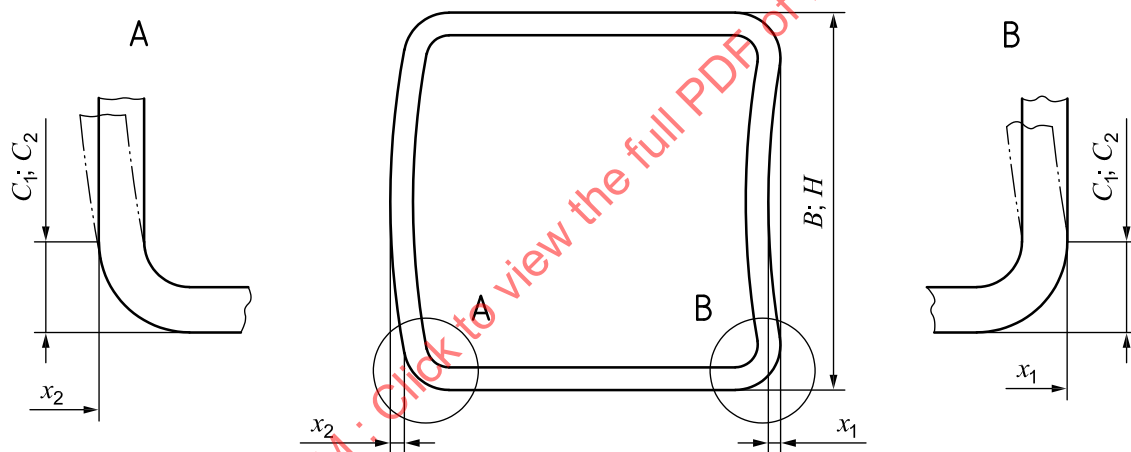
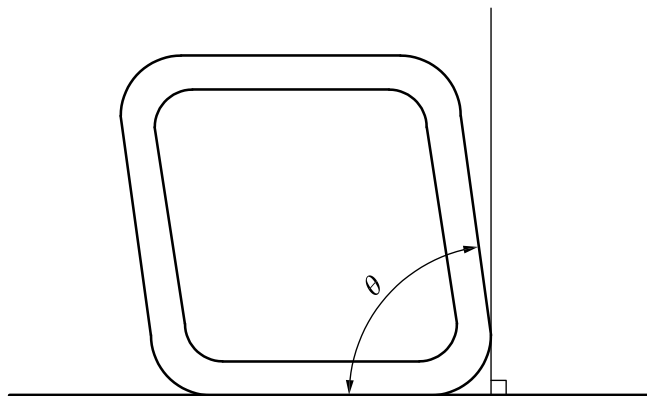


Figure 2 — Measurement of concavity/convexity of square or rectangular hollow sections

## 7.6 Squareness of sides

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



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

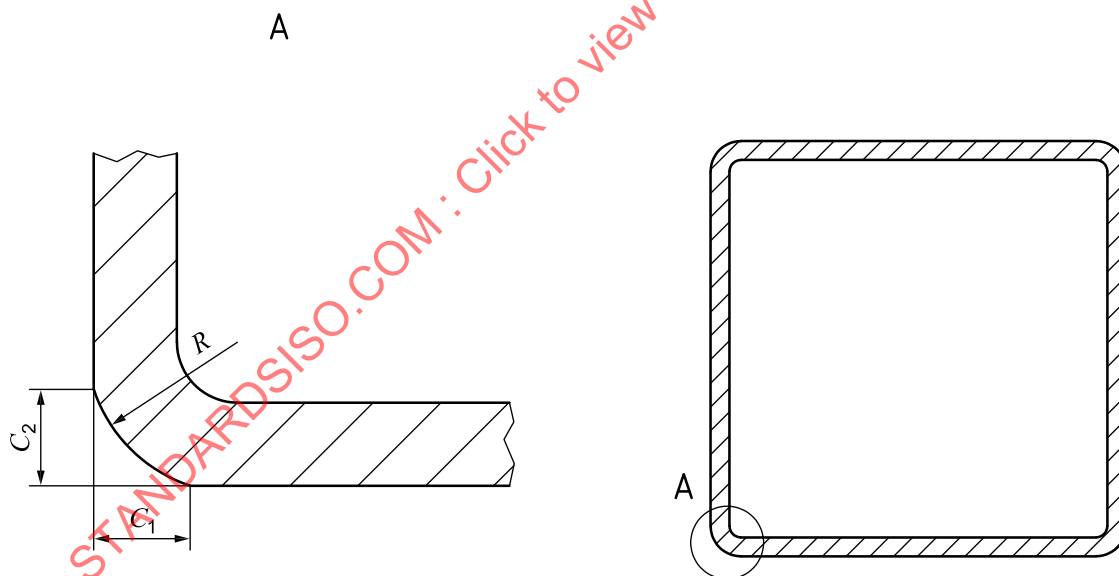
**Figure 3 — Squareness of sides of square or rectangular hollow sections**

## 7.7 External corner profile

**7.7.1** The external corner profile of a square or rectangular hollow section shall be measured 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).



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

## 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.

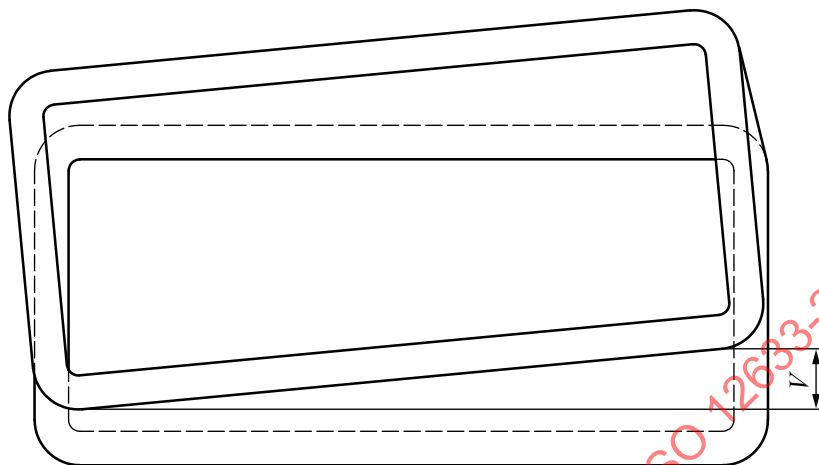
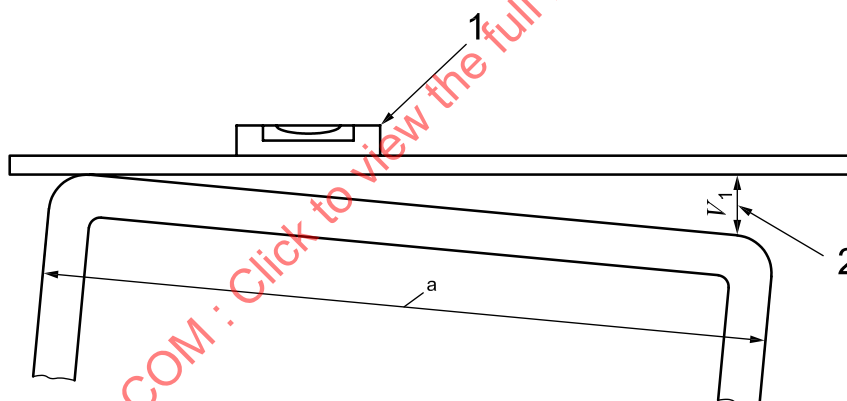


Figure 5 — Total twist of square or rectangular hollow sections



**Key**

- 1 spirit level
- 2 micrometer gauge
- <sup>a</sup>  $H$  for rectangular sections,  $B$  for square sections.

Figure 6 — Measurement of twist

## 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 7. The percentage deviation from straightness shall be calculated using the following:

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

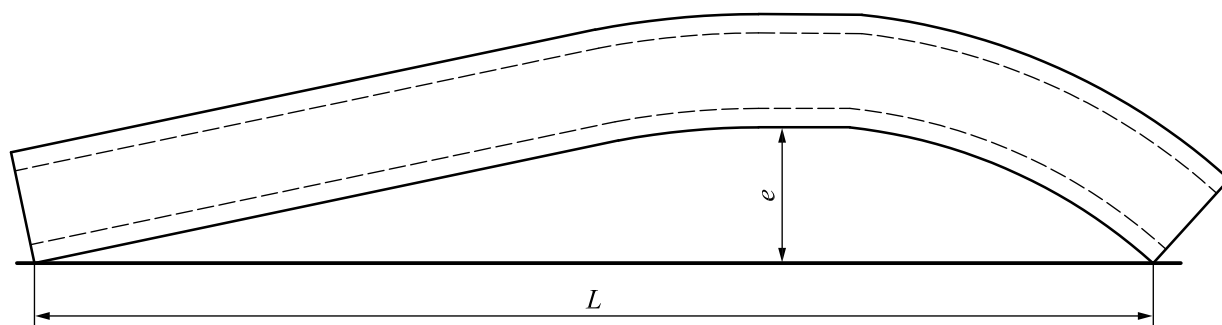
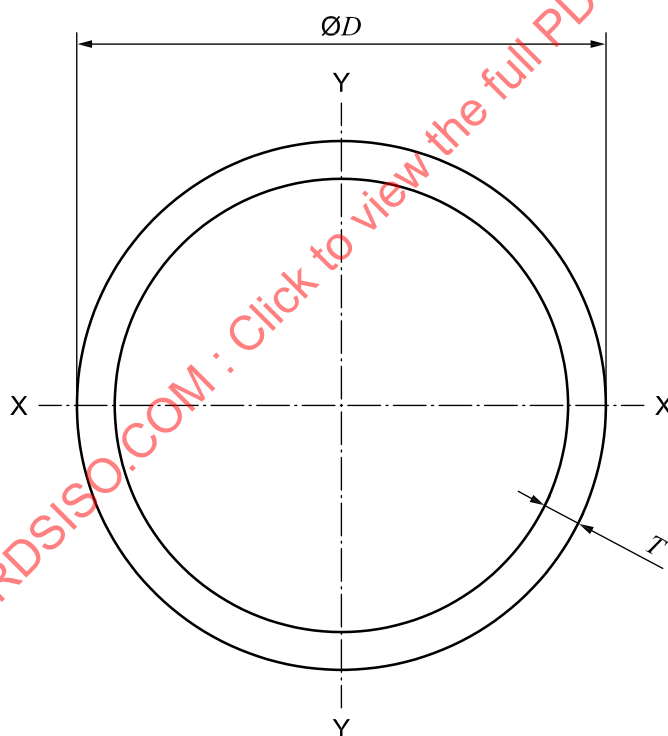


Figure 7 — Measurement of deviation from straightness

## 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 (see Figure 8), 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.



NOTE See Table 5.

Figure 8 — Circular hollow section

Table 5 — Nominal dimensions and sectional properties of circular hollow sections

| Outside diameter<br><i>D</i><br>mm | Thickness<br><i>T</i><br>mm | Mass per unit length<br><i>M</i><br>kg/m | Cross-sectional area<br><i>A</i><br>cm <sup>2</sup> | Second moment of area<br><i>I</i><br>cm <sup>4</sup> | Radius of gyration<br><i>i</i><br>cm | Elastic section modulus<br><i>W<sub>el</sub></i><br>cm <sup>3</sup> | Plastic section modulus<br><i>W<sub>pl</sub></i><br>cm <sup>3</sup> | Torsional inertia constant<br><i>I<sub>t</sub></i><br>cm <sup>4</sup> | Torsional modulus constant<br><i>C<sub>t</sub></i><br>cm <sup>3</sup> | Surface area per unit length<br><i>A<sub>s</sub></i><br>m <sup>2</sup> /m | Nominal length per tonne<br>m |
|------------------------------------|-----------------------------|------------------------------------------|-----------------------------------------------------|------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------|
| 21,3                               | 2,3                         | 1,08                                     | 1,37                                                | 0,629                                                | 0,677                                | 0,590                                                               | 0,834                                                               | 1,26                                                                  | 1,18                                                                  | 0,066 9                                                                   | 928                           |
| 21,3                               | 2,6                         | 1,20                                     | 1,53                                                | 0,681                                                | 0,668                                | 0,639                                                               | 0,915                                                               | 1,36                                                                  | 1,28                                                                  | 0,066 9                                                                   | 834                           |
| 21,3                               | 3,2                         | 1,43                                     | 1,82                                                | 0,768                                                | 0,650                                | 0,722                                                               | 1,06                                                                | 1,54                                                                  | 1,44                                                                  | 0,066 9                                                                   | 700                           |
| 26,9                               | 2,3                         | 1,40                                     | 1,78                                                | 1,36                                                 | 0,874                                | 1,01                                                                | 1,40                                                                | 2,71                                                                  | 2,02                                                                  | 0,084 5                                                                   | 717                           |
| 26,9                               | 2,6                         | 1,56                                     | 1,98                                                | 1,48                                                 | 0,864                                | 1,10                                                                | 1,54                                                                | 2,96                                                                  | 2,20                                                                  | 0,084 5                                                                   | 642                           |
| 26,9                               | 3,2                         | 1,87                                     | 2,38                                                | 1,70                                                 | 0,846                                | 1,27                                                                | 1,81                                                                | 3,41                                                                  | 2,53                                                                  | 0,084 5                                                                   | 535                           |
| 33,7                               | 2,6                         | 1,99                                     | 2,54                                                | 3,09                                                 | 1,10                                 | 1,84                                                                | 2,52                                                                | 6,19                                                                  | 3,67                                                                  | 0,106                                                                     | 501                           |
| 33,7                               | 3,2                         | 2,41                                     | 3,07                                                | 3,60                                                 | 1,08                                 | 2,14                                                                | 2,99                                                                | 7,21                                                                  | 4,28                                                                  | 0,106                                                                     | 415                           |
| 33,7                               | 4,0                         | 2,93                                     | 3,73                                                | 4,19                                                 | 1,06                                 | 2,49                                                                | 3,55                                                                | 8,38                                                                  | 4,97                                                                  | 0,106                                                                     | 341                           |
| 42,4                               | 2,6                         | 2,55                                     | 3,25                                                | 6,46                                                 | 1,41                                 | 3,05                                                                | 4,12                                                                | 12,9                                                                  | 6,10                                                                  | 0,133                                                                     | 392                           |
| 42,4                               | 3,2                         | 3,09                                     | 3,94                                                | 7,62                                                 | 1,39                                 | 3,59                                                                | 4,93                                                                | 15,2                                                                  | 7,19                                                                  | 0,133                                                                     | 323                           |
| 42,4                               | 4,0                         | 3,79                                     | 4,83                                                | 8,99                                                 | 1,36                                 | 4,24                                                                | 5,92                                                                | 18,0                                                                  | 8,48                                                                  | 0,133                                                                     | 264                           |
| 48,3                               | 2,6                         | 2,93                                     | 3,73                                                | 9,78                                                 | 1,62                                 | 4,05                                                                | 5,44                                                                | 19,6                                                                  | 8,10                                                                  | 0,152                                                                     | 341                           |
| 48,3                               | 3,2                         | 3,56                                     | 4,53                                                | 11,6                                                 | 1,60                                 | 4,80                                                                | 6,52                                                                | 23,2                                                                  | 9,59                                                                  | 0,152                                                                     | 281                           |
| 48,3                               | 4,0                         | 4,37                                     | 5,57                                                | 13,8                                                 | 1,57                                 | 5,70                                                                | 7,87                                                                | 27,5                                                                  | 11,4                                                                  | 0,152                                                                     | 229                           |
| 48,3                               | 5,0                         | 5,34                                     | 6,80                                                | 16,2                                                 | 1,54                                 | 6,69                                                                | 9,42                                                                | 32,3                                                                  | 13,4                                                                  | 0,152                                                                     | 187                           |
| 60,3                               | 2,6                         | 3,70                                     | 4,71                                                | 19,7                                                 | 2,04                                 | 6,52                                                                | 8,66                                                                | 39,3                                                                  | 13,0                                                                  | 0,189                                                                     | 270                           |
| 60,3                               | 3,2                         | 4,51                                     | 5,74                                                | 23,5                                                 | 2,02                                 | 7,78                                                                | 10,4                                                                | 46,9                                                                  | 15,6                                                                  | 0,189                                                                     | 222                           |
| 60,3                               | 4,0                         | 5,55                                     | 7,07                                                | 28,2                                                 | 2,00                                 | 9,34                                                                | 12,7                                                                | 56,3                                                                  | 18,7                                                                  | 0,189                                                                     | 180                           |
| 60,3                               | 5,0                         | 6,82                                     | 8,69                                                | 33,5                                                 | 1,96                                 | 11,1                                                                | 15,3                                                                | 67,0                                                                  | 22,2                                                                  | 0,189                                                                     | 147                           |
| 76,1                               | 2,6                         | 4,71                                     | 6,00                                                | 40,6                                                 | 2,60                                 | 10,7                                                                | 14,1                                                                | 81,2                                                                  | 21,3                                                                  | 0,239                                                                     | 212                           |
| 76,1                               | 3,2                         | 5,75                                     | 7,33                                                | 48,8                                                 | 2,58                                 | 12,8                                                                | 17,0                                                                | 97,6                                                                  | 25,6                                                                  | 0,239                                                                     | 174                           |
| 76,1                               | 4,0                         | 7,11                                     | 9,06                                                | 59,1                                                 | 2,55                                 | 15,5                                                                | 20,8                                                                | 118                                                                   | 31,0                                                                  | 0,239                                                                     | 141                           |
| 76,1                               | 5,0                         | 8,77                                     | 11,2                                                | 70,9                                                 | 2,52                                 | 18,6                                                                | 25,3                                                                | 142                                                                   | 37,3                                                                  | 0,239                                                                     | 114                           |
| 88,9                               | 3,2                         | 6,76                                     | 8,62                                                | 79,2                                                 | 3,03                                 | 17,8                                                                | 23,5                                                                | 158                                                                   | 35,6                                                                  | 0,279                                                                     | 148                           |
| 88,9                               | 4,0                         | 8,38                                     | 10,7                                                | 96,3                                                 | 3,00                                 | 21,7                                                                | 28,9                                                                | 193                                                                   | 43,3                                                                  | 0,279                                                                     | 119                           |
| 88,9                               | 5,0                         | 10,3                                     | 13,2                                                | 116                                                  | 2,97                                 | 26,2                                                                | 35,2                                                                | 233                                                                   | 52,4                                                                  | 0,279                                                                     | 96,7                          |
| 88,9                               | 6,0                         | 12,3                                     | 15,6                                                | 135                                                  | 2,94                                 | 30,4                                                                | 41,3                                                                | 270                                                                   | 60,7                                                                  | 0,279                                                                     | 81,5                          |
| 88,9                               | 6,3                         | 12,8                                     | 16,3                                                | 140                                                  | 2,93                                 | 31,5                                                                | 43,1                                                                | 280                                                                   | 63,1                                                                  | 0,279                                                                     | 77,9                          |
| 101,6                              | 3,2                         | 7,77                                     | 9,89                                                | 120                                                  | 3,48                                 | 23,6                                                                | 31,0                                                                | 240                                                                   | 47,2                                                                  | 0,319                                                                     | 129                           |
| 101,6                              | 4,0                         | 9,63                                     | 12,3                                                | 146                                                  | 3,45                                 | 28,8                                                                | 38,1                                                                | 293                                                                   | 57,6                                                                  | 0,319                                                                     | 104                           |
| 101,6                              | 5,0                         | 11,9                                     | 15,2                                                | 177                                                  | 3,42                                 | 34,9                                                                | 46,7                                                                | 355                                                                   | 69,9                                                                  | 0,319                                                                     | 84,0                          |
| 101,6                              | 6,0                         | 14,1                                     | 18,0                                                | 207                                                  | 3,39                                 | 40,7                                                                | 54,9                                                                | 413                                                                   | 81,4                                                                  | 0,319                                                                     | 70,7                          |
| 101,6                              | 6,3                         | 14,8                                     | 18,9                                                | 215                                                  | 3,38                                 | 42,3                                                                | 57,3                                                                | 430                                                                   | 84,7                                                                  | 0,319                                                                     | 67,5                          |
| 101,6                              | 8,0                         | 18,5                                     | 23,5                                                | 260                                                  | 3,32                                 | 51,1                                                                | 70,3                                                                | 519                                                                   | 102                                                                   | 0,319                                                                     | 54,2                          |
| 101,6                              | 10,0                        | 22,6                                     | 28,8                                                | 305                                                  | 3,26                                 | 60,1                                                                | 84,2                                                                | 611                                                                   | 120                                                                   | 0,319                                                                     | 44,3                          |
| 114,3                              | 3,2                         | 8,77                                     | 11,2                                                | 172                                                  | 3,93                                 | 30,2                                                                | 39,5                                                                | 345                                                                   | 60,4                                                                  | 0,359                                                                     | 114                           |
| 114,3                              | 4,0                         | 10,9                                     | 13,9                                                | 211                                                  | 3,90                                 | 36,9                                                                | 48,7                                                                | 422                                                                   | 73,9                                                                  | 0,359                                                                     | 91,9                          |
| 114,3                              | 5,0                         | 13,5                                     | 17,2                                                | 257                                                  | 3,87                                 | 45,0                                                                | 59,8                                                                | 514                                                                   | 89,9                                                                  | 0,359                                                                     | 74,2                          |
| 114,3                              | 6,0                         | 16,0                                     | 20,4                                                | 300                                                  | 3,83                                 | 52,5                                                                | 70,4                                                                | 600                                                                   | 105                                                                   | 0,359                                                                     | 62,4                          |

Table 5 (continued)

| Outside diameter<br><i>D</i><br>mm | Thickness<br><i>T</i><br>mm | Mass per unit length<br><i>M</i><br>kg/m | Cross-sectional area<br><i>A</i><br>cm <sup>2</sup> | Second moment of area<br><i>I</i><br>cm <sup>4</sup> | Radius of gyration<br><i>i</i><br>cm | Elastic section modulus<br><i>W<sub>el</sub></i><br>cm <sup>3</sup> | Plastic section modulus<br><i>W<sub>pl</sub></i><br>cm <sup>3</sup> | Torsional inertia constant<br><i>I<sub>t</sub></i><br>cm <sup>4</sup> | Torsional modulus constant<br><i>C<sub>t</sub></i><br>cm <sup>3</sup> | Surface area per unit length<br><i>A<sub>s</sub></i><br>m <sup>2</sup> /m | Nominal length per tonne<br>m |
|------------------------------------|-----------------------------|------------------------------------------|-----------------------------------------------------|------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------|
| 114,3                              | 6,3                         | 16,8                                     | 21,4                                                | 313                                                  | 3,82                                 | 54,7                                                                | 73,6                                                                | 625                                                                   | 109                                                                   | 0,359                                                                     | 59,6                          |
| 114,3                              | 8,0                         | 21,0                                     | 26,7                                                | 379                                                  | 3,77                                 | 66,4                                                                | 90,6                                                                | 759                                                                   | 133                                                                   | 0,359                                                                     | 47,7                          |
| 114,3                              | 10,0                        | 25,7                                     | 32,8                                                | 450                                                  | 3,70                                 | 78,7                                                                | 109                                                                 | 899                                                                   | 157                                                                   | 0,359                                                                     | 38,9                          |
| 139,7                              | 4,0                         | 13,4                                     | 17,1                                                | 393                                                  | 4,80                                 | 56,2                                                                | 73,7                                                                | 786                                                                   | 112                                                                   | 0,439                                                                     | 74,7                          |
| 139,7                              | 5,0                         | 16,6                                     | 21,2                                                | 481                                                  | 4,77                                 | 68,8                                                                | 90,8                                                                | 961                                                                   | 138                                                                   | 0,439                                                                     | 60,2                          |
| 139,7                              | 6,0                         | 19,8                                     | 25,2                                                | 564                                                  | 4,73                                 | 80,8                                                                | 107                                                                 | 1 129                                                                 | 162                                                                   | 0,439                                                                     | 50,5                          |
| 139,7                              | 6,3                         | 20,7                                     | 26,4                                                | 589                                                  | 4,72                                 | 84,3                                                                | 112                                                                 | 1 177                                                                 | 169                                                                   | 0,439                                                                     | 48,2                          |
| 139,7                              | 8,0                         | 26,0                                     | 33,1                                                | 720                                                  | 4,66                                 | 103                                                                 | 139                                                                 | 1 441                                                                 | 206                                                                   | 0,439                                                                     | 38,5                          |
| 139,7                              | 10,0                        | 32,0                                     | 40,7                                                | 862                                                  | 4,60                                 | 123                                                                 | 169                                                                 | 1 724                                                                 | 247                                                                   | 0,439                                                                     | 31,3                          |
| 139,7                              | 12,0                        | 37,8                                     | 48,1                                                | 990                                                  | 4,53                                 | 142                                                                 | 196                                                                 | 1 980                                                                 | 283                                                                   | 0,439                                                                     | 26,5                          |
| 139,7                              | 12,5                        | 39,2                                     | 50,0                                                | 1 020                                                | 4,52                                 | 146                                                                 | 203                                                                 | 2 040                                                                 | 292                                                                   | 0,439                                                                     | 25,5                          |
| 168,3                              | 4,0                         | 16,2                                     | 20,6                                                | 697                                                  | 5,81                                 | 82,8                                                                | 108                                                                 | 1 394                                                                 | 166                                                                   | 0,529                                                                     | 61,7                          |
| 168,3                              | 5,0                         | 20,1                                     | 25,7                                                | 856                                                  | 5,78                                 | 102                                                                 | 133                                                                 | 1 712                                                                 | 203                                                                   | 0,529                                                                     | 49,7                          |
| 168,3                              | 6,0                         | 24,0                                     | 30,6                                                | 1 009                                                | 5,74                                 | 120                                                                 | 158                                                                 | 2 017                                                                 | 240                                                                   | 0,529                                                                     | 41,6                          |
| 168,3                              | 6,3                         | 25,2                                     | 32,1                                                | 1 053                                                | 5,73                                 | 125                                                                 | 165                                                                 | 2 107                                                                 | 250                                                                   | 0,529                                                                     | 39,7                          |
| 168,3                              | 8,0                         | 31,6                                     | 40,3                                                | 1 297                                                | 5,67                                 | 154                                                                 | 206                                                                 | 2 595                                                                 | 308                                                                   | 0,529                                                                     | 31,6                          |
| 168,3                              | 10,0                        | 39,0                                     | 49,7                                                | 1 564                                                | 5,61                                 | 186                                                                 | 251                                                                 | 3 128                                                                 | 372                                                                   | 0,529                                                                     | 25,6                          |
| 168,3                              | 12,0                        | 46,3                                     | 58,9                                                | 1 810                                                | 5,54                                 | 215                                                                 | 294                                                                 | 3 620                                                                 | 430                                                                   | 0,529                                                                     | 21,6                          |
| 168,3                              | 12,5                        | 48,0                                     | 61,2                                                | 1 868                                                | 5,53                                 | 222                                                                 | 304                                                                 | 3 737                                                                 | 444                                                                   | 0,529                                                                     | 20,8                          |
| 177,8                              | 5,0                         | 21,3                                     | 27,1                                                | 1 014                                                | 6,11                                 | 114                                                                 | 149                                                                 | 2 028                                                                 | 228                                                                   | 0,559                                                                     | 46,9                          |
| 177,8                              | 6,0                         | 25,4                                     | 32,4                                                | 1 196                                                | 6,08                                 | 135                                                                 | 177                                                                 | 2 392                                                                 | 269                                                                   | 0,559                                                                     | 39,3                          |
| 177,8                              | 6,3                         | 26,6                                     | 33,9                                                | 1 250                                                | 6,07                                 | 141                                                                 | 185                                                                 | 2 499                                                                 | 281                                                                   | 0,559                                                                     | 37,5                          |
| 177,8                              | 8,0                         | 33,5                                     | 42,7                                                | 1 541                                                | 6,01                                 | 173                                                                 | 231                                                                 | 3 083                                                                 | 347                                                                   | 0,559                                                                     | 29,9                          |
| 177,8                              | 10,0                        | 41,4                                     | 52,7                                                | 1 862                                                | 5,94                                 | 209                                                                 | 282                                                                 | 3 724                                                                 | 419                                                                   | 0,559                                                                     | 24,2                          |
| 177,8                              | 12,0                        | 49,1                                     | 62,5                                                | 2 159                                                | 5,88                                 | 243                                                                 | 330                                                                 | 4 318                                                                 | 486                                                                   | 0,559                                                                     | 20,4                          |
| 177,8                              | 12,5                        | 51,0                                     | 64,9                                                | 2 230                                                | 5,86                                 | 251                                                                 | 342                                                                 | 4 460                                                                 | 502                                                                   | 0,559                                                                     | 19,6                          |
| 193,7                              | 5,0                         | 23,3                                     | 29,6                                                | 1 320                                                | 6,67                                 | 136                                                                 | 178                                                                 | 2 640                                                                 | 273                                                                   | 0,609                                                                     | 43,0                          |
| 193,7                              | 6,0                         | 27,8                                     | 35,4                                                | 1 560                                                | 6,64                                 | 161                                                                 | 211                                                                 | 3 119                                                                 | 322                                                                   | 0,609                                                                     | 36,0                          |
| 193,7                              | 6,3                         | 29,1                                     | 37,1                                                | 1 630                                                | 6,63                                 | 168                                                                 | 221                                                                 | 3 260                                                                 | 337                                                                   | 0,609                                                                     | 34,3                          |
| 193,7                              | 8,0                         | 36,6                                     | 46,7                                                | 2 016                                                | 6,57                                 | 208                                                                 | 276                                                                 | 4 031                                                                 | 416                                                                   | 0,609                                                                     | 27,3                          |
| 193,7                              | 10,0                        | 45,3                                     | 57,7                                                | 2 442                                                | 6,50                                 | 252                                                                 | 338                                                                 | 4 883                                                                 | 504                                                                   | 0,609                                                                     | 22,1                          |
| 193,7                              | 12,0                        | 53,8                                     | 68,5                                                | 2 839                                                | 6,44                                 | 293                                                                 | 397                                                                 | 5 678                                                                 | 586                                                                   | 0,609                                                                     | 18,6                          |
| 193,7                              | 12,5                        | 55,9                                     | 71,2                                                | 2 934                                                | 6,42                                 | 303                                                                 | 411                                                                 | 5 869                                                                 | 606                                                                   | 0,609                                                                     | 17,9                          |
| 193,7                              | 16,0                        | 70,1                                     | 89,3                                                | 3 554                                                | 6,31                                 | 367                                                                 | 507                                                                 | 7 109                                                                 | 734                                                                   | 0,609                                                                     | 14,3                          |
| 219,1                              | 5,0                         | 26,4                                     | 33,6                                                | 1 928                                                | 7,57                                 | 176                                                                 | 229                                                                 | 3 856                                                                 | 352                                                                   | 0,688                                                                     | 37,9                          |
| 219,1                              | 6,0                         | 31,5                                     | 40,2                                                | 2 282                                                | 7,54                                 | 208                                                                 | 273                                                                 | 4 564                                                                 | 417                                                                   | 0,688                                                                     | 31,7                          |
| 219,1                              | 6,3                         | 33,1                                     | 42,1                                                | 2 386                                                | 7,53                                 | 218                                                                 | 285                                                                 | 4 772                                                                 | 436                                                                   | 0,688                                                                     | 30,2                          |
| 219,1                              | 8,0                         | 41,6                                     | 53,1                                                | 2 960                                                | 7,47                                 | 270                                                                 | 357                                                                 | 5 919                                                                 | 540                                                                   | 0,688                                                                     | 24,0                          |
| 219,1                              | 10,0                        | 51,6                                     | 65,7                                                | 3 598                                                | 7,40                                 | 328                                                                 | 438                                                                 | 7 197                                                                 | 657                                                                   | 0,688                                                                     | 19,4                          |
| 219,1                              | 12,0                        | 61,3                                     | 78,1                                                | 4 200                                                | 7,33                                 | 383                                                                 | 515                                                                 | 8 400                                                                 | 767                                                                   | 0,688                                                                     | 16,3                          |

Table 5 (continued)

| Outside diameter<br>$D$<br>mm | Thickness<br>$T$<br>mm | Mass per unit length<br>$M$<br>kg/m | Cross-sectional area<br>$A$<br>cm <sup>2</sup> | Second moment of area<br>$I$<br>cm <sup>4</sup> | Radius of gyration<br>$i$<br>cm | Elastic section modulus<br>$W_{el}$<br>cm <sup>3</sup> | Plastic section modulus<br>$W_{pl}$<br>cm <sup>3</sup> | Torsional inertia constant<br>$I_t$<br>cm <sup>4</sup> | Torsional modulus constant<br>$C_t$<br>cm <sup>3</sup> | Surface area per unit length<br>$A_s$<br>m <sup>2</sup> /m | Nominal length per tonne<br>m |
|-------------------------------|------------------------|-------------------------------------|------------------------------------------------|-------------------------------------------------|---------------------------------|--------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------|-------------------------------|
| 219,1                         | 12,5                   | 63,7                                | 81,1                                           | 4 345                                           | 7,32                            | 397                                                    | 534                                                    | 8 689                                                  | 793                                                    | 0,688                                                      | 15,7                          |
| 219,1                         | 16,0                   | 80,1                                | 102                                            | 5 297                                           | 7,20                            | 483                                                    | 661                                                    | 10 590                                                 | 967                                                    | 0,688                                                      | 12,5                          |
| 219,1                         | 20,0                   | 98,2                                | 125                                            | 6 261                                           | 7,07                            | 572                                                    | 795                                                    | 12 520                                                 | 1 143                                                  | 0,688                                                      | 10,2                          |
| 244,5                         | 5,0                    | 29,5                                | 37,6                                           | 2 699                                           | 8,47                            | 221                                                    | 287                                                    | 5 397                                                  | 441                                                    | 0,768                                                      | 33,9                          |
| 244,5                         | 6,0                    | 35,3                                | 45,0                                           | 3 199                                           | 8,43                            | 262                                                    | 341                                                    | 6 397                                                  | 523                                                    | 0,768                                                      | 28,3                          |
| 244,5                         | 6,3                    | 37,0                                | 47,1                                           | 3 346                                           | 8,42                            | 274                                                    | 358                                                    | 6 692                                                  | 547                                                    | 0,768                                                      | 27,0                          |
| 244,5                         | 8,0                    | 46,7                                | 59,4                                           | 4 160                                           | 8,37                            | 340                                                    | 448                                                    | 8 321                                                  | 681                                                    | 0,768                                                      | 21,4                          |
| 244,5                         | 10,0                   | 57,8                                | 73,7                                           | 5 073                                           | 8,30                            | 415                                                    | 550                                                    | 10 146                                                 | 830                                                    | 0,768                                                      | 17,3                          |
| 244,5                         | 12,0                   | 68,8                                | 87,7                                           | 5 938                                           | 8,23                            | 486                                                    | 649                                                    | 11 877                                                 | 972                                                    | 0,768                                                      | 14,5                          |
| 244,5                         | 12,5                   | 71,5                                | 91,1                                           | 6 147                                           | 8,21                            | 503                                                    | 673                                                    | 12 295                                                 | 1 006                                                  | 0,768                                                      | 14,0                          |
| 244,5                         | 16,0                   | 90,2                                | 115                                            | 7 533                                           | 8,10                            | 616                                                    | 837                                                    | 15 066                                                 | 1 232                                                  | 0,768                                                      | 11,1                          |
| 244,5                         | 20,0                   | 111                                 | 141                                            | 8 957                                           | 7,97                            | 733                                                    | 1 011                                                  | 17 914                                                 | 1 465                                                  | 0,768                                                      | 9,03                          |
| 244,5                         | 25,0                   | 135                                 | 172                                            | 10 517                                          | 7,81                            | 860                                                    | 1 210                                                  | 21 034                                                 | 1 721                                                  | 0,768                                                      | 7,39                          |
| 273,0                         | 5,0                    | 33,0                                | 42,1                                           | 3 781                                           | 9,48                            | 277                                                    | 359                                                    | 7 562                                                  | 554                                                    | 0,858                                                      | 30,3                          |
| 273,0                         | 6,0                    | 39,5                                | 50,3                                           | 4 487                                           | 9,44                            | 329                                                    | 428                                                    | 8 974                                                  | 657                                                    | 0,858                                                      | 25,3                          |
| 273,0                         | 6,3                    | 41,4                                | 52,8                                           | 4 696                                           | 9,43                            | 344                                                    | 448                                                    | 9 392                                                  | 688                                                    | 0,858                                                      | 24,1                          |
| 273,0                         | 8,0                    | 52,3                                | 66,6                                           | 5 852                                           | 9,37                            | 429                                                    | 562                                                    | 11 703                                                 | 857                                                    | 0,858                                                      | 19,1                          |
| 273,0                         | 10,0                   | 64,9                                | 82,6                                           | 7 154                                           | 9,31                            | 524                                                    | 692                                                    | 14 308                                                 | 1 048                                                  | 0,858                                                      | 15,4                          |
| 273,0                         | 12,0                   | 77,2                                | 98,4                                           | 8 396                                           | 9,24                            | 615                                                    | 818                                                    | 16 792                                                 | 1 230                                                  | 0,858                                                      | 12,9                          |
| 273,0                         | 12,5                   | 80,3                                | 102                                            | 8 697                                           | 9,22                            | 637                                                    | 849                                                    | 17 395                                                 | 1 274                                                  | 0,858                                                      | 12,5                          |
| 273,0                         | 16,0                   | 101                                 | 129                                            | 10 707                                          | 9,10                            | 784                                                    | 1 058                                                  | 21 414                                                 | 1 569                                                  | 0,858                                                      | 9,86                          |
| 273,0                         | 20,0                   | 125                                 | 159                                            | 12 798                                          | 8,97                            | 938                                                    | 1 283                                                  | 25 597                                                 | 1 875                                                  | 0,858                                                      | 8,01                          |
| 273,0                         | 25,0                   | 153                                 | 195                                            | 15 127                                          | 8,81                            | 1 108                                                  | 1 543                                                  | 30 254                                                 | 2 216                                                  | 0,858                                                      | 6,54                          |
| 323,9                         | 5,0                    | 39,3                                | 50,1                                           | 6 369                                           | 11,3                            | 393                                                    | 509                                                    | 12 739                                                 | 787                                                    | 1,02                                                       | 25,4                          |
| 323,9                         | 6,0                    | 47,0                                | 59,9                                           | 7 572                                           | 11,2                            | 468                                                    | 606                                                    | 15 145                                                 | 935                                                    | 1,02                                                       | 21,3                          |
| 323,9                         | 6,3                    | 49,3                                | 62,9                                           | 7 929                                           | 11,2                            | 490                                                    | 636                                                    | 15 858                                                 | 979                                                    | 1,02                                                       | 20,3                          |
| 323,9                         | 8,0                    | 62,3                                | 79,4                                           | 9 910                                           | 11,2                            | 612                                                    | 799                                                    | 19 820                                                 | 1 224                                                  | 1,02                                                       | 16,0                          |
| 323,9                         | 10,0                   | 77,4                                | 98,6                                           | 12 158                                          | 11,1                            | 751                                                    | 986                                                    | 24 317                                                 | 1 501                                                  | 1,02                                                       | 12,9                          |
| 323,9                         | 12,0                   | 92,3                                | 118                                            | 14 320                                          | 11,0                            | 884                                                    | 1 168                                                  | 28 639                                                 | 1 768                                                  | 1,02                                                       | 10,8                          |
| 323,9                         | 12,5                   | 96,0                                | 122                                            | 14 847                                          | 11,0                            | 917                                                    | 1 213                                                  | 29 693                                                 | 1 833                                                  | 1,02                                                       | 10,4                          |
| 323,9                         | 16,0                   | 121                                 | 155                                            | 18 390                                          | 10,9                            | 1 136                                                  | 1 518                                                  | 36 780                                                 | 2 271                                                  | 1,02                                                       | 8,23                          |
| 323,9                         | 20,0                   | 150                                 | 191                                            | 22 139                                          | 10,8                            | 1 367                                                  | 1 850                                                  | 44 278                                                 | 2 734                                                  | 1,02                                                       | 6,67                          |
| 323,9                         | 25,0                   | 184                                 | 235                                            | 26 400                                          | 10,6                            | 1 630                                                  | 2 239                                                  | 52 800                                                 | 3 260                                                  | 1,02                                                       | 5,43                          |
| 355,6                         | 6,0                    | 51,7                                | 65,9                                           | 10 071                                          | 12,4                            | 566                                                    | 733                                                    | 20 141                                                 | 1 133                                                  | 1,12                                                       | 19,3                          |
| 355,6                         | 6,3                    | 54,3                                | 69,1                                           | 10 547                                          | 12,4                            | 593                                                    | 769                                                    | 21 094                                                 | 1 186                                                  | 1,12                                                       | 18,4                          |
| 355,6                         | 8,0                    | 68,6                                | 87,4                                           | 13 201                                          | 12,3                            | 742                                                    | 967                                                    | 26 403                                                 | 1 485                                                  | 1,12                                                       | 14,6                          |
| 355,6                         | 10,0                   | 85,2                                | 109                                            | 16 223                                          | 12,2                            | 912                                                    | 1 195                                                  | 32 447                                                 | 1 825                                                  | 1,12                                                       | 11,7                          |
| 355,6                         | 12,0                   | 102                                 | 130                                            | 19 139                                          | 12,2                            | 1 076                                                  | 1 417                                                  | 38 279                                                 | 2 153                                                  | 1,12                                                       | 9,83                          |
| 355,6                         | 12,5                   | 106                                 | 135                                            | 19 852                                          | 12,1                            | 1 117                                                  | 1 472                                                  | 39 704                                                 | 2 233                                                  | 1,12                                                       | 9,45                          |
| 355,6                         | 16,0                   | 134                                 | 171                                            | 24 663                                          | 12,0                            | 1 387                                                  | 1 847                                                  | 49 326                                                 | 2 774                                                  | 1,12                                                       | 7,46                          |

Table 5 (continued)

| Outside diameter<br><i>D</i><br>mm | Thickness<br><i>T</i><br>mm | Mass per unit length<br><i>M</i><br>kg/m | Cross-sectional area<br><i>A</i><br>cm <sup>2</sup> | Second moment of area<br><i>I</i><br>cm <sup>4</sup> | Radius of gyration<br><i>i</i><br>cm | Elastic section modulus<br><i>W<sub>el</sub></i><br>cm <sup>3</sup> | Plastic section modulus<br><i>W<sub>pl</sub></i><br>cm <sup>3</sup> | Torsional inertia constant<br><i>I<sub>t</sub></i><br>cm <sup>4</sup> | Torsional modulus constant<br><i>C<sub>t</sub></i><br>cm <sup>3</sup> | Surface area per unit length<br><i>A<sub>s</sub></i><br>m <sup>2</sup> /m | Nominal length per tonne<br><i>m</i> |
|------------------------------------|-----------------------------|------------------------------------------|-----------------------------------------------------|------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------|
| 355,6                              | 20,0                        | 166                                      | 211                                                 | 29 792                                               | 11,9                                 | 1 676                                                               | 2 255                                                               | 59 583                                                                | 3 351                                                                 | 1,12                                                                      | 6,04                                 |
| 355,6                              | 25,0                        | 204                                      | 260                                                 | 35 677                                               | 11,7                                 | 2 007                                                               | 2 738                                                               | 71 353                                                                | 4 013                                                                 | 1,12                                                                      | 4,91                                 |
| 406,4                              | 6,0                         | 59,2                                     | 75,5                                                | 15 128                                               | 14,2                                 | 745                                                                 | 962                                                                 | 30 257                                                                | 1 489                                                                 | 1,28                                                                      | 16,9                                 |
| 406,4                              | 6,3                         | 62,2                                     | 79,2                                                | 15 849                                               | 14,1                                 | 780                                                                 | 1 009                                                               | 31 699                                                                | 1 560                                                                 | 1,28                                                                      | 16,1                                 |
| 406,4                              | 8,0                         | 78,6                                     | 100                                                 | 19 874                                               | 14,1                                 | 978                                                                 | 1 270                                                               | 39 748                                                                | 1 956                                                                 | 1,28                                                                      | 12,7                                 |
| 406,4                              | 10,0                        | 97,8                                     | 125                                                 | 24 476                                               | 14,0                                 | 1 205                                                               | 1 572                                                               | 48 952                                                                | 2 409                                                                 | 1,28                                                                      | 10,2                                 |
| 406,4                              | 12,0                        | 117                                      | 149                                                 | 28 937                                               | 14,0                                 | 1 424                                                               | 1 867                                                               | 57 874                                                                | 2 848                                                                 | 1,28                                                                      | 8,57                                 |
| 406,4                              | 12,5                        | 121                                      | 155                                                 | 30 031                                               | 13,9                                 | 1 478                                                               | 1 940                                                               | 60 061                                                                | 2 956                                                                 | 1,28                                                                      | 8,24                                 |
| 406,4                              | 16,0                        | 154                                      | 196                                                 | 37 449                                               | 13,8                                 | 1 843                                                               | 2 440                                                               | 74 898                                                                | 3 686                                                                 | 1,28                                                                      | 6,49                                 |
| 406,4                              | 20,0                        | 191                                      | 243                                                 | 45 432                                               | 13,7                                 | 2 236                                                               | 2 989                                                               | 90 864                                                                | 4 472                                                                 | 1,28                                                                      | 5,25                                 |
| 406,4                              | 25,0                        | 235                                      | 300                                                 | 54 702                                               | 13,5                                 | 2 692                                                               | 3 642                                                               | 109 404                                                               | 5 384                                                                 | 1,28                                                                      | 4,25                                 |
| 406,4                              | 30,0                        | 278                                      | 355                                                 | 63 224                                               | 13,3                                 | 3 111                                                               | 4 259                                                               | 126 447                                                               | 6 223                                                                 | 1,28                                                                      | 3,59                                 |
| 406,4                              | 40,0                        | 361                                      | 460                                                 | 78 186                                               | 13,0                                 | 3 848                                                               | 5 391                                                               | 156 373                                                               | 7 696                                                                 | 1,28                                                                      | 2,77                                 |
| 457,0                              | 6,0                         | 66,7                                     | 85,0                                                | 21 618                                               | 15,9                                 | 946                                                                 | 1 220                                                               | 43 236                                                                | 1 892                                                                 | 1,44                                                                      | 15,0                                 |
| 457,0                              | 6,3                         | 70,0                                     | 89,2                                                | 22 654                                               | 15,9                                 | 991                                                                 | 1 280                                                               | 45 308                                                                | 1 983                                                                 | 1,44                                                                      | 14,3                                 |
| 457,0                              | 8,0                         | 88,6                                     | 113                                                 | 28 446                                               | 15,9                                 | 1 245                                                               | 1 613                                                               | 56 893                                                                | 2 490                                                                 | 1,44                                                                      | 11,3                                 |
| 457,0                              | 10,0                        | 110                                      | 140                                                 | 35 091                                               | 15,8                                 | 1 536                                                               | 1 998                                                               | 70 183                                                                | 3 071                                                                 | 1,44                                                                      | 9,07                                 |
| 457,0                              | 12,0                        | 132                                      | 168                                                 | 41 556                                               | 15,7                                 | 1 819                                                               | 2 377                                                               | 83 113                                                                | 3 637                                                                 | 1,44                                                                      | 7,59                                 |
| 457,0                              | 12,5                        | 137                                      | 175                                                 | 43 145                                               | 15,7                                 | 1 888                                                               | 2 470                                                               | 86 290                                                                | 3 776                                                                 | 1,44                                                                      | 7,30                                 |
| 457,0                              | 16,0                        | 174                                      | 222                                                 | 53 959                                               | 15,6                                 | 2 361                                                               | 3 113                                                               | 107 919                                                               | 4 723                                                                 | 1,44                                                                      | 5,75                                 |
| 457,0                              | 20,0                        | 216                                      | 275                                                 | 65 681                                               | 15,5                                 | 2 874                                                               | 3 822                                                               | 131 363                                                               | 5 749                                                                 | 1,44                                                                      | 4,64                                 |
| 457,0                              | 25,0                        | 266                                      | 339                                                 | 79 415                                               | 15,3                                 | 3 475                                                               | 4 671                                                               | 158 830                                                               | 6 951                                                                 | 1,44                                                                      | 3,75                                 |
| 457,0                              | 30,0                        | 316                                      | 402                                                 | 92 173                                               | 15,1                                 | 4 034                                                               | 5 479                                                               | 184 346                                                               | 8 068                                                                 | 1,44                                                                      | 3,17                                 |
| 457,0                              | 40,0                        | 411                                      | 524                                                 | 114 949                                              | 14,8                                 | 5 031                                                               | 6 977                                                               | 229 898                                                               | 10 061                                                                | 1,44                                                                      | 2,43                                 |
| 508,0                              | 6,0                         | 74,3                                     | 94,6                                                | 29 812                                               | 17,7                                 | 1 174                                                               | 1 512                                                               | 59 623                                                                | 2 347                                                                 | 1,60                                                                      | 13,5                                 |
| 508,0                              | 6,3                         | 77,9                                     | 99,3                                                | 31 246                                               | 17,7                                 | 1 230                                                               | 1 586                                                               | 62 493                                                                | 2 460                                                                 | 1,60                                                                      | 12,8                                 |
| 508,0                              | 8,0                         | 98,6                                     | 126                                                 | 39 280                                               | 17,7                                 | 1 546                                                               | 2 000                                                               | 78 560                                                                | 3 093                                                                 | 1,60                                                                      | 10,1                                 |
| 508,0                              | 10,0                        | 123                                      | 156                                                 | 48 520                                               | 17,6                                 | 1 910                                                               | 2 480                                                               | 97 040                                                                | 3 820                                                                 | 1,60                                                                      | 8,14                                 |
| 508,0                              | 12,0                        | 147                                      | 187                                                 | 57 536                                               | 17,5                                 | 2 265                                                               | 2 953                                                               | 115 072                                                               | 4 530                                                                 | 1,60                                                                      | 6,81                                 |
| 508,0                              | 12,5                        | 153                                      | 195                                                 | 59 755                                               | 17,5                                 | 2 353                                                               | 3 070                                                               | 119 511                                                               | 4 705                                                                 | 1,60                                                                      | 6,55                                 |
| 508,0                              | 16,0                        | 194                                      | 247                                                 | 74 909                                               | 17,4                                 | 2 949                                                               | 3 874                                                               | 149 818                                                               | 5 898                                                                 | 1,60                                                                      | 5,15                                 |
| 508,0                              | 20,0                        | 241                                      | 307                                                 | 91 428                                               | 17,3                                 | 3 600                                                               | 4 766                                                               | 182 856                                                               | 7 199                                                                 | 1,60                                                                      | 4,15                                 |
| 508,0                              | 25,0                        | 298                                      | 379                                                 | 110 918                                              | 17,1                                 | 4 367                                                               | 5 837                                                               | 221 837                                                               | 8 734                                                                 | 1,60                                                                      | 3,36                                 |
| 508,0                              | 30,0                        | 354                                      | 451                                                 | 129 173                                              | 16,9                                 | 5 086                                                               | 6 864                                                               | 258 346                                                               | 10 171                                                                | 1,60                                                                      | 2,83                                 |
| 508,0                              | 40,0                        | 462                                      | 588                                                 | 162 188                                              | 16,6                                 | 6 385                                                               | 8 782                                                               | 324 376                                                               | 12 771                                                                | 1,60                                                                      | 2,17                                 |
| 508,0                              | 50,0                        | 565                                      | 719                                                 | 190 885                                              | 16,3                                 | 7 515                                                               | 10 530                                                              | 381 770                                                               | 15 030                                                                | 1,60                                                                      | 1,77                                 |
| 610,0                              | 6,0                         | 89,4                                     | 114                                                 | 51 924                                               | 21,4                                 | 1 702                                                               | 2 189                                                               | 103 847                                                               | 3 405                                                                 | 1,92                                                                      | 11,2                                 |
| 610,0                              | 6,3                         | 93,8                                     | 119                                                 | 54 439                                               | 21,3                                 | 1 785                                                               | 2 296                                                               | 108 878                                                               | 3 570                                                                 | 1,92                                                                      | 10,7                                 |
| 610,0                              | 8,0                         | 119                                      | 151                                                 | 68 551                                               | 21,3                                 | 2 248                                                               | 2 899                                                               | 137 103                                                               | 4 495                                                                 | 1,92                                                                      | 8,42                                 |
| 610,0                              | 10,0                        | 148                                      | 188                                                 | 84 847                                               | 21,2                                 | 2 782                                                               | 3 600                                                               | 169 693                                                               | 5 564                                                                 | 1,92                                                                      | 6,76                                 |

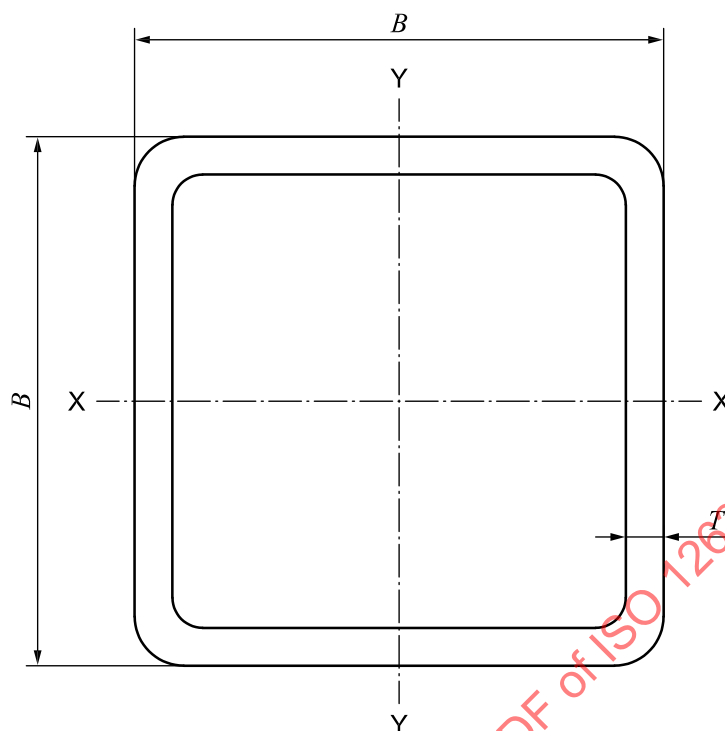
Table 5 (continued)

| Outside diameter<br>$D$<br>mm | Thickness<br>$T$<br>mm | Mass per unit length<br>$M$<br>kg/m | Cross-sectional area<br>$A$<br>cm <sup>2</sup> | Second moment of area<br>$I$<br>cm <sup>4</sup> | Radius of gyration<br>$i$<br>cm | Elastic section modulus<br>$W_{el}$<br>cm <sup>3</sup> | Plastic section modulus<br>$W_{pl}$<br>cm <sup>3</sup> | Torsional inertia constant<br>$I_t$<br>cm <sup>4</sup> | Torsional modulus constant<br>$C_t$<br>cm <sup>3</sup> | Surface area per unit length<br>$A_s$<br>m <sup>2</sup> /m | Nominal length per tonne<br>m |
|-------------------------------|------------------------|-------------------------------------|------------------------------------------------|-------------------------------------------------|---------------------------------|--------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------|-------------------------------|
| 610,0                         | 12,0                   | 177                                 | 225                                            | 100 814                                         | 21,1                            | 3 305                                                  | 4 292                                                  | 201 627                                                | 6 611                                                  | 1,92                                                       | 5,65                          |
| 610,0                         | 12,5                   | 184                                 | 235                                            | 104 755                                         | 21,1                            | 3 435                                                  | 4 463                                                  | 209 509                                                | 6 869                                                  | 1,92                                                       | 5,43                          |
| 610,0                         | 16,0                   | 234                                 | 299                                            | 131 781                                         | 21,0                            | 4 321                                                  | 5 647                                                  | 263 563                                                | 8 641                                                  | 1,92                                                       | 4,27                          |
| 610,0                         | 20,0                   | 291                                 | 371                                            | 161 490                                         | 20,9                            | 5 295                                                  | 6 965                                                  | 322 979                                                | 10 589                                                 | 1,92                                                       | 3,44                          |
| 610,0                         | 25,0                   | 361                                 | 459                                            | 196 906                                         | 20,7                            | 6 456                                                  | 8 561                                                  | 393 813                                                | 12 912                                                 | 1,92                                                       | 2,77                          |
| 610,0                         | 30,0                   | 429                                 | 547                                            | 230 476                                         | 20,5                            | 7 557                                                  | 10 101                                                 | 460 952                                                | 15 113                                                 | 1,92                                                       | 2,33                          |
| 610,0                         | 40,0                   | 562                                 | 716                                            | 292 333                                         | 20,2                            | 9 585                                                  | 13 017                                                 | 584 666                                                | 19 169                                                 | 1,92                                                       | 1,78                          |
| 610,0                         | 50,0                   | 691                                 | 880                                            | 347 570                                         | 19,9                            | 11 396                                                 | 15 722                                                 | 695 140                                                | 22 791                                                 | 1,92                                                       | 1,45                          |
| 711,0                         | 6,0                    | 104                                 | 133                                            | 82 568                                          | 24,9                            | 2 323                                                  | 2 982                                                  | 165 135                                                | 4 645                                                  | 2,23                                                       | 9,59                          |
| 711,0                         | 6,3                    | 109                                 | 139                                            | 86 586                                          | 24,9                            | 2 436                                                  | 3 129                                                  | 173 172                                                | 4 871                                                  | 2,23                                                       | 9,13                          |
| 711,0                         | 8,0                    | 139                                 | 177                                            | 109 162                                         | 24,9                            | 3 071                                                  | 3 954                                                  | 218 324                                                | 6 141                                                  | 2,23                                                       | 7,21                          |
| 711,0                         | 10,0                   | 173                                 | 220                                            | 135 301                                         | 24,8                            | 3 806                                                  | 4 914                                                  | 270 603                                                | 7 612                                                  | 2,23                                                       | 5,78                          |
| 711,0                         | 12,0                   | 207                                 | 264                                            | 160 991                                         | 24,7                            | 4 529                                                  | 5 864                                                  | 321 981                                                | 9 057                                                  | 2,23                                                       | 4,83                          |
| 711,0                         | 12,5                   | 215                                 | 274                                            | 167 343                                         | 24,7                            | 4 707                                                  | 6 099                                                  | 334 686                                                | 9 415                                                  | 2,23                                                       | 4,64                          |
| 711,0                         | 16,0                   | 274                                 | 349                                            | 211 040                                         | 24,6                            | 5 936                                                  | 7 730                                                  | 422 080                                                | 11 873                                                 | 2,23                                                       | 3,65                          |
| 711,0                         | 20,0                   | 341                                 | 434                                            | 259 351                                         | 24,4                            | 7 295                                                  | 9 552                                                  | 518 702                                                | 14 591                                                 | 2,23                                                       | 2,93                          |
| 711,0                         | 25,0                   | 423                                 | 539                                            | 317 357                                         | 24,3                            | 8 927                                                  | 11 770                                                 | 634 715                                                | 17 854                                                 | 2,23                                                       | 2,36                          |
| 711,0                         | 30,0                   | 504                                 | 642                                            | 372 790                                         | 24,1                            | 10 486                                                 | 13 922                                                 | 745 580                                                | 20 973                                                 | 2,23                                                       | 1,98                          |
| 711,0                         | 40,0                   | 662                                 | 843                                            | 476 242                                         | 23,8                            | 13 396                                                 | 18 031                                                 | 952 485                                                | 26 793                                                 | 2,23                                                       | 1,51                          |
| 711,0                         | 50,0                   | 815                                 | 1 038                                          | 570 312                                         | 23,4                            | 16 043                                                 | 21 888                                                 | 1 140 623                                              | 32 085                                                 | 2,23                                                       | 1,23                          |
| 711,0                         | 60,0                   | 963                                 | 1 227                                          | 655 583                                         | 23,1                            | 18 441                                                 | 25 500                                                 | 1 311 166                                              | 36 882                                                 | 2,23                                                       | 1,04                          |
| 762,0                         | 6,0                    | 112                                 | 143                                            | 101 813                                         | 26,7                            | 2 672                                                  | 3 429                                                  | 203 626                                                | 5 345                                                  | 2,39                                                       | 8,94                          |
| 762,0                         | 6,3                    | 117                                 | 150                                            | 106 777                                         | 26,7                            | 2 803                                                  | 3 598                                                  | 213 555                                                | 5 605                                                  | 2,39                                                       | 8,52                          |
| 762,0                         | 8,0                    | 149                                 | 190                                            | 134 683                                         | 26,7                            | 3 535                                                  | 4 548                                                  | 269 366                                                | 7 070                                                  | 2,39                                                       | 6,72                          |
| 762,0                         | 10,0                   | 185                                 | 236                                            | 167 028                                         | 26,6                            | 4 384                                                  | 5 655                                                  | 334 057                                                | 8 768                                                  | 2,39                                                       | 5,39                          |
| 762,0                         | 12,0                   | 222                                 | 283                                            | 198 855                                         | 26,5                            | 5 219                                                  | 6 751                                                  | 397 710                                                | 10 439                                                 | 2,39                                                       | 4,51                          |
| 762,0                         | 12,5                   | 231                                 | 294                                            | 206 731                                         | 26,5                            | 5 426                                                  | 7 023                                                  | 413 462                                                | 10 852                                                 | 2,39                                                       | 4,33                          |
| 762,0                         | 16,0                   | 294                                 | 375                                            | 260 973                                         | 26,4                            | 6 850                                                  | 8 906                                                  | 521 947                                                | 13 699                                                 | 2,39                                                       | 3,40                          |
| 762,0                         | 20,0                   | 366                                 | 466                                            | 321 083                                         | 26,2                            | 8 427                                                  | 11 014                                                 | 642 166                                                | 16 855                                                 | 2,39                                                       | 2,73                          |
| 762,0                         | 25,0                   | 454                                 | 579                                            | 393 461                                         | 26,1                            | 10 327                                                 | 13 584                                                 | 786 922                                                | 20 654                                                 | 2,39                                                       | 2,20                          |
| 762,0                         | 30,0                   | 542                                 | 690                                            | 462 853                                         | 25,9                            | 12 148                                                 | 16 084                                                 | 925 706                                                | 24 297                                                 | 2,39                                                       | 1,85                          |
| 762,0                         | 40,0                   | 712                                 | 907                                            | 593 011                                         | 25,6                            | 15 565                                                 | 20 873                                                 | 1 186 021                                              | 31 129                                                 | 2,39                                                       | 1,40                          |
| 762,0                         | 50,0                   | 878                                 | 1 118                                          | 712 207                                         | 25,2                            | 18 693                                                 | 25 389                                                 | 1 424 414                                              | 37 386                                                 | 2,39                                                       | 1,14                          |
| 813,0                         | 8,0                    | 159                                 | 202                                            | 163 901                                         | 28,5                            | 4 032                                                  | 5 184                                                  | 327 801                                                | 8 064                                                  | 2,55                                                       | 6,30                          |
| 813,0                         | 10,0                   | 198                                 | 252                                            | 203 364                                         | 28,4                            | 5 003                                                  | 6 448                                                  | 406 728                                                | 10 006                                                 | 2,55                                                       | 5,05                          |
| 813,0                         | 12,0                   | 237                                 | 302                                            | 242 235                                         | 28,3                            | 5 959                                                  | 7 700                                                  | 484 469                                                | 11 918                                                 | 2,55                                                       | 4,22                          |
| 813,0                         | 12,5                   | 247                                 | 314                                            | 251 860                                         | 28,3                            | 6 196                                                  | 8 011                                                  | 503 721                                                | 12 392                                                 | 2,55                                                       | 4,05                          |
| 813,0                         | 16,0                   | 314                                 | 401                                            | 318 222                                         | 28,2                            | 7 828                                                  | 10 165                                                 | 636 443                                                | 15 657                                                 | 2,55                                                       | 3,18                          |
| 813,0                         | 20,0                   | 391                                 | 498                                            | 391 909                                         | 28,0                            | 9 641                                                  | 12 580                                                 | 783 819                                                | 19 282                                                 | 2,55                                                       | 2,56                          |
| 813,0                         | 25,0                   | 486                                 | 619                                            | 480 856                                         | 27,9                            | 11 829                                                 | 15 529                                                 | 961 713                                                | 23 658                                                 | 2,55                                                       | 2,06                          |

Table 5 (continued)

| Outside diameter<br><i>D</i><br>mm | Thickness<br><i>T</i><br>mm | Mass per unit length<br><i>M</i><br>kg/m | Cross-sectional area<br><i>A</i><br>cm <sup>2</sup> | Second moment of area<br><i>I</i><br>cm <sup>4</sup> | Radius of gyration<br><i>i</i><br>cm | Elastic section modulus<br><i>W<sub>el</sub></i><br>cm <sup>3</sup> | Plastic section modulus<br><i>W<sub>pl</sub></i><br>cm <sup>3</sup> | Torsional inertia constant<br><i>I<sub>t</sub></i><br>cm <sup>4</sup> | Torsional modulus constant<br><i>C<sub>t</sub></i><br>cm <sup>3</sup> | Surface area per unit length<br><i>A<sub>s</sub></i><br>m <sup>2</sup> /m | Nominal length per tonne<br>m |
|------------------------------------|-----------------------------|------------------------------------------|-----------------------------------------------------|------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------|
| 813,0                              | 30,0                        | 579                                      | 738                                                 | 566 374                                              | 27,7                                 | 13 933                                                              | 18 402                                                              | 1 132 748                                                             | 27 866                                                                | 2,55                                                                      | 1,73                          |
| 914,0                              | 8,0                         | 179                                      | 228                                                 | 233 651                                              | 32,0                                 | 5 113                                                               | 6 567                                                               | 467 303                                                               | 10 225                                                                | 2,87                                                                      | 5,59                          |
| 914,0                              | 10,0                        | 223                                      | 284                                                 | 290 147                                              | 32,0                                 | 6 349                                                               | 8 172                                                               | 580 294                                                               | 12 698                                                                | 2,87                                                                      | 4,49                          |
| 914,0                              | 12,0                        | 267                                      | 340                                                 | 345 890                                              | 31,9                                 | 7 569                                                               | 9 764                                                               | 691 779                                                               | 15 137                                                                | 2,87                                                                      | 3,75                          |
| 914,0                              | 12,5                        | 278                                      | 354                                                 | 359 708                                              | 31,9                                 | 7 871                                                               | 10 159                                                              | 719 417                                                               | 15 742                                                                | 2,87                                                                      | 3,60                          |
| 914,0                              | 16,0                        | 354                                      | 451                                                 | 455 142                                              | 31,8                                 | 9 959                                                               | 12 904                                                              | 910 284                                                               | 19 919                                                                | 2,87                                                                      | 2,82                          |
| 914,0                              | 20,0                        | 441                                      | 562                                                 | 561 461                                              | 31,6                                 | 12 286                                                              | 15 987                                                              | 1 122 922                                                             | 24 572                                                                | 2,87                                                                      | 2,27                          |
| 914,0                              | 25,0                        | 548                                      | 698                                                 | 690 317                                              | 31,4                                 | 15 105                                                              | 19 763                                                              | 1 380 634                                                             | 30 211                                                                | 2,87                                                                      | 1,82                          |
| 914,0                              | 30,0                        | 654                                      | 833                                                 | 814 775                                              | 31,3                                 | 17 829                                                              | 23 453                                                              | 1 629 550                                                             | 35 658                                                                | 2,87                                                                      | 1,53                          |
| 1 016,0                            | 8,0                         | 199                                      | 253                                                 | 321 780                                              | 35,6                                 | 6 334                                                               | 8 129                                                               | 643 560                                                               | 12 668                                                                | 3,19                                                                      | 5,03                          |
| 1 016,0                            | 10,0                        | 248                                      | 316                                                 | 399 850                                              | 35,6                                 | 7 871                                                               | 10 121                                                              | 799 699                                                               | 15 742                                                                | 3,19                                                                      | 4,03                          |
| 1 016,0                            | 12,0                        | 297                                      | 378                                                 | 476 985                                              | 35,5                                 | 9 389                                                               | 12 097                                                              | 953 969                                                               | 18 779                                                                | 3,19                                                                      | 3,37                          |
| 1 016,0                            | 12,5                        | 309                                      | 394                                                 | 496 123                                              | 35,5                                 | 9 766                                                               | 12 588                                                              | 992 246                                                               | 19 532                                                                | 3,19                                                                      | 3,23                          |
| 1 016,0                            | 16,0                        | 395                                      | 503                                                 | 628 479                                              | 35,4                                 | 12 372                                                              | 16 001                                                              | 1 256 959                                                             | 24 743                                                                | 3,19                                                                      | 2,53                          |
| 1 016,0                            | 20,0                        | 491                                      | 626                                                 | 776 324                                              | 35,2                                 | 15 282                                                              | 19 843                                                              | 1 552 648                                                             | 30 564                                                                | 3,19                                                                      | 2,04                          |
| 1 016,0                            | 25,0                        | 611                                      | 778                                                 | 956 086                                              | 35,0                                 | 18 821                                                              | 24 557                                                              | 1 912 173                                                             | 37 641                                                                | 3,19                                                                      | 1,64                          |
| 1 016,0                            | 30,0                        | 729                                      | 929                                                 | 1 130 352                                            | 34,9                                 | 22 251                                                              | 29 175                                                              | 2 260 704                                                             | 44 502                                                                | 3,19                                                                      | 1,37                          |
| 1 067,0                            | 10,0                        | 261                                      | 332                                                 | 463 792                                              | 37,4                                 | 8 693                                                               | 11 173                                                              | 927 585                                                               | 17 387                                                                | 3,35                                                                      | 3,84                          |
| 1 067,0                            | 12,0                        | 312                                      | 398                                                 | 553 420                                              | 37,3                                 | 10 373                                                              | 13 357                                                              | 1 106 840                                                             | 20 747                                                                | 3,35                                                                      | 3,20                          |
| 1 067,0                            | 12,5                        | 325                                      | 414                                                 | 575 666                                              | 37,3                                 | 10 790                                                              | 13 900                                                              | 1 151 332                                                             | 21 581                                                                | 3,35                                                                      | 3,08                          |
| 1 067,0                            | 16,0                        | 415                                      | 528                                                 | 729 606                                              | 37,2                                 | 13 676                                                              | 17 675                                                              | 1 459 213                                                             | 27 352                                                                | 3,35                                                                      | 2,41                          |
| 1 067,0                            | 20,0                        | 516                                      | 658                                                 | 901 755                                              | 37,0                                 | 16 903                                                              | 21 927                                                              | 1 803 509                                                             | 33 805                                                                | 3,35                                                                      | 1,94                          |
| 1 067,0                            | 25,0                        | 642                                      | 818                                                 | 1 111 355                                            | 36,9                                 | 20 831                                                              | 27 149                                                              | 2 222 711                                                             | 41 663                                                                | 3,35                                                                      | 1,56                          |
| 1 067,0                            | 30,0                        | 767                                      | 977                                                 | 1 314 864                                            | 36,7                                 | 24 646                                                              | 32 270                                                              | 2 629 727                                                             | 49 292                                                                | 3,35                                                                      | 1,30                          |
| 1 168,0                            | 10,0                        | 286                                      | 364                                                 | 609 843                                              | 40,9                                 | 10 443                                                              | 13 410                                                              | 1 219 686                                                             | 20 885                                                                | 3,67                                                                      | 3,50                          |
| 1 168,0                            | 12,0                        | 342                                      | 436                                                 | 728 050                                              | 40,9                                 | 12 467                                                              | 16 037                                                              | 1 456 101                                                             | 24 933                                                                | 3,67                                                                      | 2,92                          |
| 1 168,0                            | 12,5                        | 356                                      | 454                                                 | 757 409                                              | 40,9                                 | 12 969                                                              | 16 690                                                              | 1 514 818                                                             | 25 939                                                                | 3,67                                                                      | 2,81                          |
| 1 168,0                            | 16,0                        | 455                                      | 579                                                 | 960 774                                              | 40,7                                 | 16 452                                                              | 21 235                                                              | 1 921 547                                                             | 32 903                                                                | 3,67                                                                      | 2,20                          |
| 1 168,0                            | 20,0                        | 566                                      | 721                                                 | 1 188 632                                            | 40,6                                 | 20 353                                                              | 26 361                                                              | 2 377 264                                                             | 40 707                                                                | 3,67                                                                      | 1,77                          |
| 1 168,0                            | 25,0                        | 705                                      | 898                                                 | 1 466 717                                            | 40,4                                 | 25 115                                                              | 32 666                                                              | 2 933 434                                                             | 50 230                                                                | 3,67                                                                      | 1,42                          |
| 1 219,0                            | 10,0                        | 298                                      | 380                                                 | 694 014                                              | 42,7                                 | 11 387                                                              | 14 617                                                              | 1 388 029                                                             | 22 773                                                                | 3,83                                                                      | 3,35                          |
| 1 219,0                            | 12,0                        | 357                                      | 455                                                 | 828 716                                              | 42,7                                 | 13 597                                                              | 17 483                                                              | 1 657 433                                                             | 27 193                                                                | 3,83                                                                      | 2,80                          |
| 1 219,0                            | 12,5                        | 372                                      | 474                                                 | 862 181                                              | 42,7                                 | 14 146                                                              | 18 196                                                              | 1 724 362                                                             | 28 291                                                                | 3,83                                                                      | 2,69                          |
| 1 219,0                            | 16,0                        | 475                                      | 605                                                 | 1 094 091                                            | 42,5                                 | 17 951                                                              | 23 157                                                              | 2 188 183                                                             | 35 901                                                                | 3,83                                                                      | 2,11                          |
| 1 219,0                            | 20,0                        | 591                                      | 753                                                 | 1 354 155                                            | 42,4                                 | 22 217                                                              | 28 755                                                              | 2 708 309                                                             | 44 435                                                                | 3,83                                                                      | 1,69                          |
| 1 219,0                            | 25,0                        | 736                                      | 938                                                 | 1 671 873                                            | 42,2                                 | 27 430                                                              | 35 646                                                              | 3 343 746                                                             | 54 860                                                                | 3,83                                                                      | 1,36                          |

NOTE See Figure 8.



NOTE See Table 6.

Figure 9 — Square hollow section

Table 6 — Nominal dimensions and sectional properties of square hollow sections

| Size<br><i>B</i><br>mm | Thickness<br><i>T</i><br>mm | Mass per<br>unit<br>length<br><i>M</i><br>kg/m | Cross-<br>sectional<br>area<br><i>A</i><br>cm <sup>2</sup> | Second<br>moment<br>of area<br><i>I</i><br>cm <sup>4</sup> | Radius<br>of<br>gyration<br><i>i</i><br>cm | Elastic<br>section<br>modulus<br><i>W<sub>el</sub></i><br>cm <sup>3</sup> | Plastic<br>section<br>modulus<br><i>W<sub>pl</sub></i><br>cm <sup>3</sup> | Torsional<br>inertia<br>constant<br><i>I<sub>t</sub></i><br>cm <sup>4</sup> | Torsional<br>modulus<br>constant<br><i>C<sub>t</sub></i><br>cm <sup>3</sup> | Surface area<br>per unit<br>length<br><i>A<sub>s</sub></i><br>m <sup>2</sup> /m | Nominal<br>length per<br>tonne<br>m |
|------------------------|-----------------------------|------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------|
| 20                     | 2,0                         | 1,10                                           | 1,40                                                       | 0,739                                                      | 0,727                                      | 0,739                                                                     | 0,930                                                                     | 1,22                                                                        | 1,07                                                                        | 0,074 8                                                                         | 912                                 |
| 20                     | 2,5                         | 1,32                                           | 1,68                                                       | 0,835                                                      | 0,705                                      | 0,835                                                                     | 1,08                                                                      | 1,41                                                                        | 1,20                                                                        | 0,073 6                                                                         | 757                                 |
| 25                     | 2,0                         | 1,41                                           | 1,80                                                       | 1,56                                                       | 0,932                                      | 1,25                                                                      | 1,53                                                                      | 2,52                                                                        | 1,81                                                                        | 0,094 8                                                                         | 709                                 |
| 25                     | 2,5                         | 1,71                                           | 2,18                                                       | 1,81                                                       | 0,909                                      | 1,44                                                                      | 1,82                                                                      | 2,97                                                                        | 2,08                                                                        | 0,093 6                                                                         | 584                                 |
| 25                     | 3,0                         | 2,00                                           | 2,54                                                       | 2,00                                                       | 0,886                                      | 1,60                                                                      | 2,06                                                                      | 3,35                                                                        | 2,30                                                                        | 0,092 3                                                                         | 501                                 |
| 30                     | 2,0                         | 1,72                                           | 2,20                                                       | 2,84                                                       | 1,14                                       | 1,89                                                                      | 2,29                                                                      | 4,53                                                                        | 2,75                                                                        | 0,115                                                                           | 580                                 |
| 30                     | 2,5                         | 2,11                                           | 2,68                                                       | 3,33                                                       | 1,11                                       | 2,22                                                                      | 2,74                                                                      | 5,40                                                                        | 3,22                                                                        | 0,114                                                                           | 475                                 |
| 30                     | 3,0                         | 2,47                                           | 3,14                                                       | 3,74                                                       | 1,09                                       | 2,50                                                                      | 3,14                                                                      | 6,16                                                                        | 3,60                                                                        | 0,112                                                                           | 405                                 |
| 40                     | 2,5                         | 2,89                                           | 3,68                                                       | 8,54                                                       | 1,52                                       | 4,27                                                                      | 5,14                                                                      | 13,6                                                                        | 6,22                                                                        | 0,154                                                                           | 346                                 |
| 40                     | 3,0                         | 3,41                                           | 4,34                                                       | 9,78                                                       | 1,50                                       | 4,89                                                                      | 5,97                                                                      | 15,7                                                                        | 7,10                                                                        | 0,152                                                                           | 293                                 |
| 40                     | 4,0                         | 4,39                                           | 5,59                                                       | 11,8                                                       | 1,45                                       | 5,91                                                                      | 7,44                                                                      | 19,5                                                                        | 8,54                                                                        | 0,150                                                                           | 228                                 |
| 40                     | 5,0                         | 5,28                                           | 6,73                                                       | 13,4                                                       | 1,41                                       | 6,68                                                                      | 8,66                                                                      | 22,5                                                                        | 9,60                                                                        | 0,147                                                                           | 189                                 |
| 50                     | 2,5                         | 3,68                                           | 4,68                                                       | 17,5                                                       | 1,93                                       | 6,99                                                                      | 8,29                                                                      | 27,5                                                                        | 10,2                                                                        | 0,194                                                                           | 272                                 |
| 50                     | 3,0                         | 4,35                                           | 5,54                                                       | 20,2                                                       | 1,91                                       | 8,08                                                                      | 9,70                                                                      | 32,1                                                                        | 11,8                                                                        | 0,192                                                                           | 230                                 |
| 50                     | 4,0                         | 5,64                                           | 7,19                                                       | 25,0                                                       | 1,86                                       | 9,99                                                                      | 12,3                                                                      | 40,4                                                                        | 14,5                                                                        | 0,190                                                                           | 177                                 |
| 50                     | 5,0                         | 6,85                                           | 8,73                                                       | 28,9                                                       | 1,82                                       | 11,6                                                                      | 14,5                                                                      | 47,6                                                                        | 16,7                                                                        | 0,187                                                                           | 146                                 |
| 50                     | 6,0                         | 7,99                                           | 10,2                                                       | 32,0                                                       | 1,77                                       | 12,8                                                                      | 16,5                                                                      | 53,6                                                                        | 18,4                                                                        | 0,185                                                                           | 125                                 |
| 50                     | 6,3                         | 8,31                                           | 10,6                                                       | 32,8                                                       | 1,76                                       | 13,1                                                                      | 17,0                                                                      | 55,2                                                                        | 18,8                                                                        | 0,184                                                                           | 120                                 |
| 60                     | 2,5                         | 4,46                                           | 5,68                                                       | 31,1                                                       | 2,34                                       | 10,4                                                                      | 12,2                                                                      | 48,5                                                                        | 15,2                                                                        | 0,234                                                                           | 224                                 |
| 60                     | 3,0                         | 5,29                                           | 6,74                                                       | 36,2                                                       | 2,32                                       | 12,1                                                                      | 14,3                                                                      | 56,9                                                                        | 17,7                                                                        | 0,232                                                                           | 189                                 |
| 60                     | 4,0                         | 6,90                                           | 8,79                                                       | 45,4                                                       | 2,27                                       | 15,1                                                                      | 18,3                                                                      | 72,5                                                                        | 22,0                                                                        | 0,230                                                                           | 145                                 |
| 60                     | 5,0                         | 8,42                                           | 10,7                                                       | 53,3                                                       | 2,23                                       | 17,8                                                                      | 21,9                                                                      | 86,4                                                                        | 25,7                                                                        | 0,227                                                                           | 119                                 |
| 60                     | 6,0                         | 9,87                                           | 12,6                                                       | 59,9                                                       | 2,18                                       | 20,0                                                                      | 25,1                                                                      | 98,6                                                                        | 28,8                                                                        | 0,225                                                                           | 101                                 |
| 60                     | 6,3                         | 10,3                                           | 13,1                                                       | 61,6                                                       | 2,17                                       | 20,5                                                                      | 26,0                                                                      | 102                                                                         | 29,6                                                                        | 0,224                                                                           | 97,2                                |
| 60                     | 8,0                         | 12,5                                           | 16,0                                                       | 69,7                                                       | 2,09                                       | 23,2                                                                      | 30,4                                                                      | 118                                                                         | 33,4                                                                        | 0,219                                                                           | 79,9                                |
| 70                     | 3,0                         | 6,24                                           | 7,94                                                       | 59,0                                                       | 2,73                                       | 16,9                                                                      | 19,9                                                                      | 92,2                                                                        | 24,8                                                                        | 0,272                                                                           | 160                                 |
| 70                     | 4,0                         | 8,15                                           | 10,4                                                       | 74,7                                                       | 2,68                                       | 21,3                                                                      | 25,5                                                                      | 118                                                                         | 31,2                                                                        | 0,270                                                                           | 123                                 |
| 70                     | 5,0                         | 9,99                                           | 12,7                                                       | 88,5                                                       | 2,64                                       | 25,3                                                                      | 30,8                                                                      | 142                                                                         | 36,8                                                                        | 0,267                                                                           | 100                                 |
| 70                     | 6,0                         | 11,8                                           | 15,0                                                       | 101                                                        | 2,59                                       | 28,7                                                                      | 35,5                                                                      | 163                                                                         | 41,6                                                                        | 0,265                                                                           | 85,1                                |
| 70                     | 6,3                         | 12,3                                           | 15,6                                                       | 104                                                        | 2,58                                       | 29,7                                                                      | 36,9                                                                      | 169                                                                         | 42,9                                                                        | 0,264                                                                           | 81,5                                |
| 70                     | 8,0                         | 15,0                                           | 19,2                                                       | 120                                                        | 2,50                                       | 34,2                                                                      | 43,8                                                                      | 200                                                                         | 49,2                                                                        | 0,259                                                                           | 66,5                                |
| 80                     | 3,0                         | 7,18                                           | 9,14                                                       | 89,8                                                       | 3,13                                       | 22,5                                                                      | 26,3                                                                      | 140                                                                         | 33,0                                                                        | 0,312                                                                           | 139                                 |
| 80                     | 4,0                         | 9,41                                           | 12,0                                                       | 114                                                        | 3,09                                       | 28,6                                                                      | 34,0                                                                      | 180                                                                         | 41,9                                                                        | 0,310                                                                           | 106                                 |
| 80                     | 5,0                         | 11,6                                           | 14,7                                                       | 137                                                        | 3,05                                       | 34,2                                                                      | 41,1                                                                      | 217                                                                         | 49,8                                                                        | 0,307                                                                           | 86,5                                |
| 80                     | 6,0                         | 13,6                                           | 17,4                                                       | 156                                                        | 3,00                                       | 39,1                                                                      | 47,8                                                                      | 252                                                                         | 56,8                                                                        | 0,305                                                                           | 73,3                                |
| 80                     | 6,3                         | 14,2                                           | 18,1                                                       | 162                                                        | 2,99                                       | 40,5                                                                      | 49,7                                                                      | 262                                                                         | 58,7                                                                        | 0,304                                                                           | 70,2                                |
| 80                     | 8,0                         | 17,5                                           | 22,4                                                       | 189                                                        | 2,91                                       | 47,3                                                                      | 59,5                                                                      | 312                                                                         | 68,3                                                                        | 0,299                                                                           | 57,0                                |
| 90                     | 4,0                         | 10,7                                           | 13,6                                                       | 166                                                        | 3,50                                       | 37,0                                                                      | 43,6                                                                      | 260                                                                         | 54,2                                                                        | 0,350                                                                           | 93,7                                |
| 90                     | 5,0                         | 13,1                                           | 16,7                                                       | 200                                                        | 3,45                                       | 44,4                                                                      | 53,0                                                                      | 316                                                                         | 64,8                                                                        | 0,347                                                                           | 76,1                                |
| 90                     | 6,0                         | 15,5                                           | 19,8                                                       | 230                                                        | 3,41                                       | 51,1                                                                      | 61,8                                                                      | 367                                                                         | 74,3                                                                        | 0,345                                                                           | 64,4                                |

Table 6 (continued)

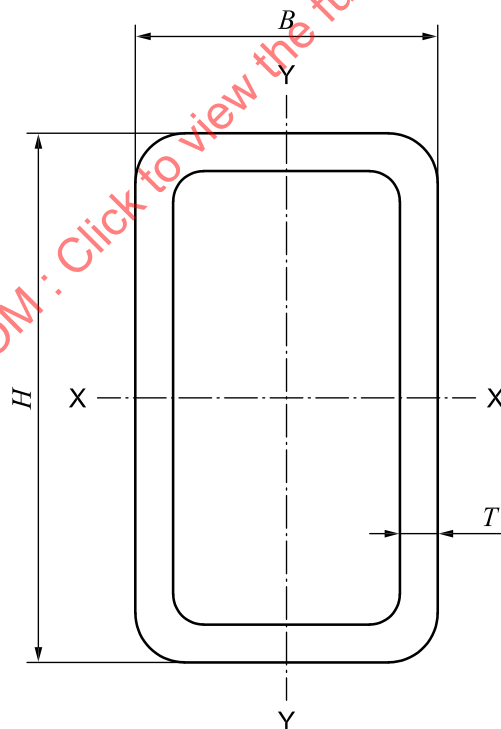
| Size<br><i>B</i><br>mm | Thickness<br><i>T</i><br>mm | Mass per<br>unit<br>length<br><i>M</i><br>kg/m | Cross-<br>sectional<br>area<br><i>A</i><br>cm <sup>2</sup> | Second<br>moment<br>of area<br><i>I</i><br>cm <sup>4</sup> | Radius<br>of<br>gyration<br><i>i</i><br>cm | Elastic<br>section<br>modulus<br><i>W<sub>el</sub></i><br>cm <sup>3</sup> | Plastic<br>section<br>modulus<br><i>W<sub>pl</sub></i><br>cm <sup>3</sup> | Torsional<br>inertia<br>constant<br><i>I<sub>t</sub></i><br>cm <sup>4</sup> | Torsional<br>modulus<br>constant<br><i>C<sub>t</sub></i><br>cm <sup>3</sup> | Surface area<br>per unit<br>length<br><i>A<sub>s</sub></i><br>m <sup>2</sup> /m | Nominal<br>length per<br>tonne<br>m |
|------------------------|-----------------------------|------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------|
| 90                     | 6,3                         | 16,2                                           | 20,7                                                       | 238                                                        | 3,40                                       | 53,0                                                                      | 64,3                                                                      | 382                                                                         | 77,0                                                                        | 0,344                                                                           | 61,6                                |
| 90                     | 8,0                         | 20,1                                           | 25,6                                                       | 281                                                        | 3,32                                       | 62,6                                                                      | 77,6                                                                      | 459                                                                         | 90,5                                                                        | 0,339                                                                           | 49,9                                |
| 100                    | 4,0                         | 11,9                                           | 15,2                                                       | 232                                                        | 3,91                                       | 46,4                                                                      | 54,4                                                                      | 361                                                                         | 68,2                                                                        | 0,390                                                                           | 83,9                                |
| 100                    | 5,0                         | 14,7                                           | 18,7                                                       | 279                                                        | 3,86                                       | 55,9                                                                      | 66,4                                                                      | 439                                                                         | 81,8                                                                        | 0,387                                                                           | 68,0                                |
| 100                    | 6,0                         | 17,4                                           | 22,2                                                       | 323                                                        | 3,82                                       | 64,6                                                                      | 77,6                                                                      | 513                                                                         | 94,3                                                                        | 0,385                                                                           | 57,5                                |
| 100                    | 6,3                         | 18,2                                           | 23,2                                                       | 336                                                        | 3,80                                       | 67,1                                                                      | 80,9                                                                      | 534                                                                         | 97,8                                                                        | 0,384                                                                           | 54,9                                |
| 100                    | 8,0                         | 22,6                                           | 28,8                                                       | 400                                                        | 3,73                                       | 79,9                                                                      | 98,2                                                                      | 646                                                                         | 116                                                                         | 0,379                                                                           | 44,3                                |
| 100                    | 10,0                        | 27,4                                           | 34,9                                                       | 462                                                        | 3,64                                       | 92,4                                                                      | 116                                                                       | 761                                                                         | 133                                                                         | 0,374                                                                           | 36,5                                |
| 120                    | 5,0                         | 17,8                                           | 22,7                                                       | 498                                                        | 4,68                                       | 83,0                                                                      | 97,6                                                                      | 777                                                                         | 122                                                                         | 0,467                                                                           | 56,0                                |
| 120                    | 6,0                         | 21,2                                           | 27,0                                                       | 579                                                        | 4,63                                       | 96,6                                                                      | 115                                                                       | 911                                                                         | 141                                                                         | 0,465                                                                           | 47,2                                |
| 120                    | 6,3                         | 22,2                                           | 28,2                                                       | 603                                                        | 4,62                                       | 100                                                                       | 120                                                                       | 950                                                                         | 147                                                                         | 0,464                                                                           | 45,1                                |
| 120                    | 8,0                         | 27,6                                           | 35,2                                                       | 726                                                        | 4,55                                       | 121                                                                       | 146                                                                       | 1160                                                                        | 176                                                                         | 0,459                                                                           | 36,2                                |
| 120                    | 10,0                        | 33,7                                           | 42,9                                                       | 852                                                        | 4,46                                       | 142                                                                       | 175                                                                       | 1382                                                                        | 206                                                                         | 0,454                                                                           | 29,7                                |
| 120                    | 12,0                        | 39,5                                           | 50,3                                                       | 958                                                        | 4,36                                       | 160                                                                       | 201                                                                       | 1578                                                                        | 230                                                                         | 0,449                                                                           | 25,3                                |
| 120                    | 12,5                        | 40,9                                           | 52,1                                                       | 982                                                        | 4,34                                       | 164                                                                       | 207                                                                       | 1623                                                                        | 236                                                                         | 0,448                                                                           | 24,5                                |
| 140                    | 5,0                         | 21,0                                           | 26,7                                                       | 807                                                        | 5,50                                       | 115                                                                       | 135                                                                       | 1253                                                                        | 170                                                                         | 0,547                                                                           | 47,7                                |
| 140                    | 6,0                         | 24,9                                           | 31,8                                                       | 944                                                        | 5,45                                       | 135                                                                       | 159                                                                       | 1475                                                                        | 198                                                                         | 0,545                                                                           | 40,1                                |
| 140                    | 6,3                         | 26,1                                           | 33,3                                                       | 984                                                        | 5,44                                       | 141                                                                       | 166                                                                       | 1540                                                                        | 206                                                                         | 0,544                                                                           | 38,3                                |
| 140                    | 8,0                         | 32,6                                           | 41,6                                                       | 1195                                                       | 5,36                                       | 171                                                                       | 204                                                                       | 1892                                                                        | 249                                                                         | 0,539                                                                           | 30,7                                |
| 140                    | 10,0                        | 40,0                                           | 50,9                                                       | 1416                                                       | 5,27                                       | 202                                                                       | 246                                                                       | 2272                                                                        | 294                                                                         | 0,534                                                                           | 25,0                                |
| 140                    | 12,0                        | 47,0                                           | 59,9                                                       | 1609                                                       | 5,18                                       | 230                                                                       | 284                                                                       | 2616                                                                        | 333                                                                         | 0,529                                                                           | 21,3                                |
| 140                    | 12,5                        | 48,7                                           | 62,1                                                       | 1653                                                       | 5,16                                       | 236                                                                       | 293                                                                       | 2696                                                                        | 342                                                                         | 0,528                                                                           | 20,5                                |
| 150                    | 5,0                         | 22,6                                           | 28,7                                                       | 1002                                                       | 5,90                                       | 134                                                                       | 156                                                                       | 1550                                                                        | 197                                                                         | 0,587                                                                           | 44,3                                |
| 150                    | 6,0                         | 26,8                                           | 34,2                                                       | 1174                                                       | 5,86                                       | 156                                                                       | 184                                                                       | 1828                                                                        | 230                                                                         | 0,585                                                                           | 37,3                                |
| 150                    | 6,3                         | 28,1                                           | 35,8                                                       | 1223                                                       | 5,85                                       | 163                                                                       | 192                                                                       | 1909                                                                        | 240                                                                         | 0,584                                                                           | 35,6                                |
| 150                    | 8,0                         | 35,1                                           | 44,8                                                       | 1491                                                       | 5,77                                       | 199                                                                       | 237                                                                       | 2351                                                                        | 291                                                                         | 0,579                                                                           | 28,5                                |
| 150                    | 10,0                        | 43,1                                           | 54,9                                                       | 1773                                                       | 5,68                                       | 236                                                                       | 286                                                                       | 2832                                                                        | 344                                                                         | 0,574                                                                           | 23,2                                |
| 150                    | 12,0                        | 50,8                                           | 64,7                                                       | 2023                                                       | 5,59                                       | 270                                                                       | 331                                                                       | 3272                                                                        | 391                                                                         | 0,569                                                                           | 19,7                                |
| 150                    | 12,5                        | 52,7                                           | 67,1                                                       | 2080                                                       | 5,57                                       | 277                                                                       | 342                                                                       | 3375                                                                        | 402                                                                         | 0,568                                                                           | 19,0                                |
| 150                    | 16,0                        | 65,2                                           | 83,0                                                       | 2430                                                       | 5,41                                       | 324                                                                       | 411                                                                       | 4026                                                                        | 467                                                                         | 0,559                                                                           | 15,3                                |
| 160                    | 5,0                         | 24,1                                           | 30,7                                                       | 1225                                                       | 6,31                                       | 153                                                                       | 178                                                                       | 1892                                                                        | 226                                                                         | 0,627                                                                           | 41,5                                |
| 160                    | 6,0                         | 28,7                                           | 36,6                                                       | 1437                                                       | 6,27                                       | 180                                                                       | 210                                                                       | 2233                                                                        | 264                                                                         | 0,625                                                                           | 34,8                                |
| 160                    | 6,3                         | 30,1                                           | 38,3                                                       | 1499                                                       | 6,26                                       | 187                                                                       | 220                                                                       | 2333                                                                        | 275                                                                         | 0,624                                                                           | 33,3                                |
| 160                    | 8,0                         | 37,6                                           | 48,0                                                       | 1831                                                       | 6,18                                       | 229                                                                       | 272                                                                       | 2880                                                                        | 335                                                                         | 0,619                                                                           | 26,6                                |
| 160                    | 10,0                        | 46,3                                           | 58,9                                                       | 2186                                                       | 6,09                                       | 273                                                                       | 329                                                                       | 3478                                                                        | 398                                                                         | 0,614                                                                           | 21,6                                |
| 160                    | 12,0                        | 54,6                                           | 69,5                                                       | 2502                                                       | 6,00                                       | 313                                                                       | 382                                                                       | 4028                                                                        | 454                                                                         | 0,609                                                                           | 18,3                                |
| 160                    | 12,5                        | 56,6                                           | 72,1                                                       | 2576                                                       | 5,98                                       | 322                                                                       | 395                                                                       | 4158                                                                        | 467                                                                         | 0,608                                                                           | 17,7                                |
| 160                    | 16,0                        | 70,2                                           | 89,4                                                       | 3028                                                       | 5,82                                       | 379                                                                       | 476                                                                       | 4988                                                                        | 546                                                                         | 0,599                                                                           | 14,2                                |
| 180                    | 5,0                         | 27,3                                           | 34,7                                                       | 1765                                                       | 7,13                                       | 196                                                                       | 227                                                                       | 2718                                                                        | 290                                                                         | 0,707                                                                           | 36,7                                |
| 180                    | 6,0                         | 32,5                                           | 41,4                                                       | 2077                                                       | 7,09                                       | 231                                                                       | 269                                                                       | 3215                                                                        | 340                                                                         | 0,705                                                                           | 30,8                                |

Table 6 (continued)

| Size<br><i>B</i><br>mm | Thickness<br><i>T</i><br>mm | Mass per<br>unit<br>length<br><i>M</i><br>kg/m | Cross-<br>sectional<br>area<br><i>A</i><br>cm <sup>2</sup> | Second<br>moment<br>of area<br><i>I</i><br>cm <sup>4</sup> | Radius<br>of<br>gyration<br><i>i</i><br>cm | Elastic<br>section<br>modulus<br><i>W<sub>el</sub></i><br>cm <sup>3</sup> | Plastic<br>section<br>modulus<br><i>W<sub>pl</sub></i><br>cm <sup>3</sup> | Torsional<br>inertia<br>constant<br><i>I<sub>t</sub></i><br>cm <sup>4</sup> | Torsional<br>modulus<br>constant<br><i>C<sub>t</sub></i><br>cm <sup>3</sup> | Surface area<br>per unit<br>length<br><i>A<sub>s</sub></i><br>m <sup>2</sup> /m | Nominal<br>length per<br>tonne<br>m |
|------------------------|-----------------------------|------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------|
| 180                    | 6,3                         | 34,0                                           | 43,3                                                       | 2 168                                                      | 7,07                                       | 241                                                                       | 281                                                                       | 3 361                                                                       | 355                                                                         | 0,704                                                                           | 29,4                                |
| 180                    | 8,0                         | 42,7                                           | 54,4                                                       | 2 661                                                      | 7,00                                       | 296                                                                       | 349                                                                       | 4 162                                                                       | 434                                                                         | 0,699                                                                           | 23,4                                |
| 180                    | 10,0                        | 52,5                                           | 66,9                                                       | 3 193                                                      | 6,91                                       | 355                                                                       | 424                                                                       | 5 048                                                                       | 518                                                                         | 0,694                                                                           | 19,0                                |
| 180                    | 12,0                        | 62,1                                           | 79,1                                                       | 3 677                                                      | 6,82                                       | 409                                                                       | 494                                                                       | 5 873                                                                       | 595                                                                         | 0,689                                                                           | 16,1                                |
| 180                    | 12,5                        | 64,4                                           | 82,1                                                       | 3 790                                                      | 6,80                                       | 421                                                                       | 511                                                                       | 6 070                                                                       | 613                                                                         | 0,688                                                                           | 15,5                                |
| 180                    | 16,0                        | 80,2                                           | 102                                                        | 4 504                                                      | 6,64                                       | 500                                                                       | 621                                                                       | 7 343                                                                       | 724                                                                         | 0,679                                                                           | 12,5                                |
| 200                    | 5,0                         | 30,4                                           | 38,7                                                       | 2 445                                                      | 7,95                                       | 245                                                                       | 283                                                                       | 3 756                                                                       | 362                                                                         | 0,787                                                                           | 32,9                                |
| 200                    | 6,0                         | 36,2                                           | 46,2                                                       | 2 883                                                      | 7,90                                       | 288                                                                       | 335                                                                       | 4 449                                                                       | 426                                                                         | 0,785                                                                           | 27,6                                |
| 200                    | 6,3                         | 38,0                                           | 48,4                                                       | 3 011                                                      | 7,89                                       | 301                                                                       | 350                                                                       | 4 653                                                                       | 444                                                                         | 0,784                                                                           | 26,3                                |
| 200                    | 8,0                         | 47,7                                           | 60,8                                                       | 3 709                                                      | 7,81                                       | 371                                                                       | 436                                                                       | 5 778                                                                       | 545                                                                         | 0,779                                                                           | 21,0                                |
| 200                    | 10,0                        | 58,8                                           | 74,9                                                       | 4 471                                                      | 7,72                                       | 447                                                                       | 531                                                                       | 7 031                                                                       | 655                                                                         | 0,774                                                                           | 17,0                                |
| 200                    | 12,0                        | 69,6                                           | 88,7                                                       | 5 171                                                      | 7,64                                       | 517                                                                       | 621                                                                       | 8 208                                                                       | 754                                                                         | 0,769                                                                           | 14,4                                |
| 200                    | 12,5                        | 72,3                                           | 92,1                                                       | 5 336                                                      | 7,61                                       | 534                                                                       | 643                                                                       | 8 491                                                                       | 778                                                                         | 0,768                                                                           | 13,8                                |
| 200                    | 16,0                        | 90,3                                           | 115                                                        | 6 394                                                      | 7,46                                       | 639                                                                       | 785                                                                       | 10 340                                                                      | 927                                                                         | 0,759                                                                           | 11,1                                |
| 220                    | 6,0                         | 40,0                                           | 51,0                                                       | 3 875                                                      | 8,72                                       | 352                                                                       | 408                                                                       | 5 963                                                                       | 521                                                                         | 0,865                                                                           | 25,0                                |
| 220                    | 6,3                         | 41,9                                           | 53,4                                                       | 4 049                                                      | 8,71                                       | 368                                                                       | 427                                                                       | 6 240                                                                       | 544                                                                         | 0,864                                                                           | 23,8                                |
| 220                    | 8,0                         | 52,7                                           | 67,2                                                       | 5 002                                                      | 8,63                                       | 455                                                                       | 532                                                                       | 7 765                                                                       | 669                                                                         | 0,859                                                                           | 19,0                                |
| 220                    | 10,0                        | 65,1                                           | 82,9                                                       | 6 050                                                      | 8,54                                       | 550                                                                       | 650                                                                       | 9 473                                                                       | 807                                                                         | 0,854                                                                           | 15,4                                |
| 220                    | 12,0                        | 77,2                                           | 98,3                                                       | 7 023                                                      | 8,45                                       | 638                                                                       | 762                                                                       | 11 091                                                                      | 933                                                                         | 0,849                                                                           | 13,0                                |
| 220                    | 12,5                        | 80,1                                           | 102                                                        | 7 254                                                      | 8,43                                       | 659                                                                       | 789                                                                       | 11 481                                                                      | 963                                                                         | 0,848                                                                           | 12,5                                |
| 220                    | 16,0                        | 100                                            | 128                                                        | 8 749                                                      | 8,27                                       | 795                                                                       | 969                                                                       | 14 054                                                                      | 1 156                                                                       | 0,839                                                                           | 10,0                                |
| 250                    | 6,0                         | 45,7                                           | 58,2                                                       | 5 752                                                      | 9,94                                       | 460                                                                       | 531                                                                       | 8 825                                                                       | 681                                                                         | 0,985                                                                           | 21,9                                |
| 250                    | 6,3                         | 47,9                                           | 61,0                                                       | 6 014                                                      | 9,93                                       | 481                                                                       | 556                                                                       | 9 238                                                                       | 712                                                                         | 0,984                                                                           | 20,9                                |
| 250                    | 8,0                         | 60,3                                           | 76,8                                                       | 7 455                                                      | 9,86                                       | 596                                                                       | 694                                                                       | 11 525                                                                      | 880                                                                         | 0,979                                                                           | 16,6                                |
| 250                    | 10,0                        | 74,5                                           | 94,9                                                       | 9 055                                                      | 9,77                                       | 724                                                                       | 851                                                                       | 14 106                                                                      | 1 065                                                                       | 0,974                                                                           | 13,4                                |
| 250                    | 12,0                        | 88,5                                           | 113                                                        | 10 556                                                     | 9,68                                       | 844                                                                       | 1 000                                                                     | 16 567                                                                      | 1 237                                                                       | 0,969                                                                           | 11,3                                |
| 250                    | 12,5                        | 91,9                                           | 117                                                        | 10 915                                                     | 9,66                                       | 873                                                                       | 1 037                                                                     | 17 164                                                                      | 1 279                                                                       | 0,968                                                                           | 10,9                                |
| 250                    | 16,0                        | 115                                            | 147                                                        | 13 267                                                     | 9,50                                       | 1 061                                                                     | 1 280                                                                     | 21 138                                                                      | 1 546                                                                       | 0,959                                                                           | 8,67                                |
| 260                    | 6,0                         | 47,6                                           | 60,6                                                       | 6 491                                                      | 10,4                                       | 499                                                                       | 576                                                                       | 9 951                                                                       | 740                                                                         | 1,02                                                                            | 21,0                                |
| 260                    | 6,3                         | 49,9                                           | 63,5                                                       | 6 788                                                      | 10,3                                       | 522                                                                       | 603                                                                       | 10 417                                                                      | 773                                                                         | 1,02                                                                            | 20,1                                |
| 260                    | 8,0                         | 62,8                                           | 80,0                                                       | 8 423                                                      | 10,3                                       | 648                                                                       | 753                                                                       | 13 006                                                                      | 956                                                                         | 1,02                                                                            | 15,9                                |
| 260                    | 10,0                        | 77,7                                           | 98,9                                                       | 10 242                                                     | 10,2                                       | 788                                                                       | 924                                                                       | 15 932                                                                      | 1 159                                                                       | 1,01                                                                            | 12,9                                |
| 260                    | 12,0                        | 92,2                                           | 117                                                        | 11 954                                                     | 10,1                                       | 920                                                                       | 1 087                                                                     | 18 729                                                                      | 1 348                                                                       | 1,01                                                                            | 10,8                                |
| 260                    | 12,5                        | 95,8                                           | 122                                                        | 12 365                                                     | 10,1                                       | 951                                                                       | 1 127                                                                     | 19 409                                                                      | 1 394                                                                       | 1,01                                                                            | 10,4                                |
| 260                    | 16,0                        | 120                                            | 153                                                        | 15 061                                                     | 9,91                                       | 1 159                                                                     | 1 394                                                                     | 23 942                                                                      | 1 689                                                                       | 0,999                                                                           | 8,30                                |
| 300                    | 6,0                         | 55,1                                           | 70,2                                                       | 10 080                                                     | 12,0                                       | 672                                                                       | 772                                                                       | 15 407                                                                      | 997                                                                         | 1,18                                                                            | 18,2                                |
| 300                    | 6,3                         | 57,8                                           | 73,6                                                       | 10 547                                                     | 12,0                                       | 703                                                                       | 809                                                                       | 16 136                                                                      | 1 043                                                                       | 1,18                                                                            | 17,3                                |
| 300                    | 8,0                         | 72,8                                           | 92,8                                                       | 13 128                                                     | 11,9                                       | 875                                                                       | 1 013                                                                     | 20 194                                                                      | 1 294                                                                       | 1,18                                                                            | 13,7                                |
| 300                    | 10,0                        | 90,2                                           | 115                                                        | 16 026                                                     | 11,8                                       | 1 068                                                                     | 1 246                                                                     | 24 807                                                                      | 1 575                                                                       | 1,17                                                                            | 11,1                                |
| 300                    | 12,0                        | 107                                            | 137                                                        | 18 777                                                     | 11,7                                       | 1 252                                                                     | 1 470                                                                     | 29 249                                                                      | 1 840                                                                       | 1,17                                                                            | 9,32                                |

Table 6 (continued)

| Size               | Thickness | Mass per unit length | Cross-sectional area   | Second moment of area  | Radius of gyration | Elastic section modulus     | Plastic section modulus     | Torsional inertia constant | Torsional modulus constant | Surface area per unit length | Nominal length per tonne |
|--------------------|-----------|----------------------|------------------------|------------------------|--------------------|-----------------------------|-----------------------------|----------------------------|----------------------------|------------------------------|--------------------------|
| $B$<br>mm          | $T$<br>mm | $M$<br>kg/m          | $A$<br>cm <sup>2</sup> | $I$<br>cm <sup>4</sup> | $i$<br>cm          | $W_{el}$<br>cm <sup>3</sup> | $W_{pl}$<br>cm <sup>3</sup> | $I_t$<br>cm <sup>4</sup>   | $C_t$<br>cm <sup>3</sup>   | $A_s$<br>m <sup>2</sup> /m   | m                        |
| 300                | 12,5      | 112                  | 142                    | 19 442                 | 11,7               | 1 296                       | 1 525                       | 30 333                     | 1 904                      | 1,17                         | 8,97                     |
| 300                | 16,0      | 141                  | 179                    | 23 850                 | 11,5               | 1 590                       | 1 895                       | 37 622                     | 2 325                      | 1,16                         | 7,12                     |
| 350                | 8,0       | 85,4                 | 109                    | 21 129                 | 13,9               | 1 207                       | 1 392                       | 32 384                     | 1 789                      | 1,38                         | 11,7                     |
| 350                | 10,0      | 106                  | 135                    | 25 884                 | 13,9               | 1 479                       | 1 715                       | 39 886                     | 2 185                      | 1,37                         | 9,44                     |
| 350                | 12,0      | 126                  | 161                    | 30 435                 | 13,8               | 1 739                       | 2 030                       | 47 154                     | 2 563                      | 1,37                         | 7,93                     |
| 350                | 12,5      | 131                  | 167                    | 31 541                 | 13,7               | 1 802                       | 2 107                       | 48 934                     | 2 654                      | 1,37                         | 7,62                     |
| 350                | 16,0      | 166                  | 211                    | 38 942                 | 13,6               | 2 225                       | 2 630                       | 60 990                     | 3 264                      | 1,36                         | 6,04                     |
| 400                | 10,0      | 122                  | 155                    | 39 128                 | 15,9               | 1 956                       | 2 260                       | 60 092                     | 2 895                      | 1,57                         | 8,22                     |
| 400                | 12,0      | 145                  | 185                    | 46 130                 | 15,8               | 2 306                       | 2 679                       | 71 181                     | 3 405                      | 1,57                         | 6,90                     |
| 400                | 12,5      | 151                  | 192                    | 47 839                 | 15,8               | 2 392                       | 2 782                       | 73 906                     | 3 530                      | 1,57                         | 6,63                     |
| 400                | 16,0      | 191                  | 243                    | 59 344                 | 15,6               | 2 967                       | 3 484                       | 92 442                     | 4 362                      | 1,56                         | 5,24                     |
| 400                | 20,0      | 235                  | 300                    | 71 535                 | 15,4               | 3 577                       | 4 247                       | 112 489                    | 5 237                      | 1,55                         | 4,25                     |
| NOTE See Figure 9. |           |                      |                        |                        |                    |                             |                             |                            |                            |                              |                          |



NOTE See Table 7.

Figure 10 — Rectangular hollow section

Table 7 — Nominal dimensions and sectional properties of rectangular hollow sections

| Size         |    | Thick-<br>ness | Mass<br>per unit<br>length | Cross-<br>sectional<br>area | Second<br>moment of<br>area |                 | Radius of<br>gyration |          | Elastic<br>section<br>modulus |                 | Plastic<br>section<br>modulus |                 | Torsional<br>inertia<br>constant | Torsional<br>modulus<br>constant | Surface<br>area per<br>unit<br>length | Nominal<br>length<br>per<br>tonne |
|--------------|----|----------------|----------------------------|-----------------------------|-----------------------------|-----------------|-----------------------|----------|-------------------------------|-----------------|-------------------------------|-----------------|----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|
| $H \times B$ |    | $T$            | $M$                        | $A$                         | $I_{XX}$                    | $I_{YY}$        | $i_{XX}$              | $i_{YY}$ | $W_{el,XX}$                   | $W_{el,YY}$     | $W_{pl,XX}$                   | $W_{pl,YY}$     | $I_t$                            | $C_t$                            | $A_s$                                 |                                   |
| mm           | mm | mm             | kg/m                       | cm <sup>2</sup>             | cm <sup>4</sup>             | cm <sup>4</sup> | cm                    | cm       | cm <sup>3</sup>               | cm <sup>3</sup> | cm <sup>3</sup>               | cm <sup>3</sup> | cm <sup>4</sup>                  | cm <sup>3</sup>                  | m <sup>2</sup> /m                     | m                                 |
| 50           | 25 | 2,5            | 2,69                       | 3,43                        | 10,4                        | 3,39            | 1,74                  | 0,994    | 4,16                          | 2,71            | 5,33                          | 3,22            | 8,42                             | 4,61                             | 0,144                                 | 371                               |
| 50           | 25 | 3,0            | 3,17                       | 4,04                        | 11,9                        | 3,83            | 1,72                  | 0,973    | 4,76                          | 3,06            | 6,18                          | 3,71            | 9,64                             | 5,20                             | 0,142                                 | 315                               |
| 50           | 30 | 2,5            | 2,89                       | 3,68                        | 11,8                        | 5,22            | 1,79                  | 1,19     | 4,73                          | 3,48            | 5,92                          | 4,11            | 11,7                             | 5,73                             | 0,154                                 | 346                               |
| 50           | 30 | 3,0            | 3,41                       | 4,34                        | 13,6                        | 5,94            | 1,77                  | 1,17     | 5,43                          | 3,96            | 6,88                          | 4,76            | 13,5                             | 6,51                             | 0,152                                 | 293                               |
| 50           | 30 | 4,0            | 4,39                       | 5,59                        | 16,5                        | 7,08            | 1,72                  | 1,13     | 6,60                          | 4,72            | 8,59                          | 5,88            | 16,6                             | 7,77                             | 0,150                                 | 228                               |
| 50           | 30 | 5,0            | 5,28                       | 6,73                        | 18,7                        | 7,89            | 1,67                  | 1,08     | 7,49                          | 5,26            | 10,0                          | 6,80            | 19,0                             | 8,67                             | 0,147                                 | 189                               |
| 60           | 40 | 2,5            | 3,68                       | 4,68                        | 22,8                        | 12,1            | 2,21                  | 1,60     | 7,61                          | 6,03            | 9,32                          | 7,02            | 25,1                             | 9,73                             | 0,194                                 | 272                               |
| 60           | 40 | 3,0            | 4,35                       | 5,54                        | 26,5                        | 13,9            | 2,18                  | 1,58     | 8,82                          | 6,95            | 10,9                          | 8,19            | 29,2                             | 11,2                             | 0,192                                 | 230                               |
| 60           | 40 | 4,0            | 5,64                       | 7,19                        | 32,8                        | 17,0            | 2,14                  | 1,54     | 10,9                          | 8,52            | 13,8                          | 10,3            | 36,7                             | 13,7                             | 0,190                                 | 177                               |
| 60           | 40 | 5,0            | 6,85                       | 8,73                        | 38,1                        | 19,5            | 2,09                  | 1,50     | 12,7                          | 9,77            | 16,4                          | 12,2            | 43,0                             | 15,7                             | 0,187                                 | 146                               |
| 60           | 40 | 6,0            | 7,99                       | 10,2                        | 42,3                        | 21,4            | 2,04                  | 1,45     | 14,1                          | 10,7            | 18,6                          | 13,7            | 48,2                             | 17,3                             | 0,185                                 | 125                               |
| 60           | 40 | 6,3            | 8,31                       | 10,6                        | 43,4                        | 21,9            | 2,02                  | 1,44     | 14,5                          | 11,0            | 19,2                          | 14,2            | 49,5                             | 17,6                             | 0,184                                 | 120                               |
| 80           | 40 | 3,0            | 5,29                       | 6,74                        | 54,2                        | 18,0            | 2,84                  | 1,63     | 13,6                          | 9,00            | 17,1                          | 10,4            | 43,8                             | 15,3                             | 0,232                                 | 189                               |
| 80           | 40 | 4,0            | 6,90                       | 8,79                        | 68,2                        | 22,2            | 2,79                  | 1,59     | 17,1                          | 11,1            | 21,8                          | 13,2            | 55,2                             | 18,9                             | 0,230                                 | 145                               |
| 80           | 40 | 5,0            | 8,42                       | 10,7                        | 80,3                        | 25,7            | 2,74                  | 1,55     | 20,1                          | 12,9            | 26,1                          | 15,7            | 65,1                             | 21,9                             | 0,227                                 | 119                               |
| 80           | 40 | 6,0            | 9,87                       | 12,6                        | 90,5                        | 28,5            | 2,68                  | 1,50     | 22,6                          | 14,2            | 30,0                          | 17,8            | 73,4                             | 24,2                             | 0,225                                 | 101                               |
| 80           | 40 | 6,3            | 10,3                       | 13,1                        | 93,3                        | 29,2            | 2,67                  | 1,49     | 23,3                          | 14,6            | 31,1                          | 18,4            | 75,6                             | 24,8                             | 0,224                                 | 97,2                              |
| 80           | 40 | 8,0            | 12,5                       | 16,0                        | 106                         | 32,1            | 2,58                  | 1,42     | 26,5                          | 16,1            | 36,5                          | 21,2            | 85,8                             | 27,4                             | 0,219                                 | 79,9                              |
| 90           | 50 | 3,0            | 6,24                       | 7,94                        | 84,4                        | 33,5            | 3,26                  | 2,05     | 18,8                          | 13,4            | 23,2                          | 15,3            | 76,5                             | 22,4                             | 0,272                                 | 160                               |
| 90           | 50 | 4,0            | 8,15                       | 10,4                        | 107                         | 41,9            | 3,21                  | 2,01     | 23,8                          | 16,8            | 29,8                          | 19,6            | 97,5                             | 28,0                             | 0,270                                 | 123                               |
| 90           | 50 | 5,0            | 9,99                       | 12,7                        | 127                         | 49,2            | 3,16                  | 1,97     | 28,3                          | 19,7            | 36,0                          | 23,5            | 116                              | 32,9                             | 0,267                                 | 100                               |
| 90           | 50 | 6,0            | 11,8                       | 15,0                        | 145                         | 55,4            | 3,11                  | 1,92     | 32,2                          | 22,1            | 41,6                          | 27,0            | 133                              | 37,0                             | 0,265                                 | 85,1                              |
| 90           | 50 | 6,3            | 12,3                       | 15,6                        | 150                         | 57,0            | 3,10                  | 1,91     | 33,3                          | 22,8            | 43,2                          | 28,0            | 138                              | 38,1                             | 0,264                                 | 81,5                              |
| 90           | 50 | 8,0            | 15,0                       | 19,2                        | 174                         | 64,6            | 3,01                  | 1,84     | 38,6                          | 25,8            | 51,4                          | 32,9            | 160                              | 43,2                             | 0,259                                 | 66,5                              |
| 100          | 50 | 3,0            | 6,71                       | 8,54                        | 110                         | 36,8            | 3,58                  | 2,08     | 21,9                          | 14,7            | 27,3                          | 16,8            | 88,4                             | 25,0                             | 0,292                                 | 149                               |
| 100          | 50 | 4,0            | 8,78                       | 11,2                        | 140                         | 46,2            | 3,53                  | 2,03     | 27,9                          | 18,5            | 35,2                          | 21,5            | 113                              | 31,4                             | 0,290                                 | 114                               |
| 100          | 50 | 5,0            | 10,8                       | 13,7                        | 167                         | 54,3            | 3,48                  | 1,99     | 33,3                          | 21,7            | 42,6                          | 25,8            | 135                              | 36,9                             | 0,287                                 | 92,8                              |
| 100          | 50 | 6,0            | 12,7                       | 16,2                        | 190                         | 61,2            | 3,43                  | 1,95     | 38,1                          | 24,5            | 49,4                          | 29,7            | 154                              | 41,6                             | 0,285                                 | 78,8                              |
| 100          | 50 | 6,3            | 13,3                       | 16,9                        | 197                         | 63,0            | 3,42                  | 1,93     | 39,4                          | 25,2            | 51,3                          | 30,8            | 160                              | 42,9                             | 0,284                                 | 75,4                              |
| 100          | 50 | 8,0            | 16,3                       | 20,8                        | 230                         | 71,7            | 3,33                  | 1,86     | 46,0                          | 28,7            | 61,4                          | 36,3            | 186                              | 48,9                             | 0,279                                 | 61,4                              |
| 100          | 60 | 3,0            | 7,18                       | 9,14                        | 124                         | 55,7            | 3,68                  | 2,47     | 24,7                          | 18,6            | 30,2                          | 21,2            | 121                              | 30,7                             | 0,312                                 | 139                               |
| 100          | 60 | 4,0            | 9,41                       | 12,0                        | 158                         | 70,5            | 3,63                  | 2,43     | 31,6                          | 23,5            | 39,1                          | 27,3            | 156                              | 38,7                             | 0,310                                 | 106                               |
| 100          | 60 | 5,0            | 11,6                       | 14,7                        | 189                         | 83,6            | 3,58                  | 2,38     | 37,8                          | 27,9            | 47,4                          | 32,9            | 188                              | 45,9                             | 0,307                                 | 86,5                              |
| 100          | 60 | 6,0            | 13,6                       | 17,4                        | 217                         | 95,0            | 3,53                  | 2,34     | 43,4                          | 31,7            | 55,1                          | 38,1            | 216                              | 52,1                             | 0,305                                 | 73,3                              |
| 100          | 60 | 6,3            | 14,2                       | 18,1                        | 225                         | 98,1            | 3,52                  | 2,33     | 45,0                          | 32,7            | 57,3                          | 39,5            | 224                              | 53,8                             | 0,304                                 | 70,2                              |
| 100          | 60 | 8,0            | 17,5                       | 22,4                        | 264                         | 113             | 3,44                  | 2,25     | 52,8                          | 37,8            | 68,7                          | 47,1            | 265                              | 62,2                             | 0,299                                 | 57,0                              |
| 120          | 60 | 4,0            | 10,7                       | 13,6                        | 249                         | 83,1            | 4,28                  | 2,47     | 41,5                          | 27,7            | 51,9                          | 31,7            | 201                              | 47,1                             | 0,350                                 | 93,7                              |
| 120          | 60 | 5,0            | 13,1                       | 16,7                        | 299                         | 98,8            | 4,23                  | 2,43     | 49,9                          | 32,9            | 63,1                          | 38,4            | 242                              | 56,0                             | 0,347                                 | 76,1                              |
| 120          | 60 | 6,0            | 15,5                       | 19,8                        | 345                         | 113             | 4,18                  | 2,39     | 57,5                          | 37,5            | 73,6                          | 44,5            | 279                              | 63,8                             | 0,345                                 | 64,4                              |
| 120          | 60 | 6,3            | 16,2                       | 20,7                        | 358                         | 116             | 4,16                  | 2,37     | 59,7                          | 38,8            | 76,7                          | 46,3            | 290                              | 65,9                             | 0,344                                 | 61,6                              |

Table 7 (continued)

| Size         |     | Thick-<br>ness | Mass<br>per unit<br>length | Cross-<br>sectional<br>area | Second<br>moment of<br>area |                 | Radius of<br>gyration |          | Elastic<br>section<br>modulus |                 | Plastic<br>section<br>modulus |                 | Torsional<br>inertia<br>constant | Torsional<br>modulus<br>constant | Surface<br>area per<br>unit<br>length | Nominal<br>length<br>per<br>tonne |
|--------------|-----|----------------|----------------------------|-----------------------------|-----------------------------|-----------------|-----------------------|----------|-------------------------------|-----------------|-------------------------------|-----------------|----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|
| $H \times B$ |     | $T$            | $M$                        | $A$                         | $I_{XX}$                    | $I_{YY}$        | $i_{XX}$              | $i_{YY}$ | $W_{el,XX}$                   | $W_{el,YY}$     | $W_{pl,XX}$                   | $W_{pl,YY}$     | $I_t$                            | $C_t$                            | $A_s$                                 |                                   |
| mm           | mm  | mm             | kg/m                       | cm <sup>2</sup>             | cm <sup>4</sup>             | cm <sup>4</sup> | cm                    | cm       | cm <sup>3</sup>               | cm <sup>3</sup> | cm <sup>3</sup>               | cm <sup>3</sup> | cm <sup>4</sup>                  | cm <sup>3</sup>                  | m <sup>2</sup> /m                     | m                                 |
| 120          | 60  | 8,0            | 20,1                       | 25,6                        | 425                         | 135             | 4,08                  | 2,30     | 70,8                          | 45,0            | 92,7                          | 55,4            | 344                              | 76,6                             | 0,399                                 | 49,9                              |
| 120          | 60  | 10,0           | 24,3                       | 30,9                        | 488                         | 152             | 3,97                  | 2,21     | 81,4                          | 50,5            | 109                           | 64,4            | 396                              | 86,1                             | 0,334                                 | 41,2                              |
| 120          | 80  | 4,0            | 11,9                       | 15,2                        | 303                         | 161             | 4,46                  | 3,25     | 50,4                          | 40,2            | 61,2                          | 46,1            | 330                              | 65,0                             | 0,390                                 | 83,9                              |
| 120          | 80  | 5,0            | 14,7                       | 18,7                        | 365                         | 193             | 4,42                  | 3,21     | 60,9                          | 48,2            | 74,6                          | 56,1            | 401                              | 77,9                             | 0,387                                 | 68,0                              |
| 120          | 80  | 6,0            | 17,4                       | 22,2                        | 423                         | 222             | 4,37                  | 3,17     | 70,6                          | 55,6            | 87,3                          | 65,5            | 468                              | 89,6                             | 0,385                                 | 57,5                              |
| 120          | 80  | 6,3            | 18,2                       | 23,2                        | 440                         | 230             | 4,36                  | 3,15     | 73,3                          | 57,6            | 91,0                          | 68,2            | 487                              | 92,9                             | 0,384                                 | 54,9                              |
| 120          | 80  | 8,0            | 22,6                       | 28,8                        | 525                         | 273             | 4,27                  | 3,08     | 87,5                          | 68,1            | 111                           | 82,6            | 587                              | 110                              | 0,379                                 | 44,3                              |
| 120          | 80  | 10,0           | 27,4                       | 34,9                        | 609                         | 313             | 4,18                  | 2,99     | 102                           | 78,1            | 131                           | 97,3            | 688                              | 126                              | 0,374                                 | 36,5                              |
| 140          | 80  | 4,0            | 13,2                       | 16,8                        | 441                         | 184             | 5,12                  | 3,31     | 62,9                          | 46,0            | 77,1                          | 52,2            | 411                              | 76,5                             | 0,430                                 | 75,9                              |
| 140          | 80  | 5,0            | 16,3                       | 20,7                        | 534                         | 221             | 5,08                  | 3,27     | 76,3                          | 55,3            | 94,3                          | 63,6            | 499                              | 91,9                             | 0,427                                 | 61,4                              |
| 140          | 80  | 6,0            | 19,3                       | 24,6                        | 621                         | 255             | 5,03                  | 3,22     | 88,7                          | 63,8            | 111                           | 74,4            | 583                              | 106                              | 0,425                                 | 51,8                              |
| 140          | 80  | 6,3            | 20,2                       | 25,7                        | 646                         | 265             | 5,01                  | 3,21     | 92,3                          | 66,2            | 115                           | 77,5            | 607                              | 110                              | 0,424                                 | 49,6                              |
| 140          | 80  | 8,0            | 25,1                       | 32,0                        | 776                         | 314             | 4,93                  | 3,14     | 111                           | 78,5            | 141                           | 94,1            | 733                              | 130                              | 0,419                                 | 39,9                              |
| 140          | 80  | 10,0           | 30,6                       | 38,9                        | 908                         | 362             | 4,83                  | 3,05     | 130                           | 90,5            | 168                           | 111             | 862                              | 150                              | 0,414                                 | 32,7                              |
| 150          | 100 | 4,0            | 15,1                       | 19,2                        | 607                         | 324             | 5,63                  | 4,11     | 81,0                          | 64,8            | 97,4                          | 73,6            | 660                              | 105                              | 0,490                                 | 66,4                              |
| 150          | 100 | 5,0            | 18,6                       | 23,7                        | 739                         | 392             | 5,58                  | 4,07     | 96,5                          | 78,5            | 119                           | 90,1            | 807                              | 127                              | 0,487                                 | 53,7                              |
| 150          | 100 | 6,0            | 22,1                       | 28,2                        | 862                         | 456             | 5,53                  | 4,02     | 115                           | 91,2            | 141                           | 106             | 946                              | 147                              | 0,485                                 | 45,2                              |
| 150          | 100 | 6,3            | 23,1                       | 29,5                        | 898                         | 474             | 5,52                  | 4,01     | 120                           | 94,8            | 147                           | 110             | 986                              | 153                              | 0,484                                 | 43,2                              |
| 150          | 100 | 8,0            | 28,9                       | 36,8                        | 1 087                       | 569             | 5,44                  | 3,94     | 145                           | 114             | 180                           | 135             | 1 203                            | 183                              | 0,479                                 | 34,7                              |
| 150          | 100 | 10,0           | 35,3                       | 44,9                        | 1 282                       | 665             | 5,34                  | 3,85     | 171                           | 133             | 216                           | 161             | 1 432                            | 214                              | 0,474                                 | 28,4                              |
| 150          | 100 | 12,0           | 41,4                       | 52,7                        | 1 450                       | 745             | 5,25                  | 3,76     | 193                           | 149             | 249                           | 185             | 1 633                            | 240                              | 0,469                                 | 24,2                              |
| 150          | 100 | 12,5           | 42,8                       | 54,6                        | 1 488                       | 763             | 5,22                  | 3,74     | 198                           | 153             | 256                           | 190             | 1 679                            | 246                              | 0,468                                 | 23,3                              |
| 160          | 80  | 4,0            | 14,4                       | 18,4                        | 612                         | 207             | 5,77                  | 3,35     | 76,5                          | 51,7            | 94,7                          | 58,3            | 493                              | 88,1                             | 0,470                                 | 69,3                              |
| 160          | 80  | 5,0            | 17,8                       | 22,7                        | 744                         | 249             | 5,72                  | 3,31     | 93,0                          | 62,3            | 116                           | 71,1            | 600                              | 106                              | 0,467                                 | 56,0                              |
| 160          | 80  | 6,0            | 21,2                       | 27,0                        | 868                         | 288             | 5,67                  | 3,27     | 108                           | 72,0            | 136                           | 83,3            | 701                              | 122                              | 0,465                                 | 47,2                              |
| 160          | 80  | 6,3            | 22,2                       | 28,2                        | 903                         | 299             | 5,66                  | 3,26     | 113                           | 74,8            | 142                           | 86,8            | 730                              | 127                              | 0,464                                 | 45,1                              |
| 160          | 80  | 8,0            | 27,6                       | 35,2                        | 1 091                       | 356             | 5,57                  | 3,18     | 136                           | 89,0            | 175                           | 106             | 883                              | 151                              | 0,459                                 | 36,2                              |
| 160          | 80  | 10,0           | 33,7                       | 42,9                        | 1 284                       | 411             | 5,47                  | 3,10     | 161                           | 103             | 209                           | 125             | 1 041                            | 175                              | 0,454                                 | 29,7                              |
| 160          | 80  | 12,0           | 39,5                       | 50,3                        | 1 449                       | 455             | 5,37                  | 3,01     | 181                           | 114             | 240                           | 142             | 1 175                            | 194                              | 0,499                                 | 25,3                              |
| 160          | 80  | 12,5           | 40,9                       | 52,1                        | 1 485                       | 465             | 5,34                  | 2,99     | 186                           | 116             | 247                           | 146             | 1 204                            | 198                              | 0,448                                 | 24,5                              |
| 180          | 100 | 4,0            | 16,9                       | 21,6                        | 945                         | 379             | 6,61                  | 4,19     | 105                           | 75,9            | 128                           | 85,2            | 852                              | 127                              | 0,550                                 | 59,0                              |
| 180          | 100 | 5,0            | 21,0                       | 26,7                        | 1 153                       | 460             | 6,57                  | 4,15     | 128                           | 92,0            | 157                           | 104             | 1 042                            | 154                              | 0,547                                 | 47,7                              |
| 180          | 100 | 6,0            | 24,9                       | 31,8                        | 1 350                       | 536             | 6,52                  | 4,11     | 150                           | 107             | 186                           | 123             | 1 224                            | 179                              | 0,545                                 | 40,1                              |
| 180          | 100 | 6,3            | 26,1                       | 33,3                        | 1 407                       | 557             | 6,50                  | 4,09     | 156                           | 111             | 194                           | 128             | 1 277                            | 186                              | 0,544                                 | 38,3                              |
| 180          | 100 | 8,0            | 32,6                       | 41,6                        | 1 713                       | 671             | 6,42                  | 4,02     | 190                           | 134             | 239                           | 157             | 1 560                            | 224                              | 0,539                                 | 30,7                              |
| 180          | 100 | 10,0           | 40,0                       | 50,9                        | 2 036                       | 787             | 6,32                  | 3,93     | 226                           | 157             | 288                           | 188             | 1 862                            | 263                              | 0,534                                 | 25,0                              |
| 180          | 100 | 12,0           | 47,0                       | 59,9                        | 2 320                       | 886             | 6,22                  | 3,85     | 258                           | 177             | 333                           | 216             | 2 130                            | 296                              | 0,529                                 | 21,3                              |
| 180          | 100 | 12,5           | 48,7                       | 62,1                        | 2 385                       | 908             | 6,20                  | 3,82     | 265                           | 182             | 344                           | 223             | 2 191                            | 303                              | 0,528                                 | 20,5                              |
| 200          | 100 | 4,0            | 18,2                       | 23,2                        | 1 223                       | 416             | 7,26                  | 4,24     | 122                           | 83,2            | 150                           | 92,8            | 983                              | 142                              | 0,590                                 | 54,9                              |
| 200          | 100 | 5,0            | 22,6                       | 28,7                        | 1 495                       | 505             | 7,21                  | 4,19     | 149                           | 101             | 185                           | 114             | 1 204                            | 172                              | 0,587                                 | 44,3                              |